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Comprehensive Research Synthesis: An Approach to Mixed Methods Research Syntheses

Abstract

Mixed methods research synthesis (MMRS) is an emerging application of both mixed-methods research (MMR) and review research. MMRS promises to comprehensively address intricate contemporary research and evaluation questions given diverse evidence sources (across quantitative, qualitative, and MMR primary studies). The significance of concurrently addressing methodological issues for new research developments is widely noted in the literature. Current efforts attempt to streamline methodological practices along with application of the MMRS approach. Researchers have proposed conceptual frameworks to guide the application and practice of MMRS studies. Despite these efforts, complications and disagreements persist. In response to these concerns, this study developed a framework synergizing evidence on the strengths and weaknesses of existing MMRS frameworks and the related literature. The Comprehensive Research Synthesis (CRS) framework addresses existing framework discrepancies, providing a tool for reforming current MMRS practices.

The CRS framework is informed by the findings of a critical review and preceded by a scoping review for inclusiveness. An expert review provided further insight on its development. The scoping review yielded fifty-seven application studies and fourteen methodological studies. The review of the application studies provided information on general characteristics, current MMRS frameworks, and current trends in the MMRS field. The review of the methodological studies in later critical review stages added information on key MMRS frameworks, their strengths and weaknesses, and pointed to the two most prevalent frameworks in the field. This information led to the development of the initial CRS draft and the expert review stage of the study.

An initial list of prospective reviewers active in the field was created during this review stage. The expert review process identified a target list of seven participants following broad communication efforts. Interviews conducted via Zoom over a period of six weeks were manually transcribed and analyzed as multiple case studies. Cross-case analysis highlighted similarities and differences in responses. The findings and themes reinforced concerns and issues about MMRS studies in the literature. An unforeseen concern regarding the classification of realist reviews under MMRS frameworks emerged. This concern spoke to the definition, purpose, and practice of MMRS studies in relation to that for realist reviews. The findings and themes informed discussions and recommendations for MMRS frameworks, the practice of MMRS studies, and the MMRS field, while enlightening revisions for the initial CRS.

Revisions of the draft CRS targeted its structure, content, language, and terminology. The CRS offers a comprehensive yet versatile tool for MMRS studies. The CRS includes notes, tips, and examples for implementing proposed steps, making it appealing for guiding the practice of MMRS studies. The CRS takes into account the perspectives of current experts in the field. There is, of course, room for improvement given current methodological, conceptual, and practical issues in the review and MMRS fields. Practical examples will further inform the MMRS field and future amendments to the CRS and other MMRS frameworks, and the MMRS field.

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Comprehensive Research Synthesis: An Approach to Mixed Methods Research Syntheses

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A Dissertation

Presented to

the Faculty of the Morgridge College of Education

University of Denver

_____

In Partial Fulfillment

of the Requirements for the Degree

Doctor of Philosophy

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by

Lilian Linialy Chimuma

June 2020

Advisor: Dr. Kathy E. Green

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CHAPTER 1

INTRODUCTION AND LITERATURE REVIEW

Methods are central to the research process. Good methodological practices promote better research processes and more reliable results. Given complex dynamics in today's world, research methods inevitably evolve to address multifarious contemporary societal needs. In many cases, research developments are accompanied by lengthy disputes over long periods before agreements on method and application are achieved. Notably, technological advances have made research innovations and applications more accessible and manageable. Furthermore, they have motivated development of advanced research applications to better address modern problems. These developments require rigorous efforts to ensure better research application practices and procedures. In line with these efforts, this dissertation study addressed methodological concerns in the use of mixed-methods research synthesis (MMRS), informed by existing literature and expert review. The objective was to develop an improved framework for conducting MMRS.

To introduce this study, the researcher presents her personal research journey and experiences before providing background information for the study, a statement of the problem, the purpose of the study and related research questions, the significance of the study, and finally a list of definitions for key terms in the study. An extensive literature review concludes this section followed by a summary of the introduction to lay the ground for subsequent chapters.

Personal Statement

The desire to advance my education is motivated by, and largely revolves around, aspiration to better use my knowledge and skills to address societal challenges through research. My desire and questioning to engage in research focused on social justice in teaching and learning, particularly in math and STEM education, resulted to my combining my master's program with teaching classes, and my transition from a pure science field to a social science one. During my master's program, and with the guidance of Dr. Iris Deloach Johnson, I began to realize that I enjoyed applying my skills and knowledge to real life problems, thus my interest in research methods.

Toward the end of my master's career, and as I worked on my research practicum, I stumbled upon mixed methods which I needed to successfully implement the study and disseminate the results. Exploring the literature, I learned that quantitative and qualitative studies pointed out consistent deficiencies in understanding students' use of metacognition in the classroom. I also found evidence that research using various tools employed mixed-methods approaches to understand the phenomenon of metacognition in the classroom. I was thus motivated to explore the viability of using mixed methods to understand students' use of metacognition when solving mathematics problems using computer pens. This was the beginning of my curiosity to better understand research methodologies beyond my quantitative background. Early interactions and conversations with key players in the field of mixed-methods research (Dr. John Creswell and Dr. Vicki Plano Clark) motivated me to learn even more about mixed methods.

The decision to embark on a doctoral journey revolved around the passion and desire to not only expand my knowledge in research methods, but to also answer intricate societal and policy questions geared towards social justice. Introductory classes across quantitative, qualitative, and mixed-methods paradigms strengthened my interest and focus on better practice, implementation, and use of research. I especially developed an interest in understanding how mixed methods are positioned to answer complex research questions in policy and program evaluation contexts. This interest with the added benefit of lengthy discussions and invaluable guidance by Dr. Antonio Olmos led to my current concern, to further explore and contribute to methodologically sound and logistical practices in MMR. I focus on mixed methods research synthesis (MMRS) in this study.

I believe that the methodological approach to a problem is crucial to effectively and efficiently address it. How we set the stage for a study or research project influences the progression of events and eventually the results we produce. Given the current practices of research and research methodologies, I trust that systematically consulting prior research is significant for improving research practices. Being fully aware of the research knowledge and gaps in available information is essential to inform next steps and decisions on any project, whether for research, policy, or decision-making.

Through this study, I hope to add to, and to engage in, efforts towards improving research practices addressing complex societal problems geared towards enacting policies policies that are centerd on social justice. As evidenced in the literature, mixed-methods research currently offers a richer approach to meet this goal with “mixed-methods research synthesis” promising to expand this endeavor.

Background and Justification of the Study.

The goal of this research was to build on existing efforts to streamline methodological practices for mixed-methods research synthesis (MMRS). This research endeavored to synergize attempts to improve practices around the application of MMRS processes through addressing concerns about current MMRS frameworks. I use the term "Comprehensive Research Synthesis (CRS)" to emphasize the use of a framework that informs and guides the integration of evidence across all possible varied sources of information in MMRS studies regarding methodological, theoretical, and structural differences. Therefore, the methodological process for combining the evidence to inform the overall research question is superior to that for the sources of the evidence. Background information pertaining to developments in research synthesis, and the gap that this study intends to fill, are discussed below. Specifically, information relating to research synthesis in general, then to specific approaches to research synthesis (quantitative, qualitative, then mixed methods), as well as recent debates in the field of research synthesis and how they led to the research problem are discussed.

Research synthesis, synonymously referred to as review research or systematic review, is a process pertinent to scientific research (Gough & Thomas, 2016). Historically, research synthesis informed primary studies (Card, 2012; Chalmers et al., 2002). Every research study begins with a brief synthesis of the relevant literature that supports the need for that primary study. Early applications of research synthesis beyond its role to inform primary studies extended to the synthesis of quantitative outcomes (meta-analysis). Later, research innovations led to the extension of research synthesis to different disciplines, thus expanding its applicability (Card & Little, 2016; Cooper, 1998;

Cooper et al., 2009). Specifically, scientists from disciplines such as medicine, psychology, and economics, recognized the value of synthesizing evidence to inform the field beyond laying the groundwork for primary studies. Considering recent advances in primary research as well as the complexity of review questions, research synthesis has evolved as a type of research of its own kind (Chen, 2005; Chalmers et al., 2002; Gough et al., 2017). Thus, research synthesis, beyond setting the stage for new research, succinctly enlightens researchers regarding the status of phenomena of interest, alongside informing policy decisions (Cooper et al., 2009; Gough et al.; O'Mara-Eves & Thomas, 2016). The broad range of uses for research synthesis has promoted advances in its methodologies and applications across and within disciplines (Gough & Thomas, 2016; Heyvaert et al., 2017; Joubert, 2017).

Traditionally, research synthesis advanced respective to the two main research paradigms of quantitative and qualitative research (Chalmers et al., 2002; Cooper, 2015; O'Mara-Eves & Thomas, 2016; Onwuegbuzie & Frels, 2016). The synthesis of results of quantitative studies, commonly referred to as meta-analysis, antedated and dominated the literature and methodological advances in research synthesis (Card, 2012; Chalmers et al., 2002; Cooper, 2015; Hunt, 1999). Subsequent developments led to the adoption and adaptation of meta-analysis across numerous disciplines and fields of research, with the medical field dominating in applications (Heyvaert et al., 2016). The dissemination of meta-analysis methods across fields resulted in better applicability and expansion in its practice (Chalmers et al., 2002). These developments then motivated application of research synthesis across paradigms, a realization that potentially provided useful information for qualitative research (Gough et al., 2017; Nye et al., 2016).

Qualitative researchers emulated the practice of research synthesis in the quantitative fields, giving rise to qualitative meta-analysis processes (Barnett-Page & Thomas, 2009; Sandelowski & Barosso, 2006). Synthesis of primary qualitative studies to inform research questions takes varied names with “literature synthesis” being used alternatively to research synthesis (Barnett-Page & Thomas). Over time, research synthesis has matured, with attention devoted to bettering practices along paradigmatic divides (Gough et al., 2017).

Consecutively, general synthesis of literature has taken many forms with efforts targeting quality outputs (Nye et al., 2016; Petticrew et al., 2013; Pustejovsky & Ferron, 2017). Particularly, meta-analysis debates and improvements have focused on ensuring better estimation of the overall treatment effect for a given intervention (Card & Little, 2016; Cooper, 2015; Chalmers et al., 2002; Hunt, 1999), while synthesis of results of qualitative studies have targeted better responses to the research questions asked (Britten et al., 2017; Xu, 2008). Overall, the challenge of study selection and quality plagues the practice of research synthesis in both qualitative and quantitative arenas (Britten et al.; Cooper, 2015; Heyvaert et al., 2016; O'Mara-Eves & Thomas, 2016).

Debates about research syntheses and their uses have prompted additional efforts, yielding more sophisticated and directed synthesis processes (Noyes et al., 2013; O'Mara-Eves & Thomas, 2016; Pustejovsky & Ferron, 2017). For example, methodological efforts among qualitative researchers to better utilize research synthesis processes have yielded different proposals for engaging in specific forms of synthesis processes. These processes have resulted in practices such as “the Grounded Theory for Research Synthesis (GTRS)” (Chen, 2005) and “meta-ethnography” (Noblit & Hare, 1988).

Recent efforts center on the extension of research synthesis to mixed methods research (MMR) in addition to the meta-analysis of quantitative and synthesis of qualitative study results (Fetters & Molina-Azorin, 2017; Hesse-Biber & Johnson, 2016; Heyvaert et al., 2016). These efforts have produced the latest applications of research synthesis to primary mixed methods research studies, mixed methods synthesis processes considering primary studies across the three research paradigms (quantitative, qualitative, mixed methods), and mixed sources of evidence to inform research, such as in program evaluation (Brandon, 2016; Gough et al., 2017; Greene, 2015; Harden 2010; O'Mara-Eves & Thomas, 2016). These developments are all motivated by the need to better address contemporary review questions (Dziuban & Picciano, 2015).

General advances in research over the past few decades have informed appreciation for diverse philosophical views and approaches to inquiry. Technological innovations play a key role in this development, making it easier to manage and store information (Creswell & Plano Clark, 2011; Dziuban & Picciano, 2015; Hesse-Biber & Johnson, 2016). Research has long evolved beyond the "paradigm war" era with changes embracing the growth and need for MMR as a distinct paradigm with its own philosophical and theoretical foundations (Leavy & Hesse-Biber, 2008; Staller et al., 2008; Teddlie & Tashakkori, 2009). This has opened venues to expand the practice and application of mixed methods relative to quantitative and qualitative methods (Onwuegbuzie & Hitchcock, 2017). Research synthesis has thus adapted to the changing research contexts reflecting the evolving dynamics in primary studies (Heyvaert et al., 2017; Pustejovsky & Ferron, 2017). For example, tremendous growth in methodological explorations and discussions inform the current wave in the appreciation for mixed

methods, hence the extension to research synthesis. These advances are further guided by the need for rigorous evidence across research settings and academic disciplines.

Specific concerns of research synthesis target comprehensively informing field and policy decisions. The highly evolving and complex nature of current societal problems (Heyvaert et al., 2016; O'Mara-Eves & Thomas, 2016) motivates the need for sophisticated research approaches (Gough et al., 2017; Heyvaert et al., 2017; O'Mara-Eves & Thomas; Onwuegbuzie & Hitchcock, 2017). This call for improvements in research synthesis processes, and a need for innovative and refined applications, speaks to intricate synthesis questions (Gough et al.). On the other hand, these improvements raise questions that have long troubled review scientists such as the quality of primary studies--as the data for review studies, and bias (Crocker & Cooper, 2011; Grimes et al., 2018; Harden & Thomas, 2005). The notion that poor quality in the reporting of primary studies carries over to review research has long concerned research reviewers (Cooper, 2015; Cooper et al., 2009). This concern translates to complex reviews that consider evidence across diverse study types.

In view of these challenges, literature on review research suggests ways to ensure better production and dissemination of both primary and review studies (Heyvaert et al., 2016). However, it is evident that there are still challenges even within frequently used processes of engaging in research synthesis such as meta-analysis (Ahn et al., 2012; Gough et al., 2012; Hunt, 1999). These concerns range from the "names" used for review processes (Gough et al.), to the methodological complexities that arise, particularly in relation to the quality of studies and the value of the resulting reviews (Heyvaert et al., 2017). It is important to examine these issues closely and to elucidate their impact on

approaches to the various synthesis processes as the field of research synthesis grows in use and application.

Given the value of review research to scientific evidence and the diverse ways in which it is presented, solely relying on evidence across the two paradigms (qualitative and quantitative) to address the complexity of contemporary research and policy questions is inadequate (Gough et al., 2017). As such, recent efforts by research reviewers target comprehensive evidence for literature synthesis to efficiently address emerging difficulty in review questions (Dziuban & Picciano, 2015). Such efforts include the consideration for multi-method approaches for synthesizing evidence such as mixed methods, using large data sets with meta-analysis, and qualitative comparative syntheses (O'Mara-Eves & Thomas, 2016).

While these improvements are appealing and welcome to researchers, logistical and practical challenges are widely noted. These challenges call for closer evaluation of synthesis processes to refine and clarify methodological issues that impede their application. In line with this need, the current study focused on highlighting existing challenges in the practice of mixed-methods research synthesis (MMRS), considering all-inclusive sources of evidence to address a given research or evaluation problem. Mainly, the author strived to clarify the process of engaging in an MMRS study by addressing issues raised by other researchers who have used and/ or proposed varied MMRS frameworks and utilized the information gained to develop a new framework.

Statement of the Problem

The need for rigorous and comprehensive evidence to inform policy and practice decisions has motivated and guided the growth of research synthesis (Coryn et al., 2017;

Ogawa & Malen, 1991a, 1991b). Despite being largely rooted in the medical field, research synthesis is widely accepted across disciplines (Erkkilä, 2016; Cooper et al., 2009). Moreover, the complex dynamics of modern societal challenges make it critical to consider evidence beyond primary research for richer information to shape policy, practice, and new research agendas (Gough et al., 2012). Additionally, improved rigor and quality in primary research methodologies and approaches make it essential to evaluate research findings, especially across research paradigms, to thoroughly address questions about what works, how, for whom, when, and where (O'Mara-Eves & Thomas, 2016). It is therefore imperative to consider evidence gathered in previous studies while noting shortcomings and flaws given the naivety in approaches used at the time, rather than dismissing older information as irrelevant (Seifert et al., 2017).

Research synthesis is a valuable process for informing inquiry and laying the ground for subsequent research (O'Mara-Eves & Thomas, 2016). However, issues of validity, legitimacy, and reliability abound regarding the implementation, interpretation, and application of past findings (Cooper, 2015). Given extensive research in many disciplines, the need for comprehensive resources that inform future studies is particularly pertinent (Erkkilä, 2016; Seifert et al., 2017).

Recent efforts extend the idea of mixed methods to research synthesis, yielding mixed methods research synthesis (MMRS) approaches (Heyvaert et al., 2011, 2013; Mertens, 2018; Sandelowski et al., 2006). Considering the benefits of mixed methods, this is an essential addition to prior research synthesis approaches. Subsequently, with the need to provide even more comprehensive research information, Heyvaert and others (2016) advance the idea of MMRS contending that consideration for qualitative,

quantitative, and mixed methods studies in a review offers more useful evidence than singular study type reviews.

Resultant to this notion, synthesis of information across paradigms is recently gaining momentum to address complex research questions and provide more comprehensive evidence to researchers than was possible earlier when considering single-method reviews (van Grootel et al., 2017). However, complexity in the usage, applicability, and dissemination of MMRS processes raises a plethora of questions regarding its practicality (Hong et al., 2017). Parallel to the variety of mixed methods approaches, diverse proposals on what encompasses the MMRS process in relation to the method, content, and context of studies, as well as the paradigmatic frameworks loom (Heyvaert et al., 2016; Hong et al., 2017; Onwuegbuzie & Frels, 2016).

With advances promising holistic approaches to synthesizing information, logistical and methodological challenges arise (Heyvaert et al., 2016). Synthesis research highlights many concerns about quality of studies included in literature reviews, meta-syntheses, and even meta-analysis (Ahn et al., 2012; Pluye et al., 2009; Webster & Watson, 2002). These concerns are raised across diverse fields of research implying that the problem is universal rather than limited to a specific area of research (Palinkas, 2012; Palinkas, & Cooper, 2017; Petticrew et al., 2013). Matters such as publication bias and lack of proper frameworks when engaging in "review research" are at the heart of the many concerns raised (Zwetsloot et al., 2017).

Developments in research synthesis coupled with methodological challenges, motivated the purpose for this study--to clarify the process of engaging in mixed-methods research synthesis (MMRS). To achieve this goal, the researcher examined existing

evidence relating to MMRS frameworks and logistical nuances, considered their viability and areas needing improvement, and then aggregated this information to inform the creation of a new MMRS framework. This effort speaks to the need to improve the applicability of MMRS studies to answer intricate research questions, evaluate complex interventions, and comprehensively address diverse questions posed by policymakers, decision makers, and practitioners (Heyvaert et al., 2016).

Despite being relatively new, MMRS provides a complex yet useful research tool. Methodological advances to clarify the application of MMRS processes are essential to allow for efficient utilization of research findings. Inextricably linked to addressing challenges associated with research practices to inform practice and the nagging issues of funding and decision-making, this study focused on developing an improved framework to apprise the process for engaging in MMRS studies. Research highlights efforts to improve the procedural steps of MMRS studies given various guidelines and frameworks. However, there are concerns about their application and adaptation to various MMRS approaches.

Questions regarding quality evaluation of studies across paradigmatic lines and proper integration of information to provide MMRS reviews are noted. For example, there is a lack of clear guidelines regarding study inclusion/exclusion (Dixon-Woods et al., 2006). Quality of primary studies defines the quality of an MMRS review, with unclear study inclusion/exclusion guidelines jeopardizing its usefulness. Petticrew and colleagues (2013) point out that differing methodological schema for qualitative and quantitative reviews are critical to the quality of resultant mixed methods reviews. Moreover, minimum guidance on structuring reviews along paradigmatic divides offer

inadequate information on addressing the complex demands of the review process. In mixed methods research syntheses, it is likely that the synthesis of quantitative studies takes precedence over that of qualitative studies given the same criterion for study quality across the two methods (Melendez-Torres et al., 2017). These concerns necessitate the examination of proposed frameworks for engaging in MMRS studies. Addressing these challenges is essential to clarifying MMRS processes. These concerns supported the focus for this methodological study on developing an improved MMRS framework.

Purpose of the Study

This dissertation sought to add to the literature and discussion on mixed methods research synthesis (MMRS) by proposing a new framework to improve its practice and application. The first purpose of this study was to identify and conduct a critical review of MMRS studies, particularly addressing the research framework. From these studies, weaknesses and strengths across frameworks suggested by different researchers were identified and noted. With this information, commonalities and inconsistencies across these frameworks were then evaluated to achieve a better understanding of the methodological efforts towards formalizing approaches to MMRS processes. Specifically, the following objectives were addressed:

1. Methodological studies on mixed-methods research synthesis (MMRS) were critically reviewed:
    a. to identify MMRS conceptual frameworks proposed by different authors
    b. and to highlight strengths and weaknesses across different MMRS frameworks.

2. A new framework – Comprehensive Research Synthesis (CRS) – was then designed by:
    a. considering findings from the first objective and pertinent to the reviewed MMRS frameworks,
    b. consulting existing literature for additional evidence on the strengths and weaknesses of the reviewed MMRS frameworks, based on their application within the field,
    c. and considering expert reviews on how the framework holds up as an improved approach.

Refining protocols and step-by step guidelines to formalize research processes are known to streamline methodological approaches. Attempts by review researchers to identify such guidelines for the MMRS processes is thus timely. Thus, the main purpose for this study was to develop an improved research framework for MMRS studies.

Research Questions

This study was methodological, specifically targeting better MMRS practices. Given its exploratory nature, it considered known aspects of research synthesis to inform the development of the new framework such as defining the study topic, qualifying the study topic for an MMRS exploration, and setting a search criterion to guide initial study retrieval. This study focused on attributes essential to the process of engaging in MMRS studies. These included issues such as information integration and the selection and "inclusion/exclusion" criteria of studies. Other key factors of value to research synthesis studies such as publication bias and sampling method were considered. The author further strived to illuminate the process of selecting qualitative, quantitative, and/ or

mixed methods primary studies for an MMRS study while considering the overtones around quality evaluation given diverse epistemological, ontological, and axiological foundations across primary studies. Additionally, the role of the definition of the construct for the study and its impact on the selection of studies across the three methodological divides was emphasized. As such, two research questions were addressed as follows:

Research Question 1

How do different researchers address the practice of MMRS design and approach their conceptual framework? What are the strengths and weaknesses of each framework?

Research Question 2

After evaluating MMRS studies based on the evidence from proposed approaches and the field (research question 1), what might an alternative framework intended to conceptualize the MMRS process look like? What are the views of experts in the field on its definition? How do these views shape the definition of the developed framework?

Significance of the Study

As Rayleigh (1885) suggests:

> If, as is sometimes supposed, science consisted of nothing but the laborious accumulation of facts, it would soon come to a standstill, crushed, as it were, under its own weight. The suggestions of a new idea, or the detection of law, supersedes much that has previously been a burden on the memory and by introducing order and coherence facilitates the retention of the remainder in an available form… Two processes are thus at work side by side, the reception of new material and the digestion and assimilation of the old; and as both are essential we may spare ourselves the discussion of their relative importance. One remark however, should be made. The work which deserves, but I am afraid does not always receive, the most credit is that in which discovery and explanation go hand in hand, in which not only are new facts presented, but their relation to old ones is pointed out (p.20).

Uttered during the presidential address at the 54th meeting of the British Association for Advancement of Science in Montreal by a professor of physics in 1884 and at Cambridge University, these words have recently become more meaningful to researchers. Efforts among researchers regarding research synthesis have targeted better quality and application of reviews. Without good research (review research practices to produce quality reviews) to inform the various goals of research practice, scientific inquiry stands to lose ground, especially in meeting the demanding needs of contemporary research.

This study therefore contributes to the methodological applications of research synthesis by clarifying the logistical procedures of engaging in a mixed methods research synthesis (MMRS) process. Currently, research syntheses face many limitations. There are diverse propositions for best practices when engaging in different research synthesis approaches that jeopardize the application of research synthesis to multi-method contexts. These concerns raise questions about the legitimacy of extending research synthesis to consider diverse sources of evidence methodologically and epistemologically. To address some of the worries for widening the application of research synthesis given complex dynamics, this study explored the clarification of methodological complexities pertaining to the MMRS process.

For practitioners, the clarification of theoretical and methodological issues associated with research synthesis processes to provide best evidence for practice is important. Questioning current practices and processes for MMRS studies reinforces the

credibility of the approach. This study contributes to efforts to define and refine the logistical and procedural nuances in the practice of MMRS studies.

Finally, this study serves as a methodological illustration of navigating the processes of engaging in an MMRS study. This study informs researchers, review researchers, and mixed methods review researchers of the complex process of good quality review products as well as that for primary studies. For mixed-methods review researchers and interested researchers, this study elucidates the frameworks for practicing mixed-methods synthesis.

Delimitations

First, despite research synthesis gaining recognition as a field early on, it is only recently that mixed-methods research synthesis was formally introduced. Despite applications of mixed methods to research synthesis in earlier years, attempts to formalize mixed-methods research synthesis have only been recorded over the past 10-15 years, and the sources for this study came primarily from the past 10-15 years. Hence, this study utilizes information and views that are still evolving. Hence, it is expected that users consider emergent and more current information in utilizing this study's findings.

Second, due to accessibility issues, this study focused on current literature on research synthesis, mainly in the English Language. While efforts were not made to consider developments in non-English speaking countriess or for untranslated material, such sources could provide more details on the state on MMRS studies and respective frameworks.

Third, for manageability, this study focused on methodological mixed-methods research synthesis studies to review existing MMRS frameworks, and then focused on the

two most prevalent MMRS frameworks for subsequent comparison to the developed framework. MMRS studies that specifically utilize, or focus on improving, or developing a specific framework informed the development of the new framework after the strengths and weaknesses of the two selected frameworks were identified. Additionally, to compare the new framework to the two commonly used ones, a small number of studies (about 5) on a given topic were utilized. A larger set of studies would offer more elaborate details for comprehensively evaluating the feasibility of the new framework.

Fourth, literature on research synthesis and MMRS indicates that work towards formalizing this practice is primarily in the health and medical fields. Despite attempts to broaden the disciplines for the sources utilized in this study, the literature was mostly reflective of this finding. Extensive interdisciplinary efforts to improve MMRS methodologies could provide a broader picture than this study.

Fifth, the literature on research synthesis indicates controversies regarding terminology within and across its applications. Efforts to avoid bias concerning terminology use led to consideration of diverse terminology as identified in the literature. Unintentional exclusion of studies may have occurred. Additionally, the researcher chose to use certain terms to comply with practices suggested by other researchers regarding terminology simplification Efforts were made to provide complementary terms to allow readers with diverse backgrounds to utilize the results of this study. Moreover, explanations for decisions to use specific terms are provided to make it easier for the reader to follow and understand the study. A different view on this issue could yield different results.

Finally, a small number of expert reviewers (7) evaluated the developed framework. Moreover, due to accessibility of some of the seasoned experts in the field, the sample selected was a convenience sample. Access to a wider sample of experts might have led to different findings.

Definition of Terms

Specific terms selectively operationalize the conceptualization of different processes based on popularity in usage as well as their centrality to this study. These terms apply both to general research and to research synthesis. The definitions below provide additional details to offer clarity and avoid confusion.

Review Researchers

In this study, the term research reviewer refers to individuals who engage in the practice of research synthesis. These individuals are researchers akin to primary research scientists. The terms review scientist and review author synonymously reference a similar definition. Despite using additional synonymous terms, this description builds on that provided by Heyvaert and her team (2017): "We use this term to refer to anybody who is undertaking a literature review for research purposes" (p. 2). Heyvaert and colleagues use the term review author to emphasize the process of engaging in a review study while conforming to the definition by leading organizations promoting and disseminating literature reviews such as the Cochrane and Campbell Collaborations (Higgins & Green, 2011). In this study, I use review researcher to emphasize the fact that research synthesis is an independent research process that utilizes existing studies to answer applicable research questions (Cooper et al., 2009).

Research Synthesis

The term research synthesis collectively refers to the various processes of synthesizing research evidence considering diverse theoretical, methodological, epistemological, and practical concepts. While terms such as research review, systematic review, and information synthesis are alternatively used across the literature to delineate these processes, this study consistently uses the term 'research synthesis' for clarity. Cooper and Colleagues (2009) discuss the relative definitions of the terms research review and systematic review that could cause confusion.

Quantitative Synthesis

Quantitative synthesis in this study refers to synthesis approaches that integrate statistical evidence from studies aligning with positivism. Though meta-analysis is used here synonymously to conform to the common usage of this practice, it is important to note that debates regarding various approaches to the practice of statistical evidence synthesis exist, mostly due to recent developments. These advances call for consideration of different names for approaches that do not fully conform to meta-analytic definitions and standards yet synthesize statistical data in quantitative studies.

Qualitative Synthesis

Like quantitative synthesis, the term qualitative synthesis collectively refers to approaches that conform to constructivist views. Terms such as meta-synthesis and meta-study are used in the literature to synonymously reference qualitative synthesis processes. This study consistently uses qualitative synthesis instead to distinguish the practices of integrating evidence from studies that emulate constructivism from general research synthesis practices.

Mixed Methods Research (MMR)

In this study, mixed-methods research refers to primary studies that adhere to the practice of mixing research evidence from the qualitative and quantitative [1]strands to inform the overall research question (Creswell & Plano Clark, 2017). Discussions among MMR researchers show disagreement on the use of the term 'mixed-methods' studies (Creamer, 2018). Many of these arguments center on logical and practical aspects of mixing and integration of information in mixed-methods studies (Fetters & Freshwater, 2015). For simplicity, the term mixed methods research refers to any study that collects, analyzes, and mixes evidence based on the respective quantitative and qualitative strands.

Multimethod Approaches to Research Synthesis

The use of the term multimethod and how it relates to mixed methods studies is debated across primary research studies. In line with the definition offered by Creswell (2015b) in the handbook of multimethods and mixed methods research, this study defines multimethod studies as any research that utilizes diverse methodological, theoretical, and varied tools of data collection to inform one or more research questions in a single study (Hesse-Biber & Leavy, 2008). This definition carries over to research synthesis hence the use of the term "multimethod method approaches to research synthesis" which include MMRS approaches.

The following review of the literature addresses three key issues relating to research synthesis before discussing issues specific to mixed methods research synthesis.

[1] The term strand refers to the units of analysis for mixed methods studies otherwise grouped as the quantitative and qualitative components (Creswell, 2013). Strand in this study refers to the collective qualitative and quantitative evidence brought together for integration to inform the overall review question in MMRS studies. This is not to be confused with the phases of analysis or synthesis of evidence to inform the overall research question for MMRS studies.

The following areas are covered: 1) research synthesis, 2) types of research synthesis, 3) mixed-methods research synthesis, and 4) exemplar conceptual models for mixed methods research synthesis. These areas of literature provide the context to inform the research questions and subsequent stages of this study.

Literature Review

Research Synthesis

Research is divided into two main branches: primary research and research synthesis. Primary research is associated with original research and it uses primary or secondary *data*. The Oxford English Dictionary defines primary research or writing as, "designating source material contemporary with the period or thing studied; designating an original document, source or text rather than one of criticism, discussion, or summary." In other words, primary research consists of firsthand research accounts of an individual or a group on a specific topic at a given time-point (usually current). Research synthesis on the other hand, commonly referred to as secondary research and not to be confused with primary research using secondary *data*, comprises accounts or views drawn from other sources. Research syntheses are informed by primary research studies, including unpublished reports (Brien et al., 2010; Levac et al., 2010). Newer propositions in research synthesis propose the use of primary *data* to complement findings in research reviews. These proposals argue for the need to validate research syntheses, making them more useful and meaningful in various contexts by incorporating current rather than past research questions (O'Mara-Eves & Thomas, 2016).

Research synthesis is the study of studies or the scientific process of synthesizing information (Chen, 2005; Cooper et al., 2009). Rogers (1985) refers to research synthesis

as, “the synthesis of primary research results into more general conclusions at the theoretical level,” further noting that, “the essence of meta-research (research synthesis) is research on research, the analysis of analysis” (p.14). Research synthesis involves purposeful summarization and review of literature to inform a topic of interest. The practice of research synthesis emerged out of the necessity to better address research questions, given extensive existing scientific research across disciplines (Cooper et al., 2009; Glass, 1976, 2006). Research synthesis has experienced tremendous growth since its formal recognition as a useful component of research (Glass, 2006; O’Mara-Eves & Thomas, 2016; Patton, 1991; Suri, 2007, 2011, 2013; Suri & Clarke, 2009).

Why Research Synthesis is Needed

Information synthesis is historically central to the practice of research (Card & Little, 2016; Patton, 1991; Rogers, 1985). To engage in any research practice, it is the norm to provide an account of key issues from past studies on a given topic for justification (Card, 2012; Cooper et al., 2009; Weed, 2005). Narrative reviews, otherwise known as literature reviews, have historically preceded research inquiries of any kind (Cooper, 2015). Considering the challenges and debates in defending new research, it is essential to have sufficient evidence informing any research inquiry (Suri, 2013; Webster & Watson, 2002). Notably, the value of research synthesis extends beyond that of only informing new inquiry (Higgins et al., 2008; O’Mara-Eves & Thomas, 2016). Glass (1978), in reference to research synthesis stated, “Determining what knowledge this enterprise has produced on some equation is itself a genuinely important scholarly endeavor” (p. 351). Other researchers reiterated this message, highlighting the value in extending our understandings of topics beyond primary studies, while reinforcing that

research synthesis ought to receive more recognition and scientific emphasis in the research community (Rogers, 1985).

Researchers use diverse terms that are sometimes interchangeable to express the idea of research synthesis. Variability in purpose, nature, and type of data extracted from the primary studies in a given synthesis facilitate these variations. Specifically, distinct theoretical and methodological disparities, where reviews utilize different forms and research approaches play a key role in the differing definitions and terms adopted by review researchers (Chen, 2005). Examples of the terms used include: meta-analysis (Glass, 1976); integrative review (Jackson, 1980); literature review; research review (Light & Pillemer, 1982; Card, 2012); research integration (Carlberg & Walberg, 1984); metasynthesis (Sandelowski et al., 1997); meta-research (Rogers, 1985); systematic review (Cook et al., 1995); and qualitative meta-analysis (Ke, 2011; Schreiber et al., 1997). Broadly speaking, methodological and theoretical components differentiate the approaches to research synthesis yielding quantitative, qualitative, and, most recently, multi-method approaches.

Different researchers outline various purposes for engaging in research synthesis. Jackson (1980) identified four key reasons for engaging in research synthesis: (a) appraising new developments in the field, (b) verifying existing theories and informing new ones, (c) synergizing information from diverse avenues of research, and (d) generalizing from a set of studies on specific topics about an essential issue. Cooper (1988) specified three reasons: (a) integration, which constitutes generalization, conflict resolution, and linguistic bridge building; (b) criticism; and (c) denoting fundamental issues (as cited in Cooper & Hedges, 1994). It is rare for a single study to offer sufficient

information on a particular topic or phenomenon (Suri, 1999, 2000). The realization that scientific research regularly produces varying results even in studies with fully replicated conditions is unnerving (Cooper et al., 2009; Suri, 2013). It is therefore vital to consider cumulative evidence across studies to uncover underlying trends (Biesta, 2010; Suri, 2007, 2011). Across diverse disciplines, enormous numbers of publications exist with erratic findings that can be misleading, unclear, or contradictory (Biesta, 2010; Dziuban & Picciano, 2015; Oates, 2011; Templier & Paré, 2018). Thus, combining data in meaningful ways to reinforce external validity is critical. In line with these issues, the Evidence-Based Practice (EBP) movement of the 20th century has influenced the practice and growth of research synthesis (Heyvaert et al., 2016; Oakley, 2002; Palinkas & Soydan, 2012).

The EBP movement led to the appreciation and application of research synthesis across the physical and later social sciences (Suri, 2011). Research synthesis is widely practiced for purposes of informing intervention administrations, policy questions, complex research questions, and program evaluation (Heyvaert et al., 2011; Suri & Clarke). Research synthesis has been largely associated with the medical field (Suri, 2007, 2011; Suri & Clarke). The EBP movement advocated for the need to provide comprehensive evidence on intervention effects with the medical field recognizing the value of research synthesis (Roelfs, 2015). Despite this observation, research synthesis is practiced across diverse research contexts and disciplines (E.g., Erkkilä, 2016; Joubert, 2017). Traditionally, research synthesis focused on accumulating information across quantitative studies, then later qualitative studies, and recently multi-method studies,

which include mixed methods studies (Creswell 2015a; Creswell & Plano Clark, 2017; Leeman et al., 2015).

To conform to the EBP movement, research syntheses have progressively advanced with the primary focus homing in on best practices for ensuring quality of both included studies and the resultant review (Cooper, 2015; Oakley, 2002). Primarily, the quality of studies informing the accumulated information becomes critical in strengthening the integrity of the cohesive conclusion (Card, 2012; Claes et al., 2017; Creswell, 2015b). Intense debates dominate the field of research synthesis regarding the amalgamation of research evidence given diverse methodologies (Creswell, 2015a; O'Mara-Eves & Thomas, 2016). It is the norm for review researchers to focus on "good quality" studies without highlighting the "bad studies" excluded from the synthesis (Thomas & Harden, 2008). Furthermore, criteria for selecting studies across and within the paradigms are in many ways questionable (Hammersley, 2001). Arguments pertaining to perpetuating research deficiencies by including poor quality primary studies fuel the debate regarding study selection criteria, hence leading to questions of the credibility of review products, especially considering the EBP movement goals (Biesta, 2010; Lau et al., 1997; Pussegoda et al., 2017; Noyes et al., 2019). These criticisms have stimulated advances in both the practice and applicability of research synthesis.

Advances in Research Synthesis

Various needs motivate improvements in research synthesis (Chalmers et al, 2002; Hedges & Cooper, 2009; Glass, 1976). Key instigators of these developments include the need to address the evolving and multifaceted nature of research questions, and to better utilize available primary research to inform new inquiries (Chalmers et al.;

Horder, 2001). Subsequently, research synthesis has gained appreciation across both fields of study and paradigmatic classes of inquiry (Brandon, 2016; Heyvaert et al., 2016). Advances in research synthesis methodology respond to the need to improve applications within and beyond the paradigmatic limits of primary studies. Furthermore, the call for EBP has propelled the growth in the method and applications of research synthesis (van Grootel et al., 2017; Pigott et al., 2017).

Despite its early recognition as a key scientific research process, progress in the practice and application of research synthesis progressed at a much slower rate than that for primary research (Cooper et al., 2009). Codification of the research synthesis process has gained momentum over the last decade, characterized by extensive methodological and contextual applications (O'Mara-Eves & Thomas, 2016; Petticrew et al., 2019). Current technological advances, allowing for better storage and management of information and analysis of complex data might have facilitated this change (Hesse-Biber & Johnson, 2015; Thomas, Noel-Storr et al., 2019). Further, growth in research and research methodologies over the past few decades has resulted in increased interest and growth in meta-research (Cooper et al.; Petticrew et al.).

Early research dates the practice of research synthesis long before the formalization of quantitative synthesis (Cooper, 2015; Shadish, 2015; Underwood, 1957). For a long time, quantitative synthesis (known as meta-analysis) of studies dominated the practice of research synthesis (Hunt, 1999; Roelfs, 2015; Shadish, 2015). The adoption of quantitative synthesis mirrored the dominance of post-positivist views in scientific research compared to constructivism and pragmatism (Cooper, 2015; Leavy & Hesse-Biber, 2008). This popularity in application and use of meta-analysis resulted in early

advances, elevating the sophistication of meta-analytic practices relative to other synthesis approaches (Leavy & Hesse-Biber; O'Mara-Eves, & Thomas, 2016; Roelfs). Later developments prompted application of research synthesis across other platforms of research starting with qualitative, then extending to the synthesis of studies utilizing different methodological approaches (O'Mara-Eves & Thomas).

Interest in understanding and focusing on specific aspects of studies motivated the growth in synthesis approaches within the main research paradigms – quantitative and qualitative (Card, 2012; O'Mara-Eves, & Thomas, 2016). For over three decades, the research synthesis movement has grown with emphasis on the type of research. Later, the application of research synthesis extended to transcend disciplinary and paradigmatic boundaries with advances targeting better practices in each context (Dziuban & Picciano, 2015; O'Mara-Eves, & Thomas; Pettricrow et al., 2013). To emphasize the value of research synthesis, researchers have further attempted to classify research synthesis relative to other types of research. For example, Davies and Crombie (2001, as cited in Chen, 2005, p. 19) rank evidence hierarchically starting with research synthesis:

> I-1 Systematic review of several double-blind randomized control trials.
> I-2 One or more large double-blind randomized control trials.
> II-1 One or more well-conducted cohort studies
> II-2 One or more well-conducted case-control studies.
> II-3 A dramatic uncontrolled experiment.
> III Expert committee sitting in review; peer leader opinion.
> IV Personal experience. (p.4)

While this list reflects the value of research synthesis across fields of research, it is important that research synthesis is "well conducted" to ensure quality products (Chen, 2005; Gough et al., 2019).

Contemporary challenges have motivated growth in applicability of research synthesis to multi-method studies (Heyvaert et al., 2017; O'Mara-Eves & Thomas, 2016). These new approaches, though appealing for answering complex research questions, require more streamlining for credible results (Frantzen & Fetters, 2016). Debates regarding logistical and methodological practices in research syntheses persist among researchers (Heyvaert et al, 2013; Pluye et al., 2009; Pluye & Hong, 2014; O'Mara-Eves & Thomas). Besides, challenges in simple research synthesis approaches extend to the systematization of complex methodologies for research synthesis (Frantzen & Fetters; Heyvaert et al., 2016; Hong, et al., 2017; O'Mara-Eves & Thomas). Consequently, the shortcomings identified in research synthesis practices carry over to advanced and contemporary practices (Gough et al., 2019).

The Practice of Research Synthesis

The process of research synthesis closely matches that of engaging in primary research. A key feature distinguishing the research synthesis process from primary research is the focus of the methods (Cooper et al., 2009). Specifically, the weight of the review lies in the method section where the researcher should summarize, aggregate, integrate, synthesize, verify, and develop information based on primary studies considered for the review (Chen, 2005). Notably, specific features characterize research syntheses. These characteristics signify the value of codifying the process of research synthesis as a legitimate and unique research process. For example, Cooper (1982) in recognizing research synthesis as a distinct research process defined five stages including:

1. Problem formulation

2. Data Collection
3. Data Evaluation
4. Analysis and interpretation
5. Public presentation (as cited in Cooper & Hedges, 1994, p.8)

Later, Davies and Crombie (2001, as cited in Chen, 2005) redefined these stages to reflect the specific process of engaging in a systematic review as a type of research synthesis:

1. Defining an appropriate research question
2. Searching the literature
3. Assessing the studies
4. Combining the results
5. Placing the findings in context

Acknowledging the value of transparency and formal guidelines, many researchers find it worthwhile to offer defined processes when applying specific research syntheses approaches. For example, Card (2012) provides specific steps and stages for engaging in meta-analysis, while Gough (2013) addresses issues concerning publication standards, guidelines, rules, and quality appraisal for meta-narrative and realist reviews. Despite attempts to address concerns in the practice of research synthesis, many challenges remain (Petticrew et al., 2019; Gough et al., 2019; Nakagawa et al., 2017). These challenges subject the process and products of review research to criticism regarding their validity, legitimacy, and trustworthiness (Biesta, 2010; Cook et al., 2017).

Criticisms of Research Synthesis

Research synthesis and its respective methods originated and evolved out of necessity. However, research synthesis has long faced harsh criticisms regarding its practice. Concerns about research syntheses center on the: quality of primary studies (hence the resultant review) (Grimes et al., 2018); the lack of consensus in terminology,

hence overlap and confusion among users of review products; methodological rigor in disseminating the syntheses (Ogawa & Malen, 1991a, 1991b); and bias both in the selection and methodological decisions and steps taken by the review researcher (Gough et al., 2019; Paré et al., 2015).

Quality in Research Synthesis. First, consider the issue of quality. Quality is central to the practice of research synthesis (Campbell, 2017). Quality is defined based on the integrity with which a given study adheres to methodological rigor and/or the procedural standards of a field (Bryman et al., 2008; Ogawa & Malen, 1991b). Generally, the expectations and definitions of quality vary across epistemological and paradigmatic lines and/or disciplinary divides (Booth, 2017; Bryman et al.). These differences present challenges when selecting primary studies for inclusion in a review study that impact the definition of the inclusion/exclusion criteria; a procedure that is central to the process of research synthesis (Carroll & Booth, 2015). Moreover, while the definition of quality is better addressed in the practice of quantitative synthesis, this is not the case for other applications of research synthesis. For example, quantitative studies adhering to traditional standards for experimental studies are considered of superior quality regarding issues of validity compared to others such as case studies (Carroll & Booth). Additionally, disagreements in the definition of quality across qualitative studies persist as well as diverse opinions on rigor in approaches used in primary studies (Macura et al., 2019; Trainor & Graue, 2014). Specifically, researchers disagree on whether review researchers should focus on methodological integrity, or procedural nuances, or both, when considering selection of primary studies for review studies. These considerations

result in debates on issues of bias in the inclusion/exclusion of studies in research syntheses, hence jeopardizing the legitimacy of reviews.

With the argument for the value of research synthesis in advancing practice, research, and policy, quality is critical to ensure validity, trustworthiness, and legitimacy of the resulting review (Whittemore et al., 2014). It is evident that research and research reviews differ largely based on the questions of interest to the research; the research paradigm employed; and the epistemological, ontological, ideological, and theoretical stances in which they are rooted (Gough et al., 2012; Paré et al, 2015). Given that reviews rely on primary studies, they tend to emulate methodological challenges, assumptions, and approaches of the included studies (Campbell, 2017; Petrricrew et al., 2019). As a result, research syntheses have evolved respective to research approaches; namely, quantitative and qualitative, and recently multi-method approaches. Thus, the shortcomings of reviewed primary studies are integral to the review products. While it is recommended that review researchers be explicit about the included studies (Gough et al., 2019), this is not always the case, and hence criticisms ensue. For example, quantitative syntheses rely on empirical evidence and generalizability while qualitative syntheses reflect the subjectivity of included studies (Glass, 2015; Whittemore et al.). Aside from noting the limitations of studies with methodological shortcomings, it is uncommon for researchers to note other weaknesses that influence the strength of the review, such as the reported statistics (e.g., reliability coefficients are only infrequently reported). These criticisms have prompted the application of research synthesis to multi-method approaches that promise more inclusive and comprehensive results (Petticrew, 2015).

Besides the argument for aggregating available knowledge on a topic, research syntheses tend to utilize mainly studies considered to be of "good" or "acceptable" quality while leaving out those that do not meet certain "good quality" criteria (Glass, 2015). This approach tends to favor "positive" findings and so conclusions in the review may not be reflective of the "true picture." This concern affects several steps for the review process, and overall, the accuracy of the review (Beista, 2010). It is important to comprehensively consider evidence on a topic. However, debate exists on whether comprehensive searches are useful for all types of reviews (Caldwell et al., 2005; Mills et al., 2012; Petticrew, 2015). Difference of opinion continues among researchers in support of either comprehensive or more purposeful searches when selecting studies (Campbell, 2017; Jansen & Naci, 2013; Salanti, 2012). In response, review researchers attempt to be clear regarding study selection and quality, so users can make informed decisions about the utility of the reviews encountered (Card & Little, 2016).

Terminology and Research Synthesis. Second, we consider the concern for terminology. It is notable that the growth of research syntheses methods across varied disciplines over the years, though positive, has resulted in a "terminology crisis" (Paré et al., 2015). Researchers use interchangeable terms that many times refer to the same thing and sometimes overlap in definition across various synthesis processes (Paré et al.). Varied terms interchangeably illustrate the idea of research synthesis though they might reflect differing theoretical and methodological foundations, as well as varied research approaches. For example, researchers use the term "systematic review" to refer to research synthesis (Gough et al., 2012; Petticrew, 2015; Tranfield et al., 2003). Moreover, some authors categorize systematic reviews as a method of research synthesis

(Whittemore et al., 2014). The definition of a systematic review does not clarify how it earns "its place" as an approach to or as a synonym for the research synthesis process, thus adding to the confusion. This is a challenge to the field of research synthesis when trying to learn from existing review studies and their methodological and logical processes (Gough et al.). I chose to use the term research synthesis in this study to refer to the overall practice of appraising, integrating, summarizing, and presenting information from primary studies on a given topic.

The concern for varied terminology further extends to individual review processes. The terms quantitative synthesis and statistical research integration are used synonymously with meta-analysis. For qualitative synthesis processes, we have terms such as qualitative meta-analysis and narrative review (Booth, 2017). Debate exists on clearer names for specific approaches to qualitative synthesis methods reflective of the very distinct approaches to qualitative methods (Barnett-Page & Thomas, 2009; Green & Thorogood, 2014). Mixed methods research synthesis approaches are evolving (Plano Clark & Ivankova, 2016). Questions exists regarding whether there should be distinct labels depending on the integration techniques, the design, and the type of evidence used (Teddlie & Tashakkori, 2009). These concerns validate the review of terminology for approaches to research synthesis to allow for proper utilization (Petticrew, 2015).

Methods and the Process of Research Synthesis. Third, methods are critical in both properly identifying and effectively disseminating results of a research synthesis. Concerns affect various aspects of research review products, ranging from the range of names assigned to the reviews to the validity of the reviews (Cooper et al., 2009). Methodological concerns are not new to research synthesis, with review researchers

attempting to set guidelines for key stages and practices (Paré & Kitsiou, 2017; Petticrew, 2015). However, concerns regarding clarification of differences across various approaches to research synthesis abound (Paré & Kitsiou). Specifically, there is uncertainty in the branding of different reviews and lack of consensus on methodological details for specific research synthesis approaches.

Discussions question the necessity for using different labels for reviews when some of the differences might apply mainly to specific stages of a review and not the review in its entirety (Whittemore et al., 2014). Moreover, most review practices emulate meta-analysis practices, which heavily envisage positivism. Despite methodological advances in meta-analytic practices, questions arise regarding newer approaches such as Bayesian approaches and the analysis of large datasets alongside the results of a traditional meta-analysis (Harden, 2010; Whittemore et al.).

Bias and Research Synthesis. Finally, bias remains a central problem in research synthesis. Beyond the inclusion of studies based on methodological foundations, other factors influence the selection of studies and are usually dependent on the researchers' view or the scope of the review. Publication bias, associated with the tendency to include published studies in a review due to their accessibility, is a common threat to results of research reviews (Borenstein et al., 2009; Duyx et al., 2017; Card & Little, 2016; Rosenthal & DiMatteo, 2001; Zwetsloot et al., 2017). Similarly, the scope and time of the review can limit the extent of the search process (Heyvaert et al., 2016). For example, language can limit a researcher to consider only studies on a topic in a language that he understands (Card, 2012). Time further complicates the nature of the search process in a review, especially when funding is involved. A comprehensive research synthesis

requires extensive labor. When resources are limited, review researchers need to make intentional decisions about efficient approaches to answer research questions.

Many of the issues affecting research synthesis in general extend to the practice of specific review research methods. While the issues discussed above do not exhaust the list of challenges affecting review research, they highlight the main concerns. The next section reviews the characteristics of the major types of research synthesis while acknowledging some of these problems.

Types/Methods of Research Synthesis

As noted earlier, the purposes of a review, as well as methodological and theoretical characteristics, are key to the classification of approaches to research synthesis. Thus, we have qualitative, quantitative, and multi-method research syntheses (Gough et al., 2012; O'Mara-Eves & Thomas, 2016). Suri and Clarke (2009) classify synthesis methods into six categories considering methodological perspectives as: (a) statistical research syntheses, (b) systematic reviews, (c) qualitative research reviews, (d) qualitative syntheses of qualitative and quantitative research, (e) critical impetus in reviewing research, and (f) exemplary synthesis. Notably, literature reviews, otherwise known as narrative reviews, are foundational to research synthesis processes (Paré et al., 2015; Webster & Watson, 2002). This section discusses current literature pertinent to various approaches to research synthesis, highlighting their applications, uses, and criticisms, starting with narrative reviews followed by quantitative, qualitative, and then other research approaches, and finally multi-method approaches.

Narrative Reviews

Narrative reviews precede any research study. Narrative reviews traditionally provide evidence to justify and/or inform a new study (Thomas et al., 2017; Tranfield et al., 2003). However, narrative reviews cannot escape subjectivity in study selection. The lack of transparency in the search, selection, and coding of studies when synthesizing information in narrative reviews is problematic (Chen, 2005; Paré et al, 2015; Thomas et al.; Tranfield et al.). Narrative reviews typically lack the comprehensiveness needed to provide complete information on phenomena, hence the need for more systematic processes of information synthesis (Card, 2012; Gough et al., 2012; Paré et al.). Additionally, as more information becomes available, it is increasingly challenging to stand by the information presented in literature reviews (Gough et al.). The current surge in the volume of published research studies neccesitates comprehensive consideration of existing evidence before proceeding with any recommendations, new research, or making policy decisions (Heyvaert et al., 2016; Ioannidis, 2017; Paré et al.). Consequently, the lack of breadth in considering the evidence gained and the lack of systematization in synthesizing evidence from selected primary studies, are the central criticisms of narrative reviews. Overall, the highlighted criticisms render narrative reviews as the most primitive form of research synthesis.

Regardless of the criticisms linked to narrative reviews, they remain an integral and critical part of introducing, laying the background, and supporting the need for primary research as well as research syntheses (Chalmers et al., 2002; Cooper & Hedges, 1994). It is worth noting advances in the practice of narrative reviews, with emergent forms systematically and explicitly providing information akin to the practice of research synthesis (Paré et al., 2015; Webster & Watson, 2002). Such efforts towards literature

reviews offer a deeper understanding of literature on a topic. For example, critical reviews evaluate literature on a topic while highlighting strengths and weaknesses of interventions, methods etc. (Paré et al.). The limitations identified in the use of narrative reviews, given the growing volume of primary research across disciplines, inspired the growth of more rigorous methodologies of research synthesis, starting with meta-analysis (Glass, 1976, 2015; Tranfield et al., 2003).

Quantitative Synthesis (Meta-analysis)

Meta-analysis refers to the collection of statistical results from primary studies driven by the need to integrate the findings to inform a research question (Glass, 1976, 2000, 2015). The term meta-analysis collectively defines the various types of quantitative syntheses adopted over time (Glass, 1976, 2015). Meta-analysis is the first formalized, rigorous, and objective research synthesis methodology adopted across many fields (Cooper et al., 2009; Glass; Rogers, 1985). Like research synthesis, researchers identify alternative terms for meta-analysis such as: (a) quantitative synthesis and (b) statistical research integration. Other terms are specific to disciplinary approaches. For example, metaphysics (Aristotle) in Physics embraces the idea of synthesizing statistical information to inform an overall topic or idea but does not explicitly use the term meta-analysis. The term meta-analysis has persisted in usage (Glass).

Meta-analysis, like many forms of research synthesis, is a form of survey research whose key "participants" are primary quantitative studies (Card & Little, 2016). Meta-analysis focuses on the overall effect size of an intervention or treatment across studies on a given phenomenon of interest (Card 2012; Cooper, 2015). The key research questions involve determining the overall effect of an intervention across systematically

selected studies (Card; Cooper; Glass, 2015). As the earliest, most widely applied form of research synthesis, meta-analysis is currently the most advanced form of review research (Cooper et al., 2009). The definition, practice, and purposes of meta-analysis have significantly evolved since its inception.

Early definitions synonymously referred to meta-analysis as research synthesis (Cooper et al., 1994; Rodgers, 1985). Contemporary definitions acknowledge the applicability of research synthesis across paradigms, hence the redefinition of the term to be more inclusive and reflective of current developments (Cooper, 2015). Moreover, the practice of contemporary meta-analysis has advanced in comparison to its predecessors. Referencing Astin and Ross's (1960) glutamic acid study, Glass in 2015 notes, "As irrelevant as that chi-square test now seems, at the time I saw it done, it was revelatory to see 'studies' being treated as data points in a statistical analysis" (p. 223). In line with this thought, many early practices of meta-analysis are obsolete or applicable only in certain types of meta-analysis and research syntheses rather than being the "gold-standard" practices. Moreover, the statistical approaches applied in the context of meta-analysis have advanced beyond initial accumulative, weighting, and comparative techniques. Besides the promising use of meta-analysis, like any other research process, there were shortcomings worth exploring. For one, as the major goal of meta-analysis was to aggregate quantitative evidence across studies, meta-analysis only considered studies with quantitative measures.

The criticism that accompanied the invention of meta-analytic practices and applications from the initial stages motivated rigorous exploration to inform

contemporary practices. Glass (2015) credits his innovation of meta-analysis to Eysenck's "anti-thesis" view of the practice.

He states:

> By doing everything in the opposite way that he did, one would have been led straight to meta-analysis. *Adopt an a posteriori attitude toward including studies in a synthesis*, *replace statistical significance by measures of strength of relationship or effect*, and *view the entire task of integration as a problem in data analysis where 'studies' are quantified and the resulting database subjected to statistical analysis*, and *meta-analysis assumes its first formulation*. Thank you, Professor Eysenck. (p. 224)

This reflection provides evidence for the guidelines that would later inform the practice of meta-analysis as well as the criticism that would ensue. The earliest and most vocal disapprovals of meta-analysis included the: (a) apples-and-oranges, (b) flat earth, and (c) garbage in garbage out (GIGO) problems. The apples-and-oranges criticism questioned the homogeneity of the treatment effect across studies in a meta-analysis (Eysneck, 1994; Glass, 2015). This concern, while valid, is addressed by clarifying the goal of the meta-analysis with the understanding that no studies can ever be identical (Glass). The flat earth reproach, initiated by Lee Cronbach, questioned the simplistic view presented by meta-analysts in relation to social science research.

Cronbanch (1982) argued:

> …some of our colleagues are beginning to sound like a kind of Flat Earth Society. They tell us that the world is essentially simple: most social phenomena are adequately described by linear relations; one-parameter scaling can discover coherent variables independent of culture and population; and inconsistences among studies of the same kind will vanish if we but amalgamate a sufficient number of studies.... The Flat Earth folk seek to bury any complex hypothesis with an empirical bulldozer. (p. 70)

This criticism calls for an insightful view of the role of meta-analysis. Like research, particularly quantitative research, the tendency to adopt a more generalized view of reality can be misleading (Mertens, 2018). Basically, the grounding of meta-analyses in a positivistic view (assuming objectivity in the results), while the key decisions that went into the procedure of disseminating them were dependent on the researcher, was controversial (Ahn et al., 2012). Initially meta-analysis assumed homogeneity of included studies, hence a fixed effect (Borenstein et al., 2009; Deeks et al., 2001; Lipsey & Wilson, 2001). This assumption, however, did not reflect variable conditions that could lead to heterogeneity. Therefore, the assumption of homogeneity, given the scientific understanding that no studies can be the same even when carried out under the same conditions, was controversial. In response, advances yielding random and mixed effects models were developed (Hedges & Vevea, 1998; Raudenbush, 2009). Later developments utilize alternative approaches to meta-analysis such as subgroup analysis, meta-regression, and multilevel models, multiple outcomes analysis, and network meta-analysis and ranking systems (O'Mara-Eves & Thomas, 2016; Rosenthal, 1994)

Finally, the garbage-in-garbage-out problem concerns the carry-over effect of shortcomings in primary studies. This issue, discussed with respect to the quality of selected studies generally in research synthesis, is of major concern in meta-analytic research. This criticism emphasizes the effect of poor quality primary studies on the value of the resultant meta-analysis (Ahn et al., 2012; Paquot & Plonsky, 2017). Examples of matters pertaining to the quality of primary studies include: small sample studies lacking the power to detect statistical differences in relation to the hypothesis, studies utilizing "less reliable or less valid measures," and those that employ inappropriate analytical

approaches (Crocker & Cooper, 2011; Grimes et al., 2018). Measures taken during the review process to address some of the identified primary studies' problems ensure more valid review results (Hunter & Schmidt, 2004). The recognition that other issues are challenging or impossible to address resulted in propositions for excluding "poor quality" primary studies completely by some researchers (Card & Little, 2016). The recommendation to exclude primary studies of poor quality cycles back to the concern about selection bias. Good reviews should inform the research community of the strengths and weaknesses of present research (Hedges & Cooper, 2009; Paquot & Plonsky, 2017). When it is not clear to distinguish between weak and strong studies, it is tough to meet this goal.

A major critique of meta-analysis relates to the issue of bias. Bias refers to the "*unfair"* inclusion or exclusion of studies. Despite the development of protocols and guidelines for what a "good" meta-analysis should employ, the role of the reviewer is central to the process (Card & Little, 2016; Eysenck, 1994). As such, subjectivity in every step of the meta-analysis is a threat to validity (Eysenck). The selection of studies is especially crucial with respect to (a) publication bias and (b) the focus on quantitative studies limiting the applicability of meta-analysis results to empirical studies. For example, the EBP movement recommended the consideration of qualitative evidence in meta-analytic processes to better inform policy and practice decisions, hence the birth of the term systematic review.

Uncertainties regarding the limitations of meta-analysis, though disconcerting, guided explorations that informed improved meta-analytic approaches as well as applications to qualitative studies and beyond. In response to increasing complexity of

societal problems, research must project its results beyond the confines of statistical norms (Glass, 2015). Thus, scientists have come to realize and appreciate the value of constructivist and pragmatic views in both research and research synthesis (Hesse-Biber &Leavy, 2008; Staller et al., 2008). The consideration for qualitative synthesis approaches, discussed next, preceded these applications.

Qualitative Research Syntheses

Qualitative research synthesis refers to the amalgamation of study findings across primary studies adhering to constructivism and respective methodologies (Xu, 2008; Zimmer, 2006). Qualitative meta-analysis, the synthesis of qualitative studies, rose out of the realization that the focus of research synthesis on quantitative studies was deficient in broadly informing the scientific community (Nye et al., 2016). Moreover, like the origins of meta-analysis, the need to extend the usefulness fof qualitative research beyond providing rich data on phenomena was evident. Particularly, it was necessary for researchers to make meaningful connections by utilizing research findings in larger contexts (Nye et al., 2016). Qualitative syntheses provide insightful information for policy and practice both on their own and as complementary to quantitative synthesis (Pillemer, 1984). Despite this awareness, the progress towards applying, using, and advancing qualitative syntheses trailed behind that for meta-analysis (Chen, 2005; Sandelowski et al., 1997; Woorland, 1997). This progress is reflective of the slower appreciation for qualitative research methods (W. Creswell & D. Creswell, 2018; Denzin, 2001; Guba, 1990; Suri, 2014).

Like other research synthesis approaches, debates on appropriate labels for the process of qualitative research synthesis as well as applicable methodologies are

prevalent (Chen, 2005; Thorne et al., 2004; Xu, 2008). Several terms identify the approach of qualitative research, including: (a) qualitative meta-analysis (Stern & Harris, 1985), (b) meta-synthesis (Polit & Beck, 2004), and (c) meta-study (Paterson et al., 2001). Sandelowski and colleagues (1997) interchangeably used the terms (d) meta-synthesis or metasynthesis, and (e) qualitative research integration (Thorne et al., 2004). Others argue for more specific qualitative research synthesis labels reflecting differing qualitative research approaches and emphasizing their research purposes and goals. For example, Noblit and Hare (1988) used the term "meta-ethnography" stating that it is the "synthesis of interpretive research," Kearny (1998) used the term "grounded formal theory" to highlight the value of existing data in informing theory, while Estabrooks, Field, and Morse (1994) used the term "aggregated analysis." Evidently, the goals and purposes of a qualitative synthesis process are key to the assigned title.

To outline the overall purpose of a qualitative research synthesis, Sandelowski and others (1997) use the term "qualitative metasynthesis," describing it as "the theories, grand narratives, generalizations, or interpretive translations produced from the integration or comparison of qualitative studies" (p. 366). Chreiber, Crooks, and Stern (1997), on the other hand, emphasize the value for qualitative syntheses processes in theory development suggesting the use of the term "qualitative meta-analysis." Generally, qualitative research synthesis refers to the "interpretation and integration of individual" studies in each field or a given topic (Nye et al., 2016, p. 60) with the term 'qualitative meta-synthesis' being consistently used across the literature (Xu, 2008). Discussions of approaches to qualitative syntheses have informed efforts to improve their application.

Early efforts to formalize the amalgamation of qualitative studies ensued about a decade after that for meta-analysis. Rogers (1985) proposed and qualitized primary quantitative studies through synthesis, while Noblit and Hare (1988) suggested the synthesis of ethnographic studies, hence meta-ethnography. Contrary to the clear epistemological dissimilarities among qualitative and quantitative studies, initial efforts to formalize the practice of qualitative syntheses were overshadowed by those for meta-analysis. Other researchers, in order to consider evidence for qualitative synthesis in a review, included it as complementary to meta-analytic evidence, giving it less weight in the review (Pillemer, 1984). Debates regarding the use, naming, and application of qualitative syntheses fueled later methodological and practical developments.

Criticisms of Qualitative Research Syntheses. Many criticisms of qualitative synthesis approaches mirror those for general research synthesis. In particular, the challenge of confusing and complex labels is more widespread in qualitative syntheses. This is evident earlier in this section by the varying suggestions for appropriately labelling qualitative synthesis approaches. For example, when considering the synthesis process, the term "metastudy" is more appropriate for a review that utilizes vote counting or quantification of qualitative study findings rather than "qualitative meta-synthesis" (Nye et al., 2016; Thorn et al., 2004). On the other hand, given the nature of qualitative research, certain aspects of the synthesis process are questionable. Nye and colleagues address some of these concerns under two categories, namely (a) philosophical and practical debates and (b) methodological issues in practice.

Philosophical and practical debates cover five concerns: the nature of qualitative studies, sampling, study quality, searching the literature, and goal for qualitative

synthesis. First, a key requirement, hence distinction of qualitative syntheses, is that they should adhere to an interpretive rather than aggregative framework (Nye et al., 2016). The interpretivism paradigm embodies numerous and diverse philosophies contrary to positivism. This awareness raises overall epistemological and practical causes for applying research synthesis to qualitative studies (Atkins et al., 2008; Britten et al., 2017; Nye et al.). In this regard, qualitative synthesis processes, while rivalling practices akin to other synthesis procedures, ought to adhere to their intended purpose (Jensen, & Allen, 1996; Thorne et al., 2004; Walsh & Downe, 2005). Specifically, it is fallacious to attempt presenting "a universal truth" given interpretivist views of qualitative research (Zimmer, 2006). Attempts to account for these concerns consider the application of research synthesis across qualitative studies based on (a) approaches (Finfgeld-Connett, 2010), and (b) methods (Greenhalgh et al., 2005; Paterson et al., 2001). Other issues regarding philosophical differences apply to sampling and related principles in study selection.

Second, given the nature of qualitative research, it is the case that purposive sampling might be more meaningful than comprehensive sampling as in meta-analysis (Sandelowski, 2014; Sandelowski & Barosso, 2006). On the other hand, Thomas and Harden (2008) support the "systematic search and retrieval" of primary studies in qualitative meta-synthesis that this process is as important in this context as it is for other research synthesis processes. In addition, the translation for terms such as "saturation" in qualitative meta-synthesis is not yet clear. Particularly, sampling for primary studies in the case of research reviews differs from that for cases in relation to primary research. Thus, the possibility of finding more common ground for participant characteristics is

higher in qualitative than in empirical studies. A question arises as to whether saturation is possible in cases where studies tend to diverge rather than converge (Nye et al., 2016).

Third, as mentioned under the discussion on overall quality for research synthesis, selection based on study quality in qualitative synthesis is still evolving. There is no agreement on the standards for assessing the value of qualitative studies due to the absence of a common "qualitative research paradigm" (Nye et al., 2016; Rolfe, 2006; Trainor & Graue, 2014). But, it is apparent that despite differences across qualitative methodologies, commonalities in reporting and conducting qualitative studies are prevalent (Burchett, 2014; Dixon-Woods et al., 2006). Additionally, the lack of techniques to evaluate study quality identical to sensitivity analysis in meta-analysis implies reliance on peer-reviewed studies, hence a concern for publication bias (Duyx et al., 2017). There is, therefore, a gap in the method literature regarding ways to evaluate study quality in qualitative studies (Trainor & Graue, 2014).

Fourth, effective literature searches for qualitative studies compared to those for quantitative studies are less feasible. Computerized search strategies using "thesaurus" versus "free-text", versus "broad-based" terms are not as effective for qualitative searches as they are for quantitative ones (Shaw et al., 2004). The diversity in the terminology used to identify qualitative research in relation to the possible key words used to differentiate these studies complicates the search process (Burchett, 2014; Green & Thorogood, 2014). It is possible to tailor strategies for better study retrieval though their sensitivity and precision could be questionable (Nye et al., 2016). Despite this limitation, technological advances allowing for techniques such as text-mining promise potential for improved search strategies and study retrieval (Dziuban & Picciano, 2015). These

discussions prompted some agreements on differentiating various terms relating to the synthesis of qualitative information. Later developments provoked arguments on specific procedural issues about the practice of qualitative syntheses.

Finally, recognition of the necessity for subjectivity and reflexivity in qualitative studies calls for a closer evaluation of its applicability in certain research synthesis endeavors. Reservations in the application of qualitative synthesis approaches has led to questions about its usefulness (Nye et al., 2016). Thorne and others (2004) reiterate Noblit's concerns regarding the value of qualitative syntheses in "clinical paradigms of evidence-based practice." There is concern on how interpretivist and positivist views interact as well as how to merge them to allow for the transmission of knowledge (Paterson et al., 2001; Zimmer, 2006).

Diverse opinions on standard procedures complicate methodological practices of qualitative research synthesis processes (Nye et al., 2016). Qualitative reviewers use various tactics to achieve different goals when synthesizing qualitative studies. A key strategy utilized for qualitative synthesis is 'reciprocal translation.' (Malpass et al., 2009; Nye et al.). Reciprocal translation promotes uniformity across studies included in a research synthesis. In this case, the review researcher strives to present their understandings of each study's findings relative to those of other included studies (Noblit & Hare, 1988). Particularly, the interpretations in qualitative studies are classified in differing categories based on the levels of understanding; thus, we have first, second, or third order constructions (Britten et al., 2017; Noblit & Hare; Nye et al.). First order constructions refer to primary study participants' accounts and interpretations, second order constructions refer to the interpretations of those accounts by the study author, and

third order constructions refer to interpretations presented by review researchers (Britten et al.; Malpass et al.). Examples of the application of these different strategies follow.

Tondeur and colleagues (2012) achieved third order constructions describing an overaching interpretive framework emulating Noblit's and Hare's (1988) approach for their study on integrating technology in the classroom. They highlight challenges experienced to manage the complexity in translating primary qualitative studies. Jamal and others (2013) used second-order constructions by rating studies for their richness and quality based on specific health topics. The authors then developed reciprocal translations, which arose from the alignment of the ratings with the themes in the study to inform their analysis, hence lines of argument synthesis. These examples demonstrate the use of different approaches, with dissimilar procedural guidelines, across qualitative synthesis methods, despite utilizing similar arguments. Thus, the differing "concepts and processes of systematically reviewing and meta-synthesizing qualitative studies" compared to quantitative synthesis processes is evident (Nye et al., p. 64). Despite these challenges, qualitative syntheses are a valuable resource to the scientific community with methodologies that are evolving.

Advances in Qualitative Syntheses. As in meta-analysis, criticism has motivated advances in qualitative synthesis, leading to discussions about upgraded practices. Progress is evident in development of reporting guidelines informed by criteria like the Preferred Reporting Items for Systematic Reviews and Meta-Analysis (PRISMA) for systematically reviewing studies of interventions (Liberati et al., 2009). These guidelines include the "Consolidated criteria for reporting qualitative research" (COREQ) for qualitative studies (Tong et al., 2007), and the "Enhancing transparency in reporting the

synthesis of qualitative research" (ENTREQ) which specifically target clear documentation and reporting of qualitative research synthesis processes (Tong et al., 2012). Such procedures ensure quality reviews that are easily usable, understandable, and replicable. Methodologists continue to explore clarity in qualitative synthesis approaches. Most of the developments in qualitative synthesis align with discipline-specific needs or contextual concerns (Nye et al., 2016). Examples of recent efforts in this regard include:

- Work by Carrroll and colleagues (2013) to meet specific contextual concerns using a 'best-fit' framework synthesis extending the work of Brunton and others (2006).
- Work by Aguirre and Bolton (2014) in social work that utilized 'qualitative interpretive meta-synthesis' building on the work of educational anthropologists (Noblit & Hare, 1988).

Discussions regarding considerations for aggregating evidence across different approaches of research synthesis are emerging (Nye et al., 2016). It is necessary to note that alongside the paradigmatic growth of research synthesis, researchers utilized other approaches to synthesize information in specific contexts and for different reasons besides their methodological orientations (Whittemore et al., 2014). These applications have in some ways contributed directly and indirectly to the evolution of research synthesis as a field. A brief discussion of some of these approaches follows.

Other Approaches to Research Synthesis

Despite research synthesis traditionally aligning with and emulating research methodologies, other practices exist. Such approaches include: (a) best-evidence synthesis, (b) propositional inventory, (c) grounded meta-analysis, (d) systematic review,

(e) descriptive review, (f) scoping/ mapping review, (g) theoretical review, (h) realist review, and (i) critical review. A brief discussion of these alternative approaches follows.

Best-Evidence Synthesis. Proposed by Slavin (1986) as a substitute for meta-analysis and traditional narrative reviews. He argued for the preservation of the merits of both narrative and quantitative meta-analysis evidence to ensure more holistic reviews. In this regard, Slavin argued for 'best-evidence' criteria to guide the review followed by presentation steps to illustrate the best evidence process. The four-step criteria targeted the following characteristics of the review: (a) definition of the topic, (b) methodological quality in selected primary studies to avoid bias, (c) external validity in addition to internal validity, and (d) inclusion/exclusion criteria with tangible details about excluded studies. The presentation steps covered four elements: (a) an introduction comparable to that in customary narrative reviews for primary studies; (b) a methods section outlining study selection and stating the "best-evidence criteria" for selected and non-selected studies; (c) a literature synthesis section with a summary table of effect sizes, characteristics and discussions associated with reviewed studies; and (d) conclusions.

Propositional Inventory. Proposed by Rogers (1985) as an alternative to meta-analysis. He defined it as a "qualitative meta-analysis" of quantitative primary studies aimed at generating "more general conclusions at the theoretical level" (p.14). This approach synthesizes verbal conclusions of primary quantitative research rather than their quantitative information. He further suggested conducting a content analysis based on a table summarizing words of propositions drawn from primary studies. He suggested procedures for coding descriptive narratives in primary studies. Dewitt-Brinks and

Rhodes (1992) adopted these guidelines in their synthesis on listening instruction listing ten steps as follows:

1. Determine the inclusion criteria in the meta-analysis and search for relevant literature for all primary studies;
2. Include studies that support and reject the proposition being studies;
3. Report competing propositions;
4. Display the qualitative data in word tables;
5. Include a description of the degree of support indicated by the primary research;
6. Describe the methods used in the meta-analysis;
7. Indicate the results of the primary research;
8. Include a critical review of the primary research;
9. Define the unit of analysis in the smallest terms possible; and
10. Analyze as many qualities of the primary research as possible (p.6-7).

Grounded Meta-analysis (Hossler & Scalese-Love, 1989). Grounded meta-analysis is foundaed on the concept of grounded theory. Grounded meta-analysis seeks to generate or construct new theory (Creswell, 2013; Glaser & Strauss, 1967; Stall-Meadows & Hyle, 2010; Yin, 1991). While the application and practice of grounded theory is mostly discussed among qualitative researchers (e.g., Burchett, 2014; Creswell, 2013), it is argued that this approach is equally applicable to quantitative and mixed methods studies (Flynn & Korcuska, 2018; Hossler & Scalese-Love, 1989). Thus, the application of this approach to research synthesis allows for review of studies within and across paradigms with the goals to generate and inform theory.

Grounded theory is primarily defined by its ability to allow for the emergence of themes (Flynn & Korcuska, 2018). Criticisms of some review researchers including Hossler and Scalese-Love (1989) center around the failure to stay true to the essence of grounded theory research in their application of grounded meta-analysis. Examples of issues pointed out include; developing a coding form *a priori* rather than using open

coding to allow for the emergence of key categorical themes on a topic of interest and matching the aim of the synthesis with the objectives, to generate new theories rather than confirm existing ones (Chen, 2005; Glaser & Strauss, 1967).

Systematic Reviews. Systematic reviews refers to the aggregation of study findings across numerous studies on a given topic where the main purpose is to reduce bias by explicitly providing information on the entire process (Whittemore et al., 2014). A systematic review can include studies "of experimental or non-experimental nature and are synthesized qualitatively" (Whittemore et al., 2014, p. 455). According to Petticrew and Roberts (2006) a systematic review should fully identify an appropriate hypothesis for the review, an *a priori* review protocol, a clear explicit inclusion-exclusion criteria, and an explicit criteria for individually assessing the methodological quality of selected studies. In this case, searches for relevant studies should be comprehensive with objectivity and transparency prevailing throughout the review process. Moreover, systematic reviews can consider mainly quantitative studies, qualitative studies, or both kinds of studies in one review. The Cochrane Collaboration avails specific guidelines for the preparation and appraisal of a systematic review. The Quality of Reporting of Meta-analyses (QUORUM) group (for randomized trials) (Moher et al., 2000) and the Meta-analysis Of Observational Studies in Epidemiology (MOOSE) group (for observational studies) outlines additional recommendations (Stroup et al., 2000). According to the Cochrane Collaboration (2011), systematic reviews are:

> Reviews of a clearly formulated question that use systematic and explicit methods to identify, select, and critically appraise relevant research, and to collect and analyze data from the studies that are included in the review. Statistical methods (meta-analysis) may or may not be used to analyze and summarize the results of the included studies.

Arguments exists in the research synthesis community regarding the use of the term systematic review. Some researchers use this term synonymously with the term "research synthesis." Other scholars emphasize that it mainly refers to processes that elicit the characteristics depicted by the process of systematically reviewing literature. On the other hand, others state that it mainly references the explicit methods used in any research synthesis and should not be considered an approach to research synthesis in its entirety (Cooper et al., 2009).

Despite this argument, the term systematic review is extensively used across disciplines alongside other approaches to research synthesis as well as to illustrate the process of research synthesis. This usage varies across disciplines and is especially prevalent in medical research, as it is believed to align well with evidence-based practice (Palinkas & Soydan, 2012). In this study, the term research synthesis represents the wide-ranging approaches to review research, rather than systematic review which denotes the methodological proceeds of a given review.

Descriptive Reviews. Descriptive reviews influence sets of empirical studies on a research area of interest based on detectable trends or patterns (Paré et al., 2015). They dwell on examining pre-existing propositions, theories, methodologies, or findings for studies offering an overall outlook on the status of inquiry in a given area (King & He, 2005). The information extracted in descriptive reviews focuses on the frequency of the following characteristics across studies: year of publication, methods used, techniques of data collection, and the nature of results (Rumrill et al., 2010). Like other forms of reviews, single studies are the "unit of analysis."

Scoping/Mapping Reviews. Scoping/mapping reviews are knowledge synthesis methods for comprehensively evaluating the nature and range of the current literature on a partivular topic (Anderson et al., 2008; Khalil et al., 2016; Peckham & Goodwin, 2008). Mapping reviews refer to reviews addressing a broad topic of interest, relating to research trends (Paré et al., 2015). Scoping reviews on the other hand focus on the larger picture and not the depth of research in given area (Anderson et al.; Khalil et al.). Content or thematic analyses are utilized to scrutinize the information, while summaries such as tables are used in scoping reviews (Thomas & Harden, 2008).

Study selection, coding, and the practicality of the scoping review are crucial for its applicability (Colquhoun et al., 2017; Paré et al., 2015). The inclusion and exclusion of studies depends on the initial research question and how well selected studies adhere to it. Additionally, two or more independent coders are recommended before the review of abstracts to reduce subjectivity (Paré et al.). Quality assessment of included studies, and its impact on the overall significance of scoping reviews is questionable (Colquhoun et al., 2014). There is also concern about the lack of quality assessment (Brien et al., 2010; Grant & Booth, 2009) by existing frameworks such as that by Arksey and O'Malley (2005), coupled by the recogintion that the consideration for both unpublished and published literature complicates the scoping review process (Levac et al., 2010).

Theoretical Reviews. Theoretical reviews represent explanation-building synthesis approaches. Theoretical reviews utilize "existing conceptual and empirical studies to provide a context for identifying, describing, and transforming into a higher order of theoretical structure and various concepts, constructs or relationships" (Paré et al., 2015, p. 188). Theoretical reviews pinpoint conceptual frameworks for an emergent

topic or inform research schemes or hypotheses (Baumeister & Leary, 1997). Theoretical reviews are accommodative of ontological and epistemological assumptions. Specifically, interpretive techniques for theoretical reviews include meta-ethnography, meta-triangulation, grounded theory, and meta-narratives while positivist approaches include content analysis and qualitative comparative analysis.

Theoretical reviews are characterized by broad initial questions that are progressively refined and narrowed down given more evidence (Eakin & Mykhalovskiy, 2003; Paré et al., 2015). A systematic search strategy embodies an all-inclusive search of both theoretical and empirical studies on a given topic. Arguments regarding the evaluation of study quality occur. Some researchers contend that quality is not critical in theoretical reviews (Greenhalgh et al., 2011), while others claim that methodologically or conceptually flawed studies should be excluded (Dixon-Woods et al., 2006).

Realist Reviews. Realist reviews emerged out of the need to better understand the effect of complex interventions in specific settings and contexts (Paré et al., 2015; Pawson, 2006; Pawson et al., 2005). Realist reviews answer the questions, "What works, for whom, under what circumstances, how and why?" (Wong et al., 2013, p. 2) and are informed by realist inquiry. Arguably, realist reviews emulating the interpretive paradigm better decode heterogeneous evidence for complex interventions within diverse contexts, informing policy and decision making more comprehensively than orthodox systematic reviews and meta-analyses (Greenhalgh et al., 2011; Oates, 2011).

Realist inquiry posits the possibility of different outcomes, given a certain intervention, due to dynamic contexts. Gough (2013) outlines the fundamental views that define a realist philosophy as listed below:

- There is a (social) reality that cannot be measured directly (because it is processed through our brains, language, culture and so on), but can be known indirectly. Realism thus sits, broadly speaking, between positivism.
- Social programs (including complex interventions) may change the macro social context (for example, by introducing legislation).
- To understand the relationship between context and outcome, realism uses the concept of mechanisms, one definition of which is "...underlying entities, processes, or [social] structures which operate in particular contexts to generate outcomes of interest" (p. 2).

Realist reviews are comparable to realist evaluation in primary research due to their exploratory nature (Astbury & Leeuw, 2010; Paré et al., 2015). Moreover, the search process is iterative with individual consideration for each study based on its potential contribution to the review (Paré et al., 2015). The complexity of realist reviews implies conceptual and methodological challenges regarding their implementation (Barnett-Page & Thomas, 2009; Pearson, 2004; Popay, 2006; Shepperd et al., 2009). Particularly, using appropriate methods to select studies, evaluate quality, and synthesize evidence is challenging (Grimshaw, 2010; Pawson et al., 2005; Wong et al., 2013). Realist review is identified as a mixed methods research synthesis review approach (Heyvaert et al., 2016; Onwuegbuzi & Frels, 2016).

Critical Reviews. Like realist and scoping reviews, critical reviews provide an overview of extensive literature on a given topic. These reviews differ by their critical approach to review existing knowledge on a topic for the sole purpose of informing scholars of the status of research (Kirkevold, 1997; Paré et al., 2015). Mainly, critical reviews focus on unearthing existing study flaws, disputes, incongruities, and controversies (Baumeister & Leary, 1997; Grant & Booth, 2009; Hedges & Cooper, 2009). Comprehensive literature searches and transparency in study appraisal and synthesis of information do not characterize critical review processes. Thus, critical

reviews are susceptible to the subjectivity of the reviewer(s). Despite this, critical reviews can utilize diverse methodological approaches depending on the researcher's epistemological stance (Dixon-Woods et al., 2005).

Multi-Method Approaches to Research Synthesis

Given diverse practices, and applications of research syntheses, researchers have debated their shortcomings and strengths while striving for improvements (Cooper, 2015; Hedges & Cooper, 2009). In addition, highly evolving and complex societal needs, coupled with technological advances have motivated creative and sophisticated scientific research (Dziuban & Picciano, 2015) compelling research synthesis to adjust respectively (Chalmers et al., 2002; Cooper et al., 2009; Thomas, Noel-Storr et al., 2019). Hence, research synthesis has grown and reformed to better address contemporary and complex research questions, especially those speaking to contextual obscurities (Gough et al., 2017; Heyvaert et al., 2017). These demands have facilitated appreciation for multi-method approaches to research synthesis that consider diverse methodological, theoretical, and epistemological positions to inform the scientific community rather than traditional, simplistic, single-viewpoint approaches (O'Mara-Eves & Thomas, 2016; Onwuegbuzie & Frels, 2016). Multimethod approaches signify studies addressing complex yet critical societal and behavioral phenomena motivated by "logics of inquiry" (Anguera et al., 2018; Greene, 2015; Hesse-Biber & Leavy, 2008). Such studies address policy and practice questions, particularly those adhering to the evidence-based practice movement (Schwandt & Lichty, 2015).

There are discussions regarding the appropriate use of the phrase "multi-method" in the literature. Confusion due to the synonymous usage of the terms multi-method and

mixed methods by some researchers (Anguera et al., 2018; Borkan, 2004; Stange et al., 2006), while others contend that they are different and should not be used synonymously (Anguera et al.; Bazeley, 2017; Hunter, & Brewer, 2015; Johnson et al., 2007; Moose, 2003, 2010; Tashakkori & Teddie, 2010). Other researchers further claim that the issue of which term to use depends on the researcher's orientation (Mark 2015). Based on Hunter's and Brewer's (2015) exploration of typologies for mixing or merging different methods to answer certain research questions, it appears reasonable to state that mixed methods would fall under multi-method approaches. Additionally, Lewis-Beck and others (2004) in the second volume of the *Sage Encyclopedia of Social Science Research Methods* while referencing multi-method research state that:

> Multi-method research entails the application of two or more sources of data or research methods to the investigation of a research question or to different but highly linked research questions. Such research is also frequently referred to as mixed methodology. The rationale for mixed-methods research is that most social research is based on findings deriving from a single research method… (p. 677)

Later, they address the combination of quantitative and qualitative research in mixed methods research stating that:

> The account of mixed methods so far has been firmly rooted in the tradition of measurement and that for triangulation of measurement in particular. However, the discussion for mixed-method research has increasingly been stretched to include the collection of qualitative as well as quantitative data. In other words, increasingly, mixed-methods research includes the combination of quantitative research and qualitative research. In this way, the discussion of mixed-methods research and, indeed, of triangulation is employed, not just in relation to measurement issues but also to different approaches to collecting data. (p.678)

For simplicity, I use the term "multi-method" approaches to research synthesis to refer to synthesis methods considering varied methodological and theoretical foundations to address differing research questions in the same study. Notably, it is sometimes the

case that diverse sources of data inform different research questions in a study. Given this stance, I consider mixed methods as an example of a multi-method approach rather than as different or synonymous to multi-method approaches.

O'Mara-Eves and Thomas (2016) discuss three recent multi-method approaches to research synthesis: namely, "mixed methods synthesis", using large datasets together with meta-analysis, and qualitative comparative methods. While these approaches promise better answers to synthesis questions, challenges in applying and disseminating these approaches are highlighted (Heyvaert et al., 2016; Hong et al., 2018). Many of the challenges discussed regarding different methods of research synthesis and the field of research synthesis in general carry over to these advances (Boeije et al., 2014; O'Mara-Eves &Thomas, 2016). Hence, to better utilize and apply these approaches, a close examination of their applications and methodological processes, as well as the defined frameworks to clarify and address issues of concern is warranted (Heyvaert et al., 2017; Hong et al., 2018). This study focuses on the process of mixed methods research synthesis and attempts to clarify methodological and conceptual issues given existing frameworks. As such, understanding the foundation for mixed-methods research synthesis processes, debates regarding its application, and procedures are important to set the stage for the study.

Mixed Methods Research Syntheses (MMRS)

Mixed-methods research syntheses refer to review approaches that integrate research evidence from qualitative, quantitative, and/or mixed methods studies (Olofson

& Garnett, 2018; Sandelowski et al., 2013). Heyvaert and colleagues (2017) note that a mixed methods research synthesis involves the application of mixed methods research (MMR) principles to a review process. Specifically, findings from primary qualitative, primary quantitative and/or primary mixed methods studies are integrated using diverse qualitative, quantitative, and mixed synthesis techniques to provide the data in an MMRS study (Burch & Heinrich, 2016; Heyvaert et al., 2013; Plano Clark & Ivankova, 2016). Matching the definition for MMR by other researchers (Johnson et al., 2007), Heyvaert and others (2017) emphasize the consideration for varied perspectives, methods of data collection, data synthesis procedures, and inferential practices to provide enriched knowledge for complex phenomena, problems, and issues of interest. The need to consider diverse sources of research synthesis is as old as the proposition of quantitative synthesis (Cooper et al, 2009; Cooper, 2015) but research synthesis considering primary mixed methods studies and ultimately studies across the three research paradigms is very recent (Heyvaert et al., 2011). The delay in formalizing, and embracing the MMR field, could be a major instigator for this scenario.

MMRS promises to provide better evidence to inform policy and practice as an emergent approach, necessitated by acknowledgement of the shortcomings of single-methodological review approaches to research synthesis (Heyvaert et al., 2016; Leeman et al., 2015). This approach is particularly valuable to address complex research questions. Given its newness, several terms have been used to refer to this approach including systematic mixed studies reviews (Pluye et al., 2009), mixed methods synthesis (Harden & Thomas, 2005), mixed-methods research synthesis (Heyvaert et al.), mixed research synthesis (Heyvaert et al., 2011; Sandelowski et al., 2006; Voils et al., 2008) and

integrative reviews (Whittemore & Knafl, 2005). Notably, uniformity in terminology is critical in advancing its proper usage, and adoption of uniform terminology allows for better refinements regarding logistical nuances for any research (Anguera et al., 2018; Creamer, 2018; Creswell & Plano Clark, 2017). Thus, despite these cited differences in terminology, the phrase, mixed methods research synthesis (MMRS) is often used. For simplicity, and to avoid confusion, this study uses MMRS to refer to synthesis processes founded on MMR.

The Status of MMRS Studies. The application of MMRS is quickly picking up across disciplines, particularly in the health and social sciences. Efforts to refine and define the typology are evident (Boeije et al., 2014; Heyvaert et al., 2016; Sandeloweski et al., 2012). Boeije and Colleagues (2014) explored the process of evaluating primary mixed methods studies for inclusion in a potential synthesis in childhood trauma research. Other researchers examine issues regarding the framework for MMRS studies. Sandelowski and others (2013) studied the process of carrying out mixed methods research syntheses, considering aggregation and integration. They highlight and discuss concerns in MMR practices with implications for research synthesis. Heyvaert and colleagues (2016) detail varied MMRS processes considering different MMR approaches. They outline critical logistical stages and steps for research synthesis. Similarly, other researchers have made efforts to generate instruments that guide and inform MMRS studies. For example, Pluye and colleagues (2011) proposed the mixed methods appraisal tool (MMAT) and later, Pace and others (2012) evaluated its reliability and efficiency; and Campbell and colleagues proposed the improved conduct and reporting of narrative synthesis of quantitative data (ICONS-Quant): protocol, targeting reporting guidelines.

Despite efforts to improve the application of MMRS studies, difficulties regarding practicality and logistics persist. MMRS studies are innovative and are linked to advances within both the MMR and research synthesis fields. Challenges across the three research paradigms and research synthesis impede the successful completion of MMRS studies. These yield concerns regarding credibility of MMRS studies. It is thus imperative and timely to meticulously review logistical and methodological nuances of MMRS studies. As Sandelowski and others (2013) note, "Although methodological advances have been made, efforts to differentiate research synthesis methods have been too focused on methods and not focused enough on the defining logics of research synthesis…" (p. 317). Literature indicates delays in straightening out nuances in the application and development of methodological innovations, resulting in challenges later when applying these innovative approaches (Sandelowski et al). Further, addressing methodological developments while bearing in mind interdisciplinary perspectives is critical.

Currently, research synthesis has advanced predominantly within the health and medical science fields (Gough et al., 2017). Due to the usability and interest to 'try out' these innovative approaches across the medical fields, researchers discuss improvements and methodological challenges extensively compared to other disciplines (Heyvaert et al., 2017). It is important for researchers from other disciplines, especially practice-oriented fields such as education and evaluation, to participate in such discussions for MMRS. Particularly, to acknowledge the imsignifcance of mixed methods research in evaluation (Burch & Heinrich, 2016; Greene et al., 1989; Meterns, 2018), efforts toward addressing the practicality of MMRS is indispensable (Fetters & Molina-Azorin, 2017; Mertens, 2015, 2018). This study thus addressed logistical issues aimed at improving the practice

and application of MMRS from the lens of a methodologist with evaluation and education training. Considering the critical role of MMR in informing the MMRS process, it is important to address some of the associated concerns.

Mixed Methods and Research Synthesis. The mixed methods research paradigm primarily informs the MMRS approach (Heyvaert et al., 2016; Hong et al., 2017, 2018). Mixed methods have become more convincing with recent developments focusing on formalization of MMR approaches (Creswell & Plano Clark, 2011; 2017). Researchers and practitioners widely welcome this necessary step towards addressing complex research and evaluation questions (Creamer, 2018; Creswell & Plano Clark, 2017; Leech & Onwuegbuzie, 2009). For example, mixed methods have largely dominated policy-oriented platforms and program evaluation contexts as they arguably provide comprehensive perspectives and answers to complex research questions (Creamer; Greene et al., 1989; Leeman et al., 2015; Mertens, 2018; Montrosse-Moorhead & Griffith, 2017). Clearly, research focused on one methodology carries forward methodological deficiencies that can never be addressed fully. This observation promoted extensive adoption of mixed methods, legitimizing the value of research synthesis in this context. It therefore follows that, focus on one methodology as the main practice be avoided for research synthesis (Sandelowski et al., 2013).

Like prior approaches to research synthesis, primarily consolidating findings across primary mixed methods studies preceded the MMRS approach. Increased efforts to define and refine mixed methods typologies over the last 20 years resulted in a growing interest and application of mixed methods studies across different fields (Creswell & Plano Clark, 2017; Olofson & Garnett, 2018). The extensive amount of

mixed methods studies across disciplines necessitated the application of research synthesis. Knowledge regarding the need to extend the MMR logic to research synthesis yielded mixed methods syntheses, which focus on synthesizing primary studies and research that employ mixed methods techniques (Heyvaert et al., 2011).

Researchers recognized the need for comprehensive evidence, particularly across methodological boundaries, to inform studies addressing complex phenomena, contexts, and research questions. This realization quickly led to the proposition and adoption of MMRS within the scientific community. Besides, given the widespread accumulation of research across the three research paradigms (Quantitative, Qualitative, and Mixed Methods), it is ineffective to consider synthesis exclusively in that order (Boeije et al., 2014; Heyvaert et al., 2016; Sandelowski et al. 2013). Subsequently, research synthesis has extended to the MMRS approach comprising primary research studies with qualitative, quantitative, and/or mixed-methods orientations to inform the same synthesis agenda. It is necessary to note that the definitions of MMRS studies does not limit the evidence sources to methodologically defined categories (Pluye & Hong, 2014; Thomas & Harden, 2008). This development, though promising, introduces methodological, conceptual, and logical challenges to the practicality of MMRS processes (Noyes et al., 2019). Concerns for primary studies, particularly primary mixed methods studies, as well as challenges facing synthesis processes extend to the MMRS process. In addition, continuous improvements in the application of mixed methods research have implications for the proper application and definition of MMRS studies (Gough et al., 2019).

The MMRS technique embodies the practice of mixed methods research, thus its definition should reflect ‘appropriate’ logistics (Sandelowksi et al., 2012). First, the

research question dictates the implementation of an MMRS study. Second, like mixed methods studies, MMRS studies address research question, phenomenon, or context that are complex in nature (Heyvaert et al., 2016). Next, an MMRS study should follow practical logistics for mixed methods studies beyond the inclusion of studies from varied research methodologies. These practices are primarily centered on the 'mixing' and integration of findings and results, across corresponding quantitative and qualitative strands to inform a study (Fetters & Freshwater, 2015; Fielding, 2012; Sligo et al., 2018). Such caution deters the misuse of labels and misapplication of processes across existing mixed-methods and research synthesis studies (Sandelowski, 2014). Given the critical role for mixed methods research in informing MMRS, it is worth noting ongoing controversies in the practice and application of MMR studies. Challenges in the practice of primary MMR studies and related synthesis attempts have implications for MMRS.

Controversies in the Practice of Mixed-Methods Research. Arguments regarding MMR studies focus on its defining characteristics. On one hand, mixed methods researchers concur relatively well on the core elements of mixed methods studies. For example, mixed methods research is both a method (Creswell & Plano Clark, 2011), and a methodology (Greene, 2008) characterized by the unique feature of the mixing of data to inform a common question (Creswell & Tashakkori, 2007). Moreover, mixed methods researchers agree that a study informed by different types of data that interact at some point of the study is a mixed methods study (Creamer, 2018; Watkins & Gioia, 2015). Despite agreement on the significance of mixing to MMR, the degree to which mixing should be present to warrant a study as 'mixed methods' is debatable. Some scholars take a more conservative view of mixing, claiming that a study with different types of data

that interact at some point fits the description for MMR (Creswell & Plano Clark, 2011). Others lean towards pragmatism arguing for 'exhaustive saturation,' with the quantitative and qualitative strands intermingling throughout the research process (Greene, 2007).

On the other hand, some researchers propose further classification of MMR studies based on the approach of mixing and by considering the need for integration. Teddlie and Tashakkori (2011) and Creamer (2018) use the term "fully integrated mixed methods" to refer to studies where the qualitative and quantitative strands dialectically engage with each other at every stage of the study. According to Teddlie and Tashakkori (2011) a study consisting both qualitative and quantitative strands that fails to consider a point of interface for the two at any point is a "quasi-mixed methods." These debates illustrate the importance of "mixing or integration of qualitative and quantitative data" in MMR studies (Creswell, 2015a; Fetters et al., 2013; Guest, 2013; Heyvaert et al., 2013; Johnson et al., 2007). Particularly, the 'degree of mixing' in relation to integration, and its value to mixed methods studies drives the controversy.

Integration in Mixed Methods Research. Integration is the combination of the qualitative and quantitative strands in a mixed methods study, to collectively inform the overarching research question. Integration should synthesize results for the parts in an MMR study, so they are symbiotic, while allowing them to uniquely retain their separate characteristics (Sligo et al., 2018). Integration is considered a crucial feature of mixed methods studies (Fetters, & Freshwater, 2015; O'Cathain et al., 2007; Sligo et al.) beyond being presented as a sum of its parts (Smith, 2006) or as a combination of separate studies (Yin, 2009). Other researchers argue for elaborate integration across the phases of the research to legitimize MMR (Castro et al., 2010; Heyvaert et al., 2013; Siddiqui &

Fitzgerald, 2014). Integration, thus, arguably enhances the research outcomes in a mixed methods study, situating it as a unique methodology (Watkins & Gioia, 2015).

However, the definition and role of integration in MMR studies is unclear (Sligo et al., 2018). Challenges in defining integration include when and where it occurs (Fetters & Freshwater, 2015; Fetters et al., 2013; Greene, 2008; O'Cathain, 2009; O'Cathain et al., 2010), how it occurs (Guest, 2013; Johnson et al., 2007), the weight and priority accorded each strand (Moran-Ellis et al., 2006), and the relative dominance (Brannen, 2005a; Greene, 2008; Guest, 2013; Pope & Mays, 2009) and sequence (Creswell, 2015a; Fetters et al., 2013) of the strands in the study. Some of these aspects are further dependent on a researcher's preference when considering the audience for the study (Sligo et al.). Thus, despite the known value of integration in MMR, it is rarely explicitly used in practice, given challenges in defining it, little research addressing it, and little guidance on implementing it. This jeopardizes the centrality of integration in the practice of mixed methods research (Bryman et al., 2008; Onwuegbuzie & Johnson, 2006).

Debates on foundational characteristics of mixed-methods studies are ongoing (Creamer, 2018). Unfortunately, MMR literature, including textbooks, are primarily focused on philosophical directions of the field, offering little or no direction for novice researchers on the logistics of a mixed methods study such as how to implement triangulation and integration (Creamer). Dedicating more literature to addressing the logistics of mixed methods research such as sampling, mixing, and integration would be useful to the field. Practical concerns in MMR relate to the applicability of some of its foundational concepts given timing and priority. Practical examples of proposed approaches for mixed methods research in different research contexts and disciplines

(E.g., Erkkilä, 2016; Joubert, 2017) could address some of these concerns. Moreover, disagreements on differences between qualitative and quantitative research obscure the general concept and definition of MMR (Creamer; Greene). Some scholars dismiss the existence of this distinction (e.g., Maxwell, 2010; Newman, & Hitchcock, 2011). These challenges hamper the application of MMRS studies.

As discussed above, integration is a significant facet in MMR despite controversial views. To contribute to the discussion, the present study considered integration as an important feature in the review process for MMRS studies rather than in the selection of primary studies. Therefore, integration is suggested as an important aspect for consideration when consolidating evidence from primary studies given diverse theoretical and methodological orientations. Some researchers caution against blindly focusing on integration, a technical aspect of mixed-methods inquiry (Greene, 2007; O'Cathain et al., 2010). Such studies run the risk of separating research from theory (Sale et al., 2002). It is important that method and methodological decisions are grounded in theory (Sligo et al., 2018). Theoretical perspectives provide a viable means for connecting epistemological issues with research projects (Sligo et al.), uniting researchers' perspectives about knowledge with respective production efforts (Morgan, 2007). Superseding theoretical views or epistemological stances offer an integrative purpose to MMR projects (Fetters et al., 2013; Mayoh & Onwuegbuzie, 2015; Sligo et al.). Such views are best addressed considering appropriate research frameworks as discussed next.

Research Frameworks

Research frameworks are central to the research process. Classified as theoretical, practical, and conceptual; frameworks allow researchers to properly phrase, address, and answer study questions (Onwuegbuzie & Frels, 2016). The current study was collectively informed by both theoretical and conceptual frameworks. Evans and colleagues (2011) state that theoretical frameworks perhaps offer a structure for 'bringing together observations and facts from separate investigations; assist in summarizing and linking findings into an accessible, coherent, useful structure; guide understanding of phenomena – both the what and why of their occurrence; and provide a basis for prediction' (p. 278). This definition supports the need to append an appropriate theoretical framework to this study, given the method employed, its structure, and purpose. On the other hand, conceptual frameworks are more suited for informing and guiding relevant stages and steps of a study. A conceptual framework authenticates procedural ideas in an investigation as well as possible associations among them (Onwuegbuzie & Frels). In recognition of current efforts to improve and streamline good practices in the MMRS process, the central purpose for this study, it is important to outline how conceptual frameworks inform the respective stages and the research questions. The theoretical framework, then the conceptual framework that inform this study, are discussed next.

Theoretical Frameworks

Combining evidence across diverse sources in review studies presents conceptual and methodological challenges. Primary studies are informed by differing theoretical frameworks considering diverse objectives and methodologies. Therefore, it is possible that a new framework is necessary when synthesizing evidence (Irwin, 2013). This study

considers evidence across different methodological MMRS studies to inform the development of a new framework. Situating mixed methods research in a single theoretical framework is common practice (see e.g., Chen, 2005; Evans et al., 2011). But, such a simplistic view does not always address complexity in research. It is often the case that a research topic addresses diverse and multifaceted questions, some based on tactical and pragmatic concerns like resources, knowledge of procedures, and expectations of funders and how they align with researchers' skills (Gough et al., 2019; Noyes et al., 2019). This study contributes to this debate by taking a stance on the choice of a theoretical framework to guide the development of an MMRS framework as an application of mixed methods research. The research question not only directs the decision on method choice, it should also be informed by theory (Hesse-Biber & Johnson, 2015; Siddiqui & Fitzgerald, 2014). In response to these issues, the current study is founded within and aligns with the pragmatic perspective in relation to gathering the evidence for and developing the new framework.

Pragmatism emphasizes the role of pluralistic views of the researcher in the interpretation of the findings, where the *truth* is based on "what works" to inform best practices for MMRS studies. In this study, the objectives guided the choice of review methods, and were mainly informed by pragmatism. Pragmatism in this sense deviates from the traditional definition which emphasizes the focus on different methodological approaches. Pragmatism is referenced herein regarding the possibility to select and utilize tools that best inform the development of a viable MMRS framework considering existing evidence. This stance was necessary given that the literature indicates diverse theoretical views in various MMRS methodological studies. This project utilized a

scoping review and a critical review to synthesize and integrate the evidence from retrieved methodological studies within a pragmatic framework. Specifically, methodological triangulation (Fielding, 2012; Teddlie & Tashakkori, 2009) was used to identify and weight evidence relating to the aspects that impact methodological practices of MMRS studies. The aspects of deduction, induction, and abduction (Denzin, 2001; Patton, 2002; Staat, 1993; Teddlie & Tashakkori; Yu, 1994) were considered during different phases and stages leading to the eventual development of the new framework.

To address methodological concerns for MMRS as an application of mixed methods research, with the intention of developing a new framework, it was critical to adopt dialectic pluralism. Dialectic pluralism presents an ontological stance informed by the belief in multiple realities that interact in diverse ways to reinforce our understanding of a given phenomenon (Johnson, 2012). This view informed and guided the process for developing the new framework given the need to consider diverse perspectives. It was particularly important to utilize differences and similarities in discussions and proposed MMRS frameworks give diverse philosophical, disciplinary, and methodological orientations. Therefore, pragmatism informed the study globally, while elements of critical realism were utilized during the consolidation of the information for the framework development.

Critical realism is viewed as a compromise between positivism and interpretivism, yielding a subtle version of realist ontology (Mingers 2001, 2004; Teddlie & Tashakkori, 2009; Zachariadis, Scott, & Barrett, 2013; Venkatesh et al. 2013). This belief directed the development of the new framework which considered diverse evidence from existing methodological MMRS studies and related literature. By utilizing varied

sources of evidence to enlighten the creation of the new framework as the *truth*, the researcher postulates the belief that this information is true to the extent to which it is presented in those studies. Moreover, the tools utilized for the expert review process included both numeric and qualitative data. These details were analyzed using both quantitative and qualitative means before being qualitized into appropriate descriptions to inform the final and refined new framework. Though the development of the framework in this study was informed by pragmatism, it is important that studies applying it to different contexts utilize alternative theoretical perspectives appropriately.

Theoretical and pragmatic validation informed the selection of review methods allowing for the research questions to be systematically addressed. As a methodological study, the current project proposes a conceptual MMRS framework developed within pragmatism. Before dwelling on the logistics for this study, it is important to outline current MMRS frameworks and related efforts, categorized as conceptual frameworks.

Conceptual Frameworks

Lester (2005) states that, "A conceptual framework is an argument that the concepts chosen for investigation, and any anticipated relationships among them, will be appropriate and useful given the research problem under investigation" (p. 460). Conceptual frameworks evolve with respect to existing knowledge and data on a topic, and the demands of the research question, warranting habitual revision. Conceptual frameworks also reinforce contextual definitions of selected concepts and their interrelationships to achieve study validity (Onwuegbuzie & Frels; Sweetman et al., 2010). It is thus vital to rationalize the study processes beyond providing explanations in a conceptual framework (Lester).

Review researchers outline various conceptual frameworks for review processes. These processes can be inductive or deductive based on the research questions (Suri, 2014). Deductive frameworks lend themselves to positivist-oriented syntheses, while inductive frameworks align with interpretive syntheses approaches (Suri, 2014; Suri, & Clarke, 2009). Despite these classifications and the epistemological divides in the framework choice, fluidity prevails in their application (Saini & Shlonsky, 2012). Therefore, frameworks can be pre-defined or iterative. The research question and the evidence sought inform the decision on the synthesis approach and the framework utilized (Hong et al., 2017; Nye et al., 2016). Examples of frameworks for qualitative syntheses processes include meta-summary which is more aggregative in nature and considered more reflective of post-positivism; meta-synthesis, which is integrative and falls on the continuum between the two perspectives; and meta-ethnography, which is more interpretive (Sandelowski & Baroso, 2006). Frameworks specific to quantitative synthesis approaches primarily follow the same systematic process across different approaches. The research question asked and evidence sought differentiate the approaches for estimating the overall effect size (Biesta, 2010; Hong et al., 2017). Though quantitative synthesis approaches could be aggregative or configurative, they all tend to align with post-positivism and the eventual estimation of the overall effect for a given phenomenon or intervention (Gough et al., 2012; O'Mara-Eves & Thomas, 2016). Such views are not feasible for complex synthesis studies and those that consider diverse evidence to inform the research question.

Synthesis methods that consider diverse sources of evidence historically target complex research questions (Frantzen & Fetters, 2016; Hong et al., 2017). As such,

guidelines addressing these syntheses reflect their complexity. Examples of these frameworks include:

- Realist synthesis (Pawson, 2006; Pawson et al., 2005),
- Meta-narrative mapping (Greenhalgh, 2004),
- Bayesian meta-analysis (Roberts et al., 2002),
- Critical interpretive synthesis (Dixon-Woods et al., 2006; Flemming, 2010),
- Qualitative case analysis,
- Narrative synthesis (Mays et al., 2001; Popay et al., 2006),
- The Evidence for Policy Practice Information and Co-coordinating Center's (EPPI) approach (Thomas et al., 2004),
- Methodologically inclusive research synthesis (Suri, 2009); and
- The Critical Construct Synthesis approach (Wolgemuth et al., 2017).

Leaning towards disciplinary-oriented strategies, some researchers provide guidelines for applying mixed methods syntheses in their fields. Mertens (2018) addresses the practice of mixed methods designs for systematic reviews in evaluation based on the evaluation branches of methods, values, use, and social justice as well as for dialectical pluralism. Palinkas and Cooper (2017) address the general application of mixed methods synthesis to evaluation, while Onwuegbuzie and Hitchcock (2017) propose a "meta-framework" for directing the process for mixed methods impact evaluations. These procedures provide additional information for conceptual frameworks (Hevyvaert et al., 2016) and are briefly addressed next.

Review Guidelines, Publication Standards, and Quality Appraisal

Guidelines exist for general or specific syntheses, or parts of syntheses processes such as reporting. Most of these recommendations are available on EQUATOR (Enhancing the QUAlity and Transparency Of health Research) (Heyvaert et al., 2016). For example, the Preferred Reporting Items for Systematic Review and Meta-Analysis Protocols (PRISMA-P) (Shamseer et al., 2015) outlines the procedure for reporting on literature reviews. Other guidelines specifically target systematic reviews in health practice such as: Finding What Works in Health Care: Standards for Systematic Reviews (Morton et al., 2011), and the Center for Reviews and Dissemination's (CRD) guidance for undertaking reviews in health care. Finally, other guidelines target specific synthesis approaches. These include:

- The PRISMA (Moher et al., 2009) for systematic reviews and meta-analysis;
- ENTREQ (Tong et al., 2012) for qualitative syntheses;
- The RAMESES (Realist And MEta-narrative Evidence Syntheses: Evolving Standards) publication standards for realist syntheses (Wong et al., 2013);
- The Mixed-Methods Appraisal Tool (MMAT) for appraising qualitative, quantitative, and mixed methods studies; and
- The Joanna Briggs Institute's (JBI) standards for reporting on meta-aggregative synthesis (Joanna Briggs Institute [JBI], 2011, 2014, 2019).

Overall, these procedures are informative when contemplating both MMRS reporting guidelines and overall frameworks.

Transparency in MMRS is important (Templier & Paré, 2018), hence the need for conceptual frameworks to inform and guide the process. Many of the underlying assumptions that guide conceptual frameworks proposed for less complex syntheses inform those for MMRS designs. But, due to their intricacy, MMRS studies must navigate epistemological and methodological intersectionality when considering specific conceptual frameworks (Saini & Shlonsky, 2012). Guidelines and frameworks are particularly useful for novice researchers who might encounter complex review questions requiring the application of MMRS approaches. Ongoing efforts by MMRS review researchers reveal the need to outline clear guidelines to improve and diversify their application (Frantzen & Fetters, 2016; Hong et al., 2017). Currently, reviewers have extended some of the frameworks proposed for multi-vocal and multi-method evidence synthesis easily to MMRS (Hong et al.; Pluye & Hong, 2014). These adaptations conceptually fit into the context of MMRS given their capability to address review questions that are complex (Frantzen & Fetters; Hong et al.; Pluye et al., 2009).

Heyvaert and colleagues (2016) provide extensive hypothetical extensions for some of the existing mixed methods frameworks for MMRS while emphasizing the various MMR approaches that guide these applications. Hong and others (2017) appraised systematic reviews coalescing qualitative and quantitative evidence (systematic mixed studies reviews – SMSR) and identified four key factors; the title, justification for choice of synthesis, methods of synthesis, and the integration of qualitative and quantitative evidence, as crucial aspects in mixed methods research. They further emphasize the need for clarity when articulating methodological choices and steps. They state, “Hence in addition to naming the synthesis method, we recommend that reviews

should provide a clear description of what was done to synthesize the data and add methodological references." (p. 11).

In addition to efforts by review researchers, leading organizations whose work revolves around literature reviews provide submission guidelines for reviewers to consider when submitting their MMRS to them (Heyvaert et al., 2016; Higgins & Green, 2011). These organizations include the Campbell Collaboration, which provides guidelines for MMRS in crime and justice, education, international development, and social welfare; and the Cochrane Collaboration, which provides templates for MMRS in human health care and health policy fields. No templates or reporting guidelines are in existence exclusively for MMRS studies (Heyvaert et al.).

Despite these efforts, existing challenges call for extensive review, redefinition, and refining of MMRS frameworks. Mainly, the presentation of clear arguments and the justification for the choices made during the review to accompany methodological guidelines should be reinforced. For example, issues relating to methodological steps like the appraisal of mixed methods primary studies which impacts their inclusion in MMRS (Pluye & Hong, 2014), and the integration of information, and reporting requires further clarification (Wolgemuth et al., 2017). This study utilized knowledge from diverse frameworks proposed by MMRS researchers rather than relying on one. The resulting evidence comprehensively informed the emergent framework in this study, referred to as the comprehensive research synthesis (CRS) framework, while further considering active discussions on MMRS frameworks in the literature.

Section Summary

Scientific research is necessary to effectively address and meet societal needs. Sophisticated approaches are needed to address intricate and progressively changing research questions. Thus, primary research, traditionally aligned to positivism or constructivism, has advanced to adequately meet the demands for multifaceted questions by considering pragmatism. These advances in primary research have in turn provoked similar growth in research synthesis.

Research synthesis, preceded by narrative reviews which primarily focused on setting the stage for new research, evolved out of necessity. The need to understand large volumes of existing research and to better inform current inquiry particularly with regards to how well interventions worked motivated the formalization of research synthesis. Though practiced for over 40 years, research synthesis received recognition as an autonomous approach to research much later. Developments in the practice of research synthesis emulated those for primary research whereby applications reflecting quantitative research practices dominated the field for many years, before qualitative and more recently multi-method approaches. Multimethod approaches consider evidence across diverse procedural, theoretic, and epistemological stances, and thus include mixed methods approaches to research synthesis.

Research synthesis has gained popularity over the past decade leading to rapid applications to complex contexts and research questions. Advances are mainly driven by the need to carefully address constantly evolving contemporary research questions due to complex societal contexts. Specifically, the evidence-based practice movement that targeted better findings for policy questions, coupled with widespread developments in

primary research and easier management and access to information have largely influenced this growth. It is worth noting that although research synthesis initially materialized within the education field, many of its methodological and practical developments have occurred within the medical/health sciences field. Despite the promising state regarding the development of research synthesis, it is evident that logistical challenges obstruct emerging applications.

Arguments persist regarding good practices to ensure legitimacy of the processes of research synthesis as well as the resulting products. These debates include methodological and procedural concerns such as the inclusion/exclusion of studies selected for research synthesis studies that raises questions about bias. Arising challenges have motivated discussions leading to improved applications of research syntheses. However, some challenges persist. For example, the quality of selecting studies across and within methodological divides is debatable, with implications for the final synthesis product. Moreover, the practice of research synthesis is plagued with terminology challenges jeopardizing the application and consumption of the synthesis products. These challenges call for caution when applying research synthesis to complex research questions and contexts. It is necessary to critically examine proposed methodologies and frameworks. This study therefore focuses on the practice of mixed methods research synthesis (MMRS) as one of the most recent propositions for research synthesis approaches.

The concept of mixed-methods research is foundational to the practice of mixed-methods research synthesis (MMRS). MMRS promises to provide comprehensive evidence for research synthesis studies, particularly for policy and practice, though

difficult to carry out. The complexity in implementing and disseminating MMRS stems from considering evidence across quantitative, qualitative, and mixed methods studies. Despite promising rich and comprehensive evidence, it is essential that research reviewers carrying out MMRS studies deliberate on the shortcomings of studies within individual paradigms as well as across the whole review. Moreover, given ongoing developments in the mixed methods field along including the controversial issues of design and implementation, there is need for rigorous efforts towards explicating its application and practical logistics.

Ongoing efforts to refine the practice of MMRS highlight the need for further investigation of procedural steps to ensure quality results. This study therefore focused on contributing to these efforts and to the research synthesis literature in general by proposing an improved MMRS framework. Specifically, this study reviewed existing MMRS frameworks to highlight their strengths and weaknesses, hence streamlining and defining collective practices that informed the new framework with the input of leading experts in the field.

CHAPTER 2

METHOD

This study sought to create a new framework for mixed methods research synthesis (MMRS) studies informed by existing frameworks and related literature. This Chapter provides an overview of the method while subsequent Chapters provide in-depth details of technical aspects for implementing the specific stages of the study along with the results, discussions, and implications for this study and for the field. This study is exploratory and evolutionary in nature; thus, it is impossible to separate the method from the data collection and analysis stages as they were iterative. This chapter describes the research design and rationale, the identification and selection process for primary studies, the data collection methods, the data analysis methods and reporting, and possible ethical considerations. An extensive discussion of the procedures based on key stages addresses the research questions.

Introduction

The purpose for this study was two-fold: to identify and review existing MMRS frameworks and pinpoint their strengths and weaknesses, and to develop a new framework based on the knowledge gained from the review and informed by related discussions in the field, while considering feedback from select experts in the field. There were two main research questions for this study. The research questions with respective sub-questions are presented below:

1. MMRS designs and conceptual frameworks:
    a. How do different researchers address the practice of MMRS design with respect to methodological process and related conceptual frameworks?
    b. What are the strengths and weaknesses of MMRS frameworks utilized by these researchers?
2. Generate an improved framework based on findings from research question 1 while considering expert review input:
    a. Can an improved approach be generated, after evaluating the MMRS studies in research question 1, to conceptualize the MMRS process based on the evidence from current approaches and related literature?
    b. How is such a framework defined?
    c. Does the framework hold up as an improvement under expert review?

Study Design and Rationale

Research denotes the need for clear methodological processes when engaging in review studies. Considering that diversity in evidence to inform one research endeavor effectively is fundamental to research synthesis, clarifying the procedural connotations in research synthesis is important (Lemire, 2017). Particularly, the integration of studies given their diversity in data, methods, designs, and research evidence on related or similar phenomena has continuously challenged review researchers (Fetters & Freshwater, 2015; Lemire; Thomas et al., 2004; Sheldon, 1998). These complications translate to multifaceted applications of research synthesis. This study addressed this concern by developing a viable conceptual framework for MMRS studies.

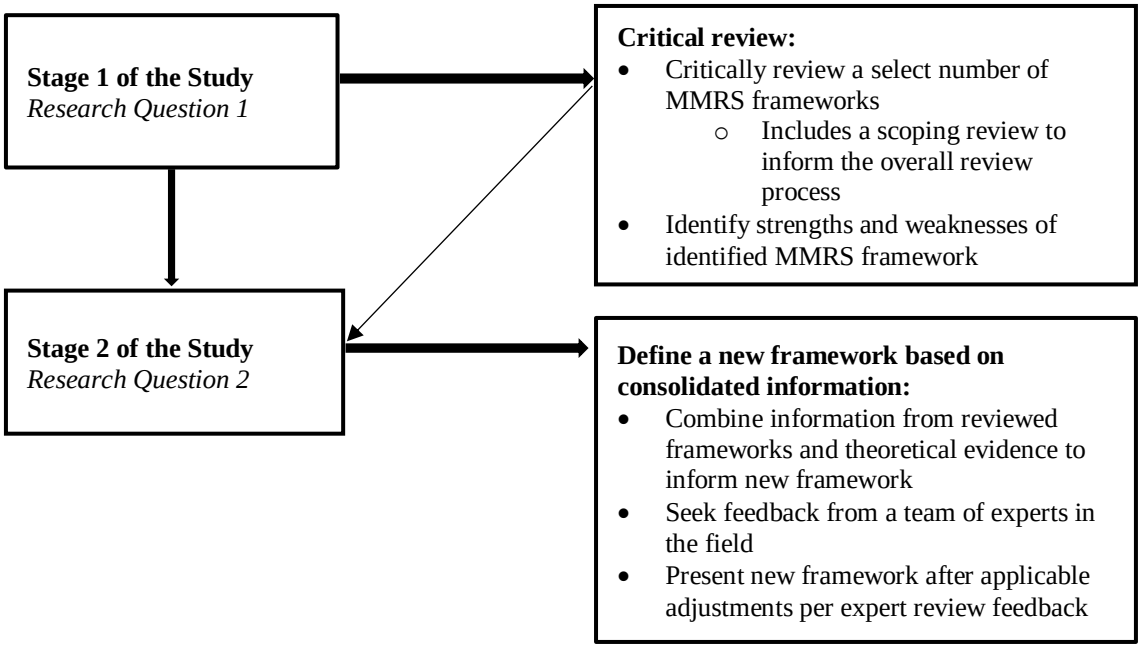
While stretching the idea of mixed methods research (MMR) to research synthesis is promising, questions regarding its intricacy and its legitimacy prevail. Many of the concerns related to the application of MMRS are inherent to the practical components associated with both the MMR and research synthesis fields (Heyvaert et al., 2011; Thomas et al., 2004). For example, MMR is an emergent field with ongoing debates about many definitional and practical aspects (Creamer, 2018). Therefore, in addition to methodological advances, researchers should pay attention to the practical and procedural nuances of innovative research approaches concurrently. This study sought to contribute to the efforts toward addressing methodological concerns about the application of MMRS to research synthesis.

MMRS and Conceptual Frameworks. Conceptual frameworks distinguish MMRS approaches by laying out characteristics informed by theory. Several approaches have been proposed to inform the MMRS process (Lemire, 2017; Saini & Shlonsky, 2012). Despite these efforts, concerns regarding limitations in their application are noted. A persistent challenge for review researchers involves the clarification of methodological practices translated to MMRS given the diverse conceptual perspectives surrounding various MMR approaches. Examination of MMRS frameworks offers guidelines for defining good MMRS practices, allowing for better application of MMRS studies.

Complex research syntheses require systematic core processes (Gough et al., 2019). It is by following well defined and transparent review processes including explicit searching, selection, and integration of evidence that legitimate, easy-to-follow reviews can be replicated (Heyvaert et al., 2016). This dissertation sought to define a

comprehensive framework for MMRS, based on information on frameworks identified and reviewed from methodological studies, and then examined the feasibility of the refined framework by seeking feedback from a set of experts in the field. Expert feedback particularly addressed the developed framework compared to the two most prevalent MMRS frameworks in the field identified as part of this study and complemented by applicable literature. Figure 1 illustrates the overall stages for this study.

Figure 1
Overall Study Design Diagram



This study consists of two sub-studies, labelled Stages 1 and 2. Stage 1 of the study informed Stage 2. Evidence gained from the critical review stage guided the development of the new framework in the second stage. A panel of experts in the field provided feedback on the developed framework that guided additional revisions and refinement. The methods, tools, and procedures for these stages are described next.

Stage 1: Critical Review

This stage addressed the first research question as stated below:

Research Question 1

How do different researchers address the practice of MMRS design, and what conceptual frameworks do they employ? What are the strengths and weaknesses of each identified framework?

A critical review was conducted using Grant and Booth's (2009) description. The critical review offered insight on current MMRS frameworks and informed the development of the new framework. This approach ensured thorough scrutiny of literature on MMRS frameworks. Per Grant and Booth's views, "An effective critical review presents, analyses and synthesizes material from diverse sources. Its product perhaps most easily identifies it—typically manifest in a hypothesis or a model, not an answer" (p. 93). From their evaluation of review methods, Grant and Booth note four stages signifying general critical review processes. These stages, based on the Search, AppraisaL, Synthesis, and Analysis (SALSA) framework include searching for the literature, appraisal of identified studies, synthesis, and analysis of the findings.

Additional steps were taken to complement shortcomings of the critical review and to strengthen the validity of the results in this study. Recognizing the emergent nature of MMRS literature, terminology, and methods, an exploratory scoping review was first carried out to inform the selection of conceptual studies and subsequent stages for the critical review (Heyvaert et al., 2016). The scoping review provided a preliminary picture of the extant literature on MMRS frameworks (Grant & Booth, 2009), and guided

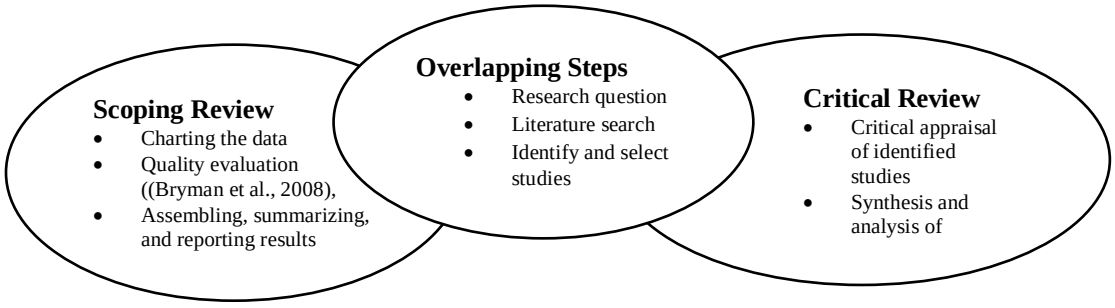
the initial search and identification of methodological MMRS studies while setting the stage for subsequent steps of the critical review. This process also reinforced the researcher's knowledge and understanding of MMRS studies by allowing an extensive exploration of the literature.

Scoping Review

A scoping review following the steps recommended by Arksey and O'Malley (2005) was carried out. These steps include identification of the research question, identification and selection of relevant studies, charting the data, then assembling, summarizing, and reporting the results. Rumrill and Colleagues (2010) detail the processes involved in each of these steps. This approach is not exhaustive and it excludes quality assessment (Anderson et al., 2008; Grant & Booth, 2009; Rumrill et al., 2010). Daudt and others (2013) suggest adding quality evaluation of included studies as an extra step. This study included an additional step for assessing quality, given the centrality of quality in research and research synthesis (Bryman et al., 2008; Talbott et al., 2018). Figure 2 illustrates the scoping review and the critical review stages.

Figure 2

The Scoping (Arksey & O'Malleys, 2005) and Critical Review Steps (Grant & Booth, 2009).

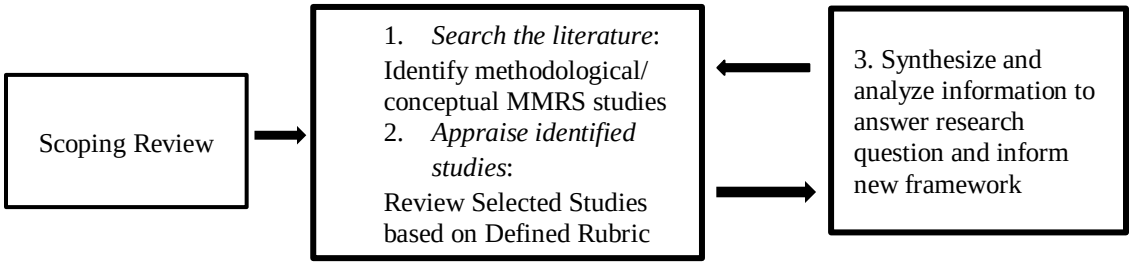


Note: The outside circles show the review stages for the scoping and critical review stages while the middle shows the overlapping phases.

It is important to note that the scoping review was carried out within the context of a critical review. Therefore, key steps of the scoping review and critical review are intertwined. The overlapping steps (See Figure 2) were not repeated as traditionally recommended but were revisited iteratively to refine the information in steps after the scoping review. The general progression of the study is discussed next. Figure 3 illustrates the progression of the critical review steps. Elaborations for these progressions are discussed below.

Figure 3.

The Progression for Stage 1 of the Study-- Critical Review steps (Grant & Booth, 2009)



Progression of the Study.

A scoping review of MMRS frameworks was initially carried out to inform the logistics of the study and the development of an initial rubric to guide quality evaluation of identified primary studies. The scoping review broadly identified studies of MMRS frameworks (Peters et al., 2015; Squires et al., 2017). A review of the identified studies then commenced and in line with the research question and initial inclusion criteria. Next, a refined inclusion criterion was used to critically evaluate identified studies based on the developed rubric, initial review of the studies, and literature on conceptual MMRS studies. Also, pertinent revisions were made to tools developed during the scoping review stage. Finally, the information was summarized, synthesized, and analyzed to

inform the next stage of the study and the development of the new framework. The review and synthesis stages have a feedback loop to show their iterative nature.

Scoping Review. A scoping review conducted to provide a preliminary picture of the extant literature on MMRS frameworks (Grant & Booth, 2009; Peters et al., 2015) guided the initial search and identification of MMRS frameworks. This review was not exhaustive and did not include quality assessment (Anderson, et al., 2008; Pham et al., 2014; Rumrill et al., 2010) thus additional tools, developed during the study, were employed to complete the critical review of the selected studies. These tools consisted of a study quality evaluation rubric, a review protocol, initial search criteria to inform the inclusion/exclusion of studies, and a coding form. See Appendix A for the tools.

Evaluation of quality is argued to reinforce resulting scoping reviews (Daudt et al., 2013; Pham et al., 2014; Rumrill et al., 2010). The initial search was based on scoping the literature using descriptors related to terminology associated with MMRS studies and noted from identified studies, and related literature. This search informed the initial inclusion/exclusion criteria, providing a practical foundation for the researcher to understand the nature and scopextant MMRS literature and to meet the purpose of the study. A spreadsheet was established to track key information in MMRS methodological studies. This information reflected the characteristics in the initial protocol and the coding form and included: key words used in the studies, label(s) used to refer to MMRS studies, types of conceptual studies, journals publishing the studies, and the search engines and/ or sources of information for identified studies, and the disciplinary distribution of these studies. A copy of the spreadsheet is presented in Appendix A. The

spreadsheet allowed for accountability while providing a reference for later stages of the study. Finally, conceptual mapping delineated the scope and magnitude of terminology and methodological propositions for MMRS frameworks. This information strengthened the validity of the review process, while informing later stages for the critical review and the development of the study tools.

Review Protocol. The review protocol guided study selection, and informed the initial inclusion criteria (Card & Little, 2016). This protocol was refined as the scoping review progressed and as information emerged during subsequent stages. The review protocol targeted general study characteristics to allow for easy tracking of retrieved studies before embarking on the review processes. The characteristics identified on the protocol guided the tracking of studies, allowing for record keeping in an Excel spreadsheet. The protocol is presented in Appendix A. Some information considered for the protocol included:

- Reference type (book chapter, journal article, or grey literature),
- Citation (Author (s), year),
- Country/ Place of publication, and
- Publication source.

Study Coding Form. A coding form (See Appendix A) was developed to highlight aspects of value to the research questions and to provide key details on retrieved studies at a glance throughout the review process. This form further informed refinement of the inclusion and exclusion criteria, and the improvement of the study evaluation rubric. The information on the coding form included issues of importance to the research

question and consisted of issues such as the labels used for the method (synonyms to MMRS), the quality of the study per the *study quality evaluation rubric*, relevant notes in the study, and the MMRS framework used in the study. The coding form was iteratively polished as information emerged in subsequent stages.

Study Quality Evaluation Rubric. A rubric was developed to appraise selected studies for the critical review (Grant & Booth, 2009). The rubric was informed by the results and findings of the scoping review and initial stages of the critical review (initial search and initial review of studies), thus guiding the general study selection and appraisal. The rubric detailed the quality of included methodological studies based on characteristics such as rigor, applicability, adaptability, and comprehensiveness. The rubric is presented in Appendix A. Some information considered for the rubric development included:

- Publication source such as the prevalence of the publishing source of the study,
- Identification of the MMRS framework used,
- Methodological rigor and transparency, and
- Procedural transparency for identified MMRS frameworks.

To adhere to the procedures by Grant and Booth, the search formally connoted the first stage of the critical review. Note that the scoping review was conducted within the critical review where overlapping stages (see Figure 2) were not repeated but revisited iteratively as depicted in Figure 3.

Initial Search Criterion. A period was not assigned for the initial search considering that MMRS literature is a relatively new approach. Words, identified in MMRS literature such as, *mixed methods research synthesis, mixed methods synthesis, mixed methods research synthesis framework, and mixed methods research protocol* were utilized for this search. These searches were not systematic and were mainly conducted across two search engines, *Web of Science*, and *Google Scholar*. Additional terminology including synonyms for MMRS identified through literature and during the scoping review were added iteratively to the search. The search criteria were refined and revised progressively as information emerged.

Refined Search Criteria. The refined search developed after the scoping review and before the critical review stages was more comprehensive. This search targeted both published and unpublished literature to reduce the effect of publication bias. The criteria guided the selection of studies across diverse platforms including common search engines (*web of science and Google Scholar*), select databases, and applicable journal and conference websites, and backward and forward searches. Retrieved studies were coded and the information recorded in the developed spreadsheet (Appendix A) for easy access. Due to time constraints and logistical challenges, authors engaged in mixed methods research synthesis were not contacted for possible unpublished works.

The scoping review informed the study review stage, which closely aligned with the core guidelines for the critical review. First, the quality evaluation rubric was refined to consider the 'quality of methodological studies.' This refined rubric guided the review stage along with revised versions of the other tools (review protocol, search criteria, and

coding form). Due to the methodological structure of this study, the final stages of the scoping review (i.e., charting and quality evaluation) were carried out within the initial phase of the critical review. Charting provided simplified summaries for the included studies while quality evaluation informed the appraisal process.

Review and Appraisal of Selected Studies. Selected studies were assessed based on the quality evaluation rubric. It is important to note that the final inclusion of studies considered the frameworks identified for review during the scoping stage. Particularly, studies outlining frameworks that have been clearly defined and sufficiently grounded in theory were reviewed. Appendix A shows the study quality evaluation rubric.

This stage of the study was iterative and included further data collection and sampling. An initial review of chosen studies required the evaluation of abstracts. Emergent details, considered valuable to the research questions, were added to the spreadsheet and the coding form. Through this assessment, the goals and the nature of the selected studies depicted how well they fit the defined criteria (per the rubric). Some of the retrieved studies were dropped, while new studies were added. Due to the concern for subjectivity in this stage, clear details for decisions made were documented for transparency and are outlined in Appendix A. Further backward and forward searches were conducted after reviewing the abstracts and methods sections of retrieved studies. Despite striving to be comprehensive in study selection and inclusion, this study was selective in that it utilized purposeful sampling focused on retrieving methodological MMRS studies. After achieving saturation, the final set of studies was closely evaluated to address the research questions.

Synthesize Information to Answer Research Question and Inform New Framework. This phase of the study comprised an extensive critical review of the final set of selected studies focusing on identified conceptual frameworks. The defined rubric informed the process for identifying the strengths and weaknesses of these frameworks. A final rigorous review of the selected studies then followed to document any additional information that would edify response to the research questions. Content analysis (Beck & Woynar, 2017) and thematic synthesis were applied to summarize and synthesize information from the identified studies. Specific coding techniques, data display methods, and analytical strategies reinforced procedural clarity. Chapter 3 and Appendix A includes summaries of this information, presented in tables and figures to highlight key information from the analyses. The information was integrated to provide succinct responses to the research question along with conclusions and discussions for the findings laying the foundation for the subsequent stage of this study.

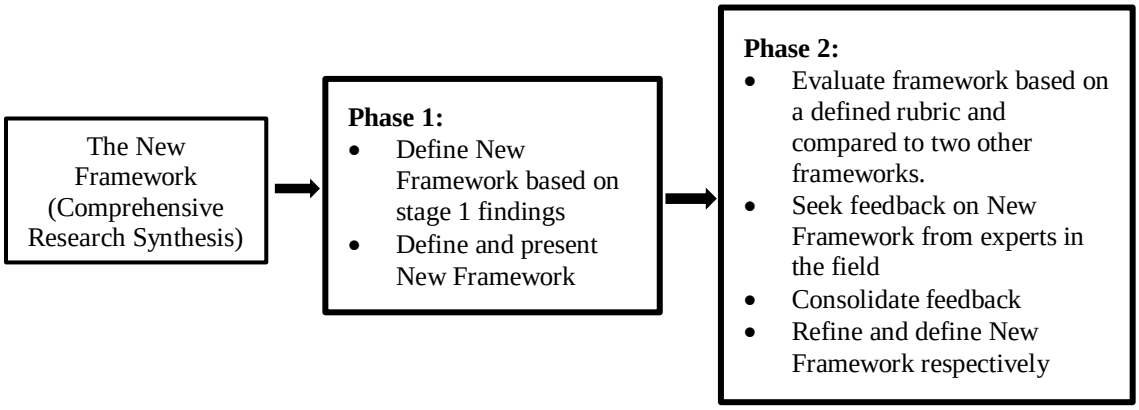
Stage 2: The New Framework (Comprehensive Research Synthesis)

This stage addressed the second research question as stated below:

Research Question 2

After evaluating MMRS studies based on the evidence from proposed approaches and the field (research question 1), what might an alternative framework intended to conceptualize the MMRS process look like? What are the views of experts in the field on its definition? How do these views shape the definition of the developed framework? Figure 4 outlines the approach to development and refinement of the new framework.

Figure 4.
The Process for Developing and Refining the New Framework (Stage 2 of the Study)



This section, consisting of two phases, was informed by the outcomes of the analysis for the first stage. The first phase focused on developing the new framework, while the second phase focused on expert review and refining the new framework. The information from the expert reviews enlightened the fundamental question of an improved framework for MMRS studies. This stage led to the overall conclusion for the study with implications for the new framework and the field.

Phase 1

Using the findings from the first stage, the researcher developed a new framework. Summaries and conceptual maps portray the flow of information while highlighting critical decisions made to inform the new framework. Arguments for the content included in the new framework are provided along with supporting evidence from the literature or logical argument. For example, information borrowed from processes employed to develop mixed methods research frameworks such as the work by Creswell and Plano Clark (2011) is highlighted. The developed framework is presented visually

and supported by descriptions for each proposed procedural step in Chapter 4. In the second phase, experts in the field reviewed the new framework as described below.

Phase 2

This segment builds on the initial phase. To reinforce the process of creating the new framework, seeking feedback from experts in the field was crucial. This step addressed persistent debates regarding the practice of mixed methods research and research synthesis. Initially the researcher, using a pre-developed rubric, rated the new framework alongside two other prominent frameworks before engaging in the expert review process. Expert review was then sought to offer feedback on the rating process and researcher's judgement of the rubrics. The rubric used to evaluate the new framework alongside two others is provided in Appendix B.

Efforts were made to ensure that influential individuals in the field of mixed methods research synthesis (MMRS) were considered for the review. Researchers who appeared to hold more influence, through the number of publications and citations in the field and in providing direction to the field of MMRS, were identified from studies selected in the first stage and related literature. Additional names of researchers were added to the list of experts based on word of mouth, from reviewing opinion studies, and from recommendations made by the experts. A final list of prominent researchers was generated, and a search for their contact information ensued before seeking their feedback on the new framework. Next, a draft message was composed and presented for IRB review and exemption determination along with a sample set of interview questions to solicit responses from the reviewers. To initiate the expert review process, an

introductory email was first sent to the selected set of experts after obtaining approval from the IRB. The characteristics of the interview questions and the email message are discussed below. The email message, the IRB exemption form, the IRB exemption letter, and the interview questions are shown in Appendix B.

The introductory email provided background to the expert reviewers before seeking their permission to participate in the study. The message briefly described the study, its purpose, and intended outcomes; then the request and expectations for participating in the interview. This initial email also sought the expert reviewers' consent. A second and follow-up email with more details about the logistics of the study along with relevant materials was then sent to the reviewers who consented to the study. The reviewers offered feedback on the researcher's evaluation of three frameworks, the developed framework-- labeled framework 3--compared to the two other prevalent MMRS frameworks, labeled frameworks 1 and 2. The benefits of the research project were emphasized to encourage the participants' input in the study as prominent researchers with methodological expertise in MMRS, and mixed methods research (MMR). Participants were invited to offer additional feedback on the developed framework and the other two frameworks beyond the interview at their discretion. The participants were specifically asked to provide additional written feedback to the researcher after their interview sessions if they chose to. Details regarding additional reviewer feedback and the review results are presented in appendix B along with the interview questions and related documents. The rubric used by the researcher to evaluate the frameworks was critical in directing this stage and is described next.

MMRS Frameworks' Rubric. The rubric was based on issues identified as critical to MMRS frameworks from the first stage of the study. Appropriate measure development steps described below were taken before its usage. The rubric addressed three key factors relating to the frameworks and MMRS studies: quality, structure, and clarity. Definitions for these factors were presented with the rubric to provide additional context as defined below.

First, the researcher addressed the quality of the overall frameworks, then the qualitative, quantitative, and mixed methods components. Quality in this sense referred to how well the framework addressed issues associated with methods and methodological and logistical stipulations. Quality was further categorized into three groups based on the design of the framework, the sampling process, and the integrity with which it observes the respective methods and methodological requisites of the field.

Next, the structure of the new framework was compared to that of two others identified as most prominent in the field. The structure addressed the procedural nuances of the framework, hence the ease with which an individual can make sense of the logistical processes. The structure measured six aspects: the overall framework, the leading/dominant component strand, the minor component, the transition between strands, the mixing and integration of strands, and the conclusion/ending of the framework.

Finally, the clarity of the frameworks was evaluated. Clarity explored the general presentation, appearance, and flow of information in the framework. Specifically, by examining whether the framework was clear, the researcher provided evidence about how

easy it was for users to understand and follow the content in the framework. To achieve this goal, five characteristics were considered, namely: the overall framework, the language used in the framework, the procedures employed, and steps taken in the framework, and the general outline of the framework.

The researcher further provided additional feedback on their general understanding of the frameworks after rating them per the rubric as a written summary. This information enriched the data collected and enlightened the researcher and the experts. Appendix B contains a summary of the researcher's ratings and notes on the three frameworks. The interview protocol and questions for the expert review are discussed next.

Expert Review Interview Protocol and Questions. The interview protocol had two major sections, an introductory section and the interview questions. The introductory section offered a brief background for the study, instructions for preparing for the interview, logistics for the interview session (such as audio recording), along with other IRB requirements on risks, benefits and consent information.

The second section consisted of 14 interview questions divided into seven sub-categories. The questions focused on the developed framework and the researcher's evaluation of the frameworks with the goal of pinpointing issues of general interest to the practice of MMRS studies and MMRS frameworks. The sub-categories were labeled, 'opening questions,' 'questions general to MMRS,' 'questions general to MMRS frameworks,' 'questions specific to the two provided frameworks,' 'questions specific to the researcher's ratings of the two frameworks,' 'questions on the researcher ratings of

the two frameworks,' questions on researcher developed framework,' and 'closing questions,' respectively. The first part consisted of three questions with one closed- and two open-ended questions. The questions sought general background information on the expert reviewers and served as opening questions for the conversation. The rest of the sections had two questions each except the sub-category 'questions on researcher ratings for the two frameworks' which had one question. The second question under the sub-section 'questions general to MMRS frameworks' had three sub-questions. Finally, the 'closing questions' were optional and were a means for the participants to offer input beyond the interview or to expound on issues covered during the interview.

One question specifically sought feedback on the researcher rating of the two most prevalent frameworks. The researcher's ratings provided numeric data ranking the frameworks as described earlier complemented by a summary of each framework. The question sought to provide more information on the value of frameworks on directing the MMRS process, issues related to the development of these frameworks, and implications for research and practice. General comments about the frameworks and efforts to streamline procedural challenges were also sought. Though sample questions were provided for the IRB process, the final and revised interview protocol is shown in Appendix B.

Presentation of Results

Summaries and diagrams are important when illustrating methodological concepts, particularly considering composite study designs (Bazeley, 2017). To successfully disseminate MMRS studies, one should consider many procedural steps,

some easier to conceptualize than others. As such, visual presentation of applicable steps and summaries of complex processes are warranted. The complexity of the current study is evident considering the varied sources of information it uses. Consequently, the need to utilize diverse representational features to allow users to make sense of the processes and stages that informed the study is inevitable.

In this study, the author utilized diagrams, figures, and table summaries where applicable to illustrate various stages, steps, and processes. Figures are particularly useful for illustrating logical processes and steps in the study. Table summaries, on the other hand, are useful for illustrating important concepts, key findings, and other critical information that pertains to certain processes within the study. For users to better understand the logical steps that inform the study, these summaries allow for easy replication, application, and comparison. This is also significant because it fosters transparency, an important ethical aspect of review studies (Heyvaert et al., 2017).

Ethical Considerations

Despite the traditional emphasis on the need for IRB reviews mainly for primary research studies, it is important for institutions to confirm that the processes for research reviews conforms to respective ethical regulations. In line with this realization, an initial exemption form for the overall study was submitted for IRB review by the researcher after completing the research proposal. Due to the emergent nature of this study, a subsequent exemption form along with related data collection tools (i.e., draft email to expert reviewers and the sample interview questions) was submitted to the IRB board at

the end of the first stage, and at the end of the first phase of the second stage for this study. The researcher also considered additional ethical concerns for research syntheses.

Ethical considerations for the review studies are mostly, if not entirely, dependent on the decisions taken during the review by the reviewer/s. Despite the susceptibility to subjectivity, researchers address this concern by suggesting ways to ensure the legitimacy of reviews. Most importantly, the interests of the review users are of core value in shaping and informing the proxess and progression of the review.

Sensitivity to the Needs of the Users of the Review.

The value and requisite for MMRS and reviews in general extend beyond the reviewers' interests. It is necessary to engage other interested parties, especially the users, throughout the review process to achieve practical results (Heyvaert et al., 2016). The motivations for this study were outlined by highlighting the research gap and research questions. This information advances the benefits of this study to the larger research synthesis and research community, going beyond the researcher's interests. The author further provided a personal reflection on her motivations, research background, and journey that influenced her desire to engage in this study. Particularly, the author, in the introduction, briefly discussed her desire to contribute to the methodological efforts and debates in MMRS.

Additional issues include consideration of stakeholder contributions throughout the review process (Rees, & Oliver, 2012), as well as the need for the review to address equity and social justice (Mertens, 2018; Sweetman et al., 2010). The main purpose of this study was to contribute to the efforts for research to provide better tools for tackling

research questions aligning with MMRS studies as a complex and emergent review approach. Additionally, the author's reflection on the philosophical assumptions that have informed and guided her research interests, and how they may or may not influence her approach to this study and decisions made, contribute to transparency in this study.

Transparency

Many of the ethical concerns that jeopardize reviews relate to their process and presentation. Review researchers need clearly articulate methodological choices, steps, and decisions made; and strengths and shortcomings of the review and/ or processes. Additionally, when reporting, it is vital that reviewers disclose funding information relating to the project, to be clear about publishing and reporting concerns regarding contributing authors, and to report on issues of concern such as plagiarism noted in primary studies utilized or not utilized in the review (Wager & Wiffen, 2011). Heyvaert and colleagues (2017) suggest consideration for the PROGRESS (place of residence (P), race/ethnicity (R), occupation (O), gender (G), religion (R), education (E), socioeconomic status (S), and social capital (S)) acronym by Welch and colleagues (2013) when contemplating issues of representation for populations in the review. These issues guided and informed my stance on ethics for this study as discussed below.

To address methodological concerns around the practice of MMRS studies, this study strived to accommodate diverse perspectives and opinions towards efforts to improve MMRS frameworks. Diversity was considered when retrieving MMRS studies for the review stage through efforts to include application studies across different disciplines in addition to searching diverse repositories. Also, limitations at various

stages are clearly acknowledged and noted to enlighten the users of this research. Transparency in all stages is reinforced through the presentation, and discussion of methodological steps, processes, and decisions made to equip users with essential knowledge about the technical details of this study. This further allows users to recognize that the framework developed in this study is not prescriptive but rather adaptable to innumerable MMRS study content and contexts. Finally, proper acknowledgements for works borrowed from researchers other than this study's author are provided through respective citations and references to credit how they inform this study.

CHAPTER 3

CRITICAL REVIEW

This chapter details the first stage of this study including the data collection, data analysis, and results. The procedures discussed outline the review process per the scoping review and the critical review, and follow the procedures described in Chapter 2, and as illustrated in Figure 2. Results of the scoping review and the critical review were provided in their respective sections. The scoping review helped outline the nature of the literature on mixed methods research synthesis (MMRS) frameworks, their usage and applications and laid the foundation for the critical review. The critical review built on the findings from the scoping review to identify the most prominent MMRS frameworks and their strengths and weaknesses, informing the development of the new framework, the comprehensive research synthesis (CRS) framework.

Scoping Review

The scoping review, as previously stated, followed recommendations by Arksey and O'Malley (2005) with the added consideration for quality evaluation as suggested by Daudt and others (2013). The scoping review informed and shaped the logistics for later stages of the study (Peters et al., 2015) and the critical review steps, leading to the development of the new framework, by mapping the MMRS literature and identifying patterns in relation to the research question. The scoping review primarily addressed the first part of the first research question. In line with Levac and others' (2010) suggestions

to ensure there is a connection between the purpose and research question, two objectives guided the review at this stage. The first objective examined the nature and scope of MMRS literature. The second objective identified patterns in methodological concerns regarding the practice of MMRS studies. To achieve these objectives, the scoping literature:

- Informed the identification of a reasonable number of studies for review in line with existing MMRS literature and the research question,
- Guided the creation of a preliminary list of descriptors to direct the search for appropriate databases,
- Oriented the researcher to the MMRS literature, its nature, and scope in relation to the research question, and
- Directed the identification of target journals and authors that publish MMRS research.

For the purposes of this study, methodological studies were defined as studies that address the *structure and conduct of MMRS studies* through a research question. However, studies that applied the proposed methodologies, referred to as frameworks in this study, and those that offered commentary on the structure and conduct of MMRS studies, provided insight on the overall research question. These studies further informed subsequent parts of the study. A distinction was made between studies that proposed or offered commentary on MMRS frameworks and those that addressed their adoption and/or application. Initially, the timeline for identified studies was not limited to allow for a rich exploration. This is because the MMRS approach is recent, but issues that

might affect its methodological practices could be widespread in the literature. A decision regarding time limitations was considered in later stages if it became apparent that specifying the period of the studies would improve the study's feasibility. These preliminary definitions laid out the 'initial' inclusion/exclusion criteria that were refined during subsequent stages. Appendix A presents a summary of the initial criteria to identify studies during the scoping review.

Identifying Relevant Studies and Study Selection.

The identification and selection of studies consisted of three steps. These steps, described below, included an *initial literature scan*, a *preliminary scoping search*, and *a refined systematic search*. Electronic searches were conducted after the initial literature scan and during the scoping stage across select academic databases and the online search engine *Google Scholar* in May of 2018. The refined searches were revisited in July and August of 2018 before embarking on data analysis. Two librarians were independently consulted after completing data collection for the first phase of the study, and during later study retrieval stages to review and verify the search strategies used for systematic searches. A clinical librarian was specifically consulted for searches in medical databases and journals.

Initial Literature Scan. The initial search was not systematic. It permitted a scan of present literature on MMRS and MMRS frameworks and familiarized the researcher with the nature and scope of the extant literature. This search complemented the literature review. It was evident from the literature that the MMRS approach is relatively new, and that the terminology used is diverse and not straightforward. Therefore, a scoping search

preceding systematic search attempts was necessary. Preliminary searches were conducted mainly in *Google Scholar* and *Web of Science* using key words and phrases associated with MMRS as identified in the literature review. Table 1 shows a summary of initial search terms and phrases.

Table 1

Search Terms and Phrases Identified from the Scoping Search

Synonyms for the MMRS Approach	***Procedural terms/ Phrases***	***Additional terms/ phrases used in associated studies***
Mixed methods research synthesis. *Mixed-Methods systematic review.* *Systematic mixed studies reviews.* *Mixed methods synthesis.* *Integrative reviews.* *Mixed methods, mixed research synthesis study.* *Systematic mixed studies reviews.*	Mixed methods research protocol. Conceptual framework. Framework.	Mixed methods/ mixed-methods/ mixed method/ Mixed methods research. Qualitative/ Qualitative research. Quantitative/ Quantitative research. Mixed methodology. Mixed studies. Quantitative and qualitative methodology. Methodologically inclusive.
Synonyms for the process	***General***	***Others***
Research synthesis. *Synthesis.* *Systematic review/ systematic reviews.* *Knowledge synthesis.* *Literature review.* *Evidence synthesis.* *Research utilization.*	Method. Methodology. Research methodology.	Qualitative meta-synthesis/ Qualitative synthesis/ Qualitative meta-analysis. Quantitative synthesis/ Quantitative research synthesis/ Meta analysis/ meta-analysis/ metaanalysis. Mixed research synthesis/ Mixed methods review/s/ Quantitative and qualitative synthesis. Meta-synthesis/ Meta-study/ Meta-narrative.

Since *Google Scholar* includes ‘grey literature’ in its collection, searches using similar descriptors consistently yielded more results than those in *Web of Science*. The titles and abstracts for identified studies were scanned to identify additional terms, phrases, and keywords associated with MMRS studies and literature. The results in *Google Scholar* are organized by relevance, therefore, given the consistently large

volume of results, only the first five pages (~ 50 studies) for each search were scanned for additional phrases and keywords. This process was iterative. A trial of different search term combinations was utilized to compare results across the two search engines and select databases. A preliminary list of descriptors based on this initial scan of studies informed initial systematic searches within select electronic databases.

Preliminary Systematic Searches. These searches used the identified key words and phrases to inform the refined systematic searches. This stage was important to determine optimal search string settings for retrieving studies across different databases. Different databases have different indexing practices, which affect the process involved in retrieving studies. Various combinations of the key phrases and terms identified were used mostly in basic searches and efforts made to identify related index terms across various databases. This was particularly useful for the health and medical sciences databases as they rely heavily on indexing of published work.

The search strings and strategies for the select descriptors were adjusted for specific databases. It was apparent that most of the literature and work on MMRS, like many research synthesis studies and reviews, is within the health and medical sciences field. This necessitated a search within key health and medical sciences databases. Searches across common databases for social sciences and beyond were further added for comprehensiveness. In general, most of the key phrases associated with MMRS were not indexed. Therefore, basic searches were conducted to capture targeted studies and to reduce the possible amount of unrelated literature. Finally, it was noted that the term 'integrative review,' though used by some researchers to reference MMRS studies

(Heyvaert et al., 2017; Onwuegbuzie & Frels, 2016), when used within search strings yielded large volumes of results (almost double) compared to when excluded. This is because 'integrative reviews' are also identified as a distinct type of research synthesis studies and have been practiced much longer than MMRS studies. Therefore, the term 'integrative reviews' was strategically excluded from all search strings. These searches were mainly carried out in *Google Scholar, ProQuest (Central)* and *Web of Science*. On achieving saturation, when the number of results did not appear to vary significantly, the preliminary search process concluded. The search string settings at this point informed the refined systematic searches. Appendix A provides a list of the initial search strings used for different databases. The results, with the term 'integrative review' excluded are presented in parentheses to illustrate the difference when the term is included.

Refined Systematic Searches. A refined search, conducted after setting the search strings and updating the search criteria, formed the systematic phase for this study. The databases searched were: *Web of Science* (Web of Science Core Collection, Biological Abstracts, KCI-Korean Journal Database, Medline ®, Russian Citation Index, SciELO Citation Index), the Cumulative Index to Nursing and Allied Health Literature (CINAHL), Eric (ProQuest), ProQuest (Central), PsycINFO (EBSCOhost), PubMed (Central), EMBASE, Cochrane CENTRAL, Cochrane Database of Systematic Reviews, and PubMed (Medline). *Google Scholar* searches complemented the searches across the other databases and allowed for the retrieval of applicable grey literature.

Hand searches were conducted in select journals devoted to publishing empirical mixed methods and research synthesis studies. Additional searches in relevant medical

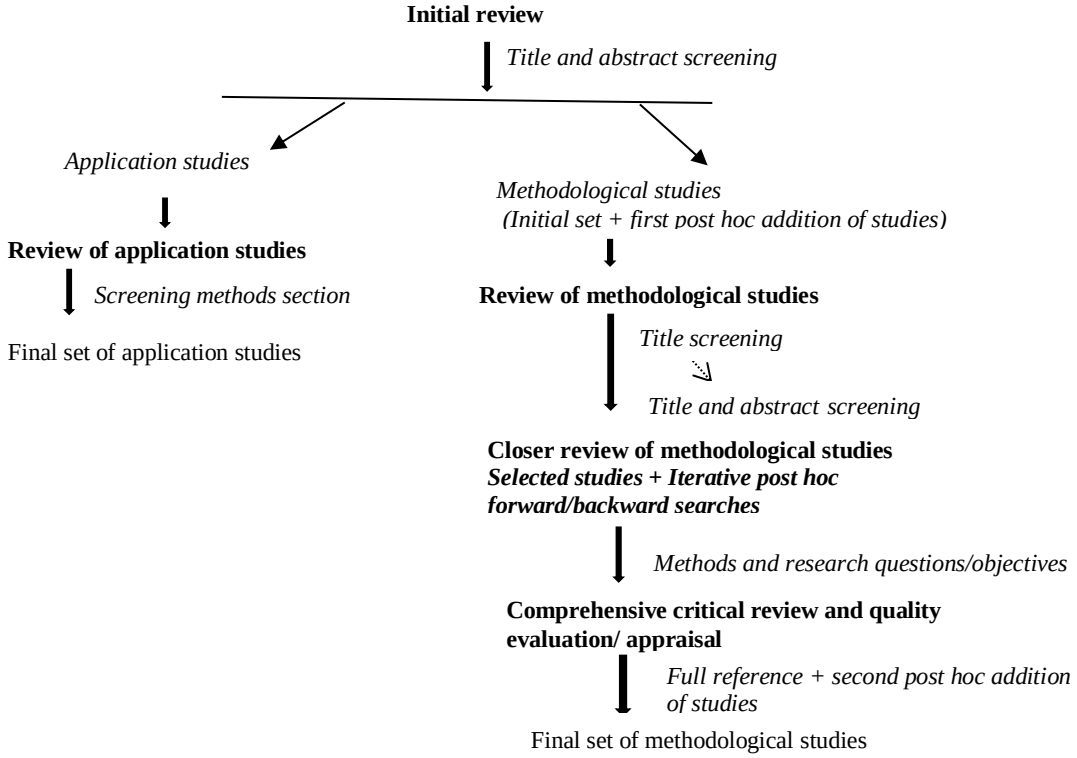
and health sciences journals further diversified the body of retrieved studies. Eclectic searches using review articles, reference lists, and suggested application studies allowed for post hoc retrieval of other relevant studies. Appendix A and Tables 3 and 4 provide a comprehensive summary of study sources including databases, journals, conferences, and relevant websites along with the associated search strategies. Appendix A and Table 5 summarizes the results returned for the final and consolidated search strategies. The final set of retrieved studies before review and removal of duplicates was 2,996. The studies were saved in the online information management system '*RefWorks*' before embarking on the review process leading to the initial selection of studies.

Study Selection. The inclusion/exclusion criteria were refined at this stage based on emergent details from the *initial literature scan*. Duplicates were identified and removed in *RefWorks* leading to 1,509 unique results. The study selection process involved three key stages: an initial review of titles and abstracts to identify studies aligning with the study purposes and research questions, followed by a comprehensive and closer review of the retrieved studies to delineate application and methodological studies, and a final comprehensive review of methodological studies to address the main research question. Figure 5 illustrates the study selection stages. These processes were guided by two main purposes: to identify application and methodological studies associated with certain MMRS frameworks, and to detect key issues about MMRS frameworks as identified in the selected studies. Application studies were particularly relevant if their titles and/or abstracts included the term, "mixed methods research synthesis" or synonyms identified earlier. Studies were classified as methodological if it

was apparent from the abstracts that they addressed procedural issues regarding various MMRS frameworks. This stage initiated the development of the study quality evaluation rubric, later used to appraise the final set of selected methodological studies. The rubric considered key aspects related to MMRS studies such as transparency and clarity in procedures used. The review processes are described next. Figure 5 illustrates the stages for the review processes in this study.

Figure 5

The Progression of the Review Steps



Initial Review. This review followed the title screening and initial abstract review for the selected studies. A revised inclusion-exclusion criteria, stated earlier, guided the review. Appendix A and Table 2 presents these criteria. Studies were excluded if they failed to mention any known MMRS labels or synonyms though they may have included

qualitative, quantitative, and/ or mixed methods primary studies. The selected studies exemplified practices analogous to MMRS studies. Five hundred and four studies that comprised 361 application, and 73 methodological studies were included at this stage. Studies were classified as methodological if they clearly addressed MMRS frameworks and/ or related methodological issues without applying the framework to a study or research project. Illustrative application studies were included if they accompanied the development of a given framework or were used to demonstrate its application. The second review stage commenced, focused on the selected application studies.

Review of Application Studies. This review covered a substantial part of the scoping review and targeted the selected 361 application studies. The abstracts and methods sections for these studies were screened for inclusion. This review informed the first research question regarding available MMRS frameworks, and the prevalence of their usage. Three things were sought regarding the framework used:

- Whether a defined MMRS framework was utilized;
- Whether the framework was utilized with fidelity; and
- Notes on why a framework was utilized with fidelity or not.

To address these issues, information collected from the selected application studies included the name of the framework used, the rationale for using it, the study citation, and noted methodological limitations when applying the identified framework. Studies were excluded if they were proposals rather than completed studies, were conference abstracts or commentaries with inadequate methodological details on framework used or mentioned, and if they referenced MMRS studies in their titles and/or

abstract but applied methodologies specific to other review processes among other concerns. Table 2 presents a summary of the adapted inclusion/exclusion criteria.

Table 2
The Adapted Inclusion and Exclusion Criteria for Application studies

Inclusion	• Studies applying a given MMRS framework clearly referenced, mentioned and/ or outlined in the methods • Completed studies • Framework addressed is geared towards the actual process for MMRS studies and not reporting guidelines • Studies that developed and registered protocols aligning with a defined MMRS framework
Exclusion	• Methodological • Illustrative/ Hypothetical studies for a given framework rather than actual studies • Studies that do not clearly state/ reference and/ or outline the framework employed • Proposals rather than completed studies, • Studies that use MMRS reporting guidelines rather than a defined framework • Conference abstracts or commentaries with inadequate methodological details on framework used or mentioned • Studies that developed and registered protocols are not in line with a defined MMRS framework

Additional concerns for including studies comprised the stated methodology, synthesis processes, and the fidelity with which a given MMRS framework was employed. To this end, studies were excluded if they utilized parts of different frameworks in their methods for different stages, if they based their methods on reporting standards such as PRISMA, and if they were focused on specific processes of MMRS studies such as synthesis of findings. Studies that adhered to a defined set of reporting standards and to a defined MMRS framework were included.

Three hundred and three studies were excluded during this review process. Sixty-five of the excluded studies were methodological, one study was excluded because the

full paper was not translated to English, four papers were inaccessible at the time of the review, and three were manually identified as duplicates. Two studies (Heyvaert et al., 2014, 2015) published as parts of one study were counted as a single application study. The other 172 papers were excluded mainly for not meeting the inclusion criteria. Fifty-seven studies were included in total for this stage. Appendix D lists the references for the final set of included application studies only. Tables 1 and 2 in Appendix C, respectively, present a summary of the extracted details and characteristics of the included application studies. The characteristics extracted for the reviewed studies included: the first author's last name, their field or discipline, and the country in which they conducted the study; and the year of publication for the study, and the MMRS framework, and label used in the study.

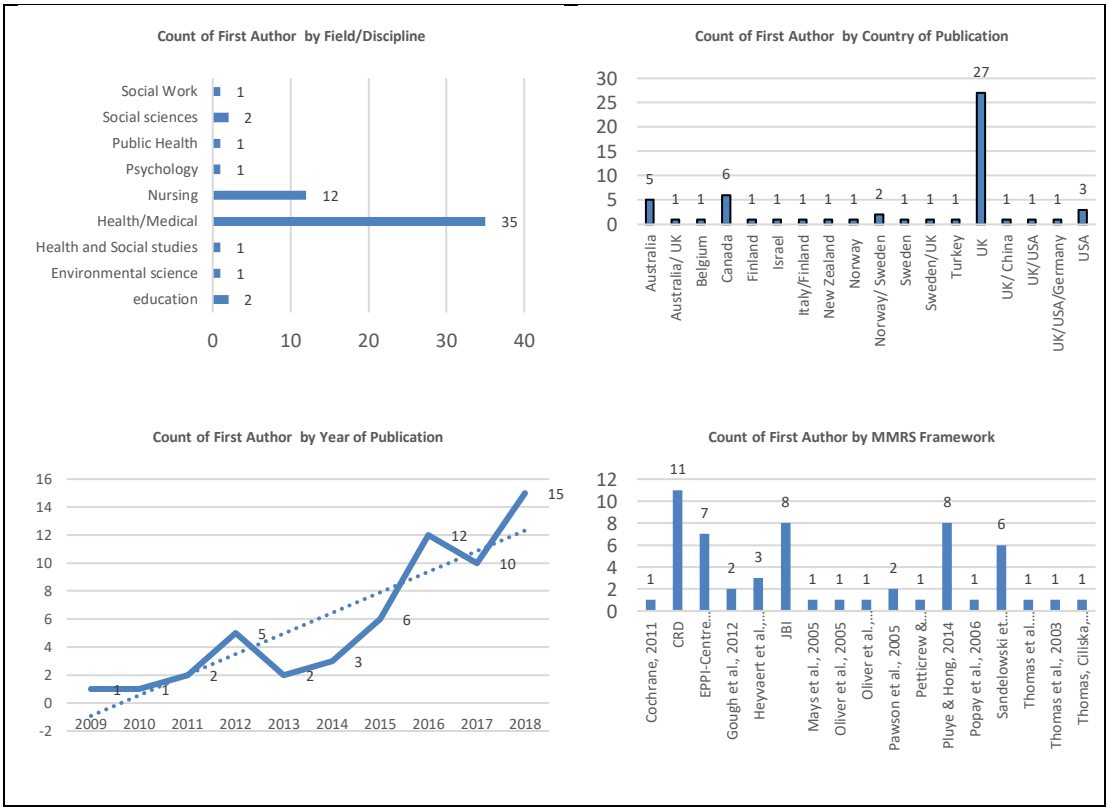
It was evident that authors in Western countries and specifically European nations predominantly conducted the included studies. Authors in Israel and another in Turkey conducted one study. An author in China collaborated with others in the UK on another study. The literature on MMRS frameworks and their application is recent with publications rising steadily over the past nine years. Publications applying MMRS frameworks have steeply increased over the past 3 years.

Various authors have utilized diverse frameworks with the guidelines. The Center for Review Dissemination (CRD), was the most used followed the JBI guidelines and the framework proposed by Pluye and Hong (2014), then the Evidence for Policy and Practice Information and Co-ordinating (EPPI) center guidelines, and the framework

proposed by Sandelowski and Colleagues (2006). Other frameworks were scarcely utilized. Figure 6 shows the distributions for these characteristics.

Figure 6

Relationships for Reviewed Application Studies between Publications by First Author to the Field or Discipline, Country of Publication, Year of Publication and MMRS Frameworks

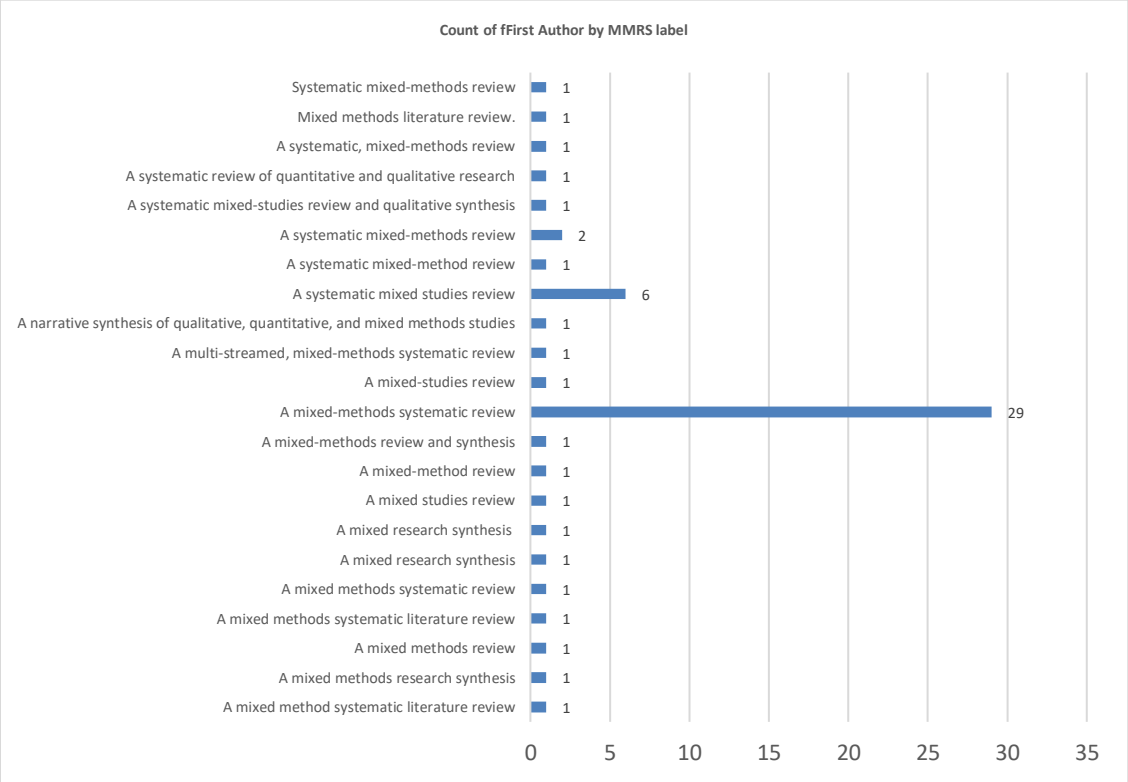


Finally, the use of the term ‘mixed-methods systematic review’ dominated in the set of included application studies with variations using the plural for methods and a hyphen between mixed methods (See Table 2, Appendix C). ‘Systematic mixed studies review’ was the second most utilized phrase. Other phrases were used less to smiliar degrees across included studies. Figure 7 illustrates the distributions of used labels based on the first author. Note that these results would differ somewhat given a different search

period. For example, a later search showed more usage of the term mixed methods research synthesis than had been noted during initial searches for this study.

Figure 7

The Relationship between Publications by First Author and the MMRS Label for Reviewed Application Studies



Review of Methodological Studies. This stage was central to the overall study and it focused on the first research question. Seventy-three methodological studies identified during the review of application studies were considered for analysis in addition to the studies identified during the post hoc searches after the title screening.

Post hoc searches, modified to retrieve additional methodological studies, were primarily conducted across the original databases used for the initial and general searches. A deviation from the initial search considered MEDLINE (EBSCOhost) and MEDLINE (Ovid) rather than PubMed (MEDLINE) for optimal results. Appendix A and

Table 4 presents a summary of the databases and additional resources searches, modified search strings, and search results. These searches yielded a total of 1,855 studies. The titles for identified studies were screened before retrieval, yielding 222 studies that were considered for inclusion. At this stage, studies were excluded if they were application studies and if the topic of interest based on the title did not address issues relating to methods and processes of executing MMRS studies. An additional set of 39 studies was identified through hand searches. The 222 studies, together with the additional 39 studies were combined with the 73 studies identified as methodological in the initial review stage of the study selection process. These combinations resulted in a total of 334 methodological studies that were then saved in a folder in the reference management platform, *RefWorks*. Exact and close duplicates were then sought and removed in *RefWorks* resulting in a total of 178 studies.

Next, the titles and abstracts for identified studies were scrutinized for inclusion. Studies were excluded if they failed to address, advance, or propose a specific MMRS framework. Studies that addressed specific MMRS processes such as synthesis, critical appraisal, or quality evaluation were excluded. Methodological studies primarily focusing on procedural issues relating to a defined MMRS framework were retained during this process. A final set of 64 studies were considered for the next review stage which was focused on the methods section.

Studies were excluded if they failed to address all stages of the framework covered. For example, studies that discussed MMRS frameworks on a broader scale, focused on a stage of the framework such as integration of findings, and/or solely on

issues relating to findings from qualitative or quantitative studies were excluded. Studies primarily speaking to an identified framework or the development of a 'new' framework were included. At the end of this review stage, 41 studies remained.

Backward and forward searches were conducted during this review for select studies, and identified studies added to the set of methodological studies in *RefWorks* until 'saturation' was achieved. Saturation was achieved when it appeared that no new studies were being identified for inclusion. Duplicates for studies identified through backward and forward searches were manually identified before inclusion. The review process resumed at each stage. Thirteen studies were selected for full review. One new resource (a wiki tool kit developed by Pluye and colleagues (2016) was identified and included during this stage resulting in 14 studies.

Coding of the set of 14 studies before the critical review and quality evaluation stage ensued using the coding form in Appendix A. This information targeted general characteristics of the selected studies and details specific to the research question. Information was captured and recorded in Excel worksheets for tracking and reference. This information provided insight for summarizing the select set of studies and guided subsequent stages. Charting facilitated a better conceptualization of the key details.

Figures 8a and 8b present flow charts per the PRISMA statement depicting the search process and exclusions.

Figure 8a.

The Study Retrieval Processes with Numbers of Included/Excluded Studies up to the Review of Application Studies Stage.

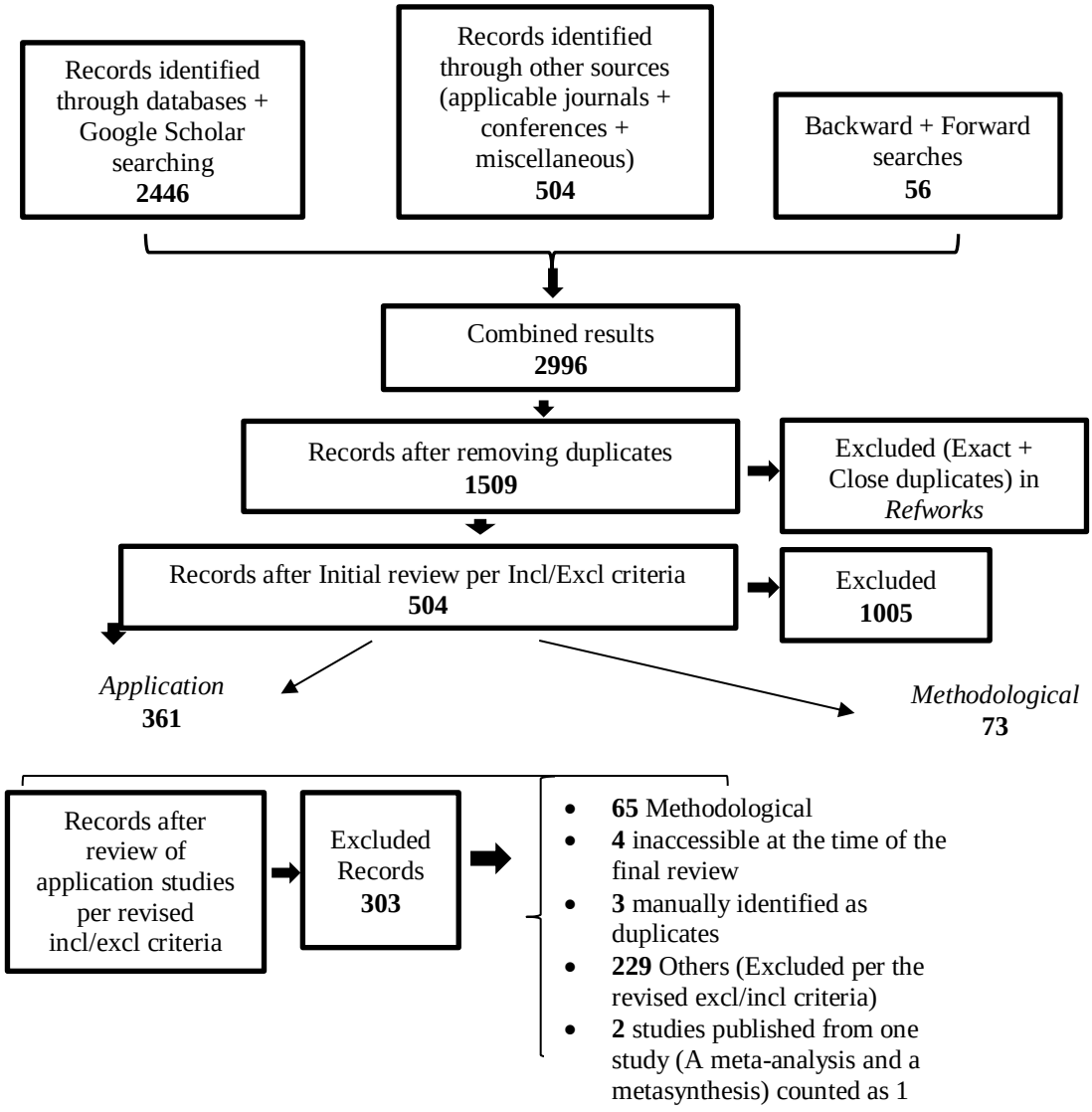
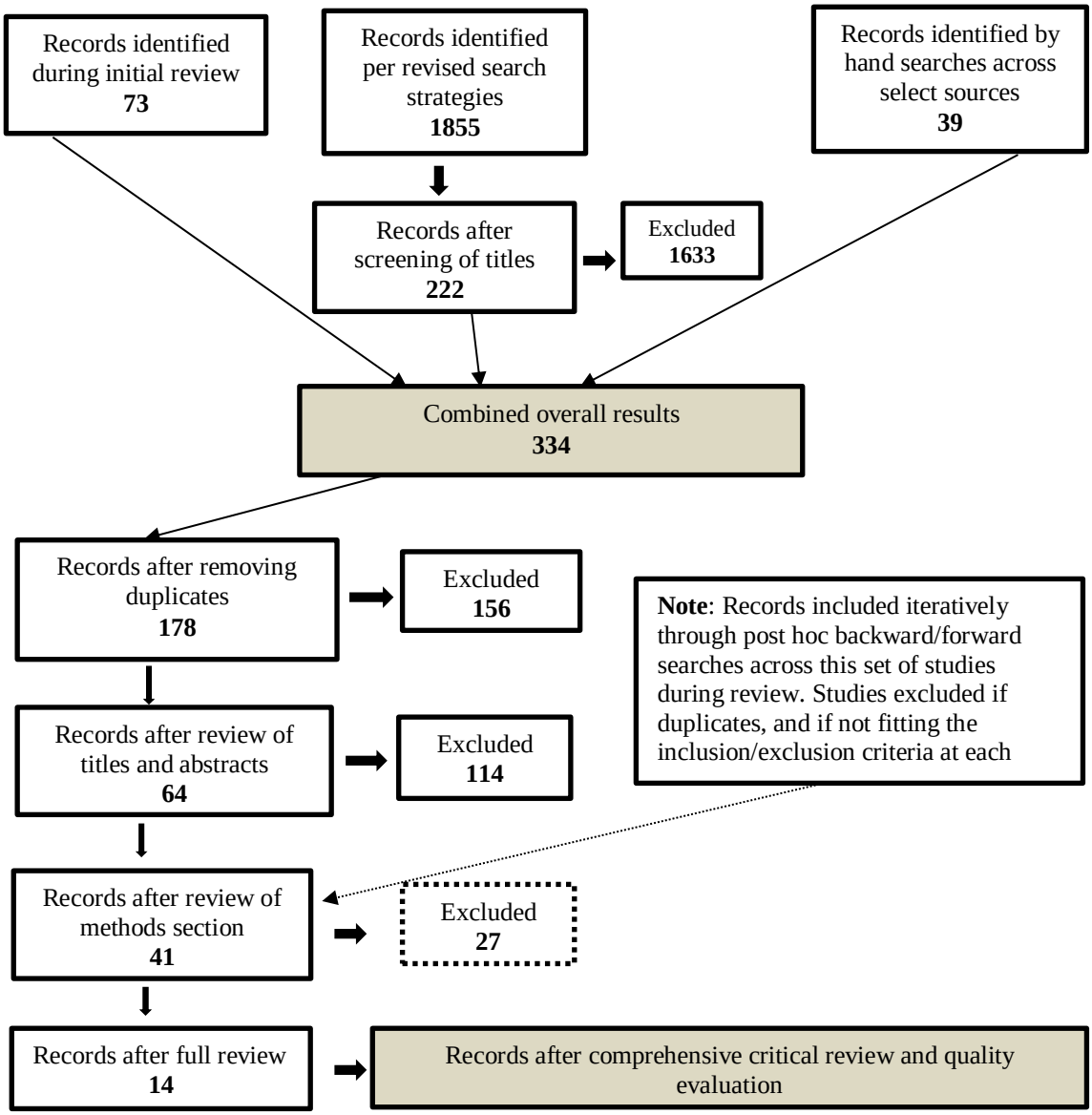


Figure 8b

The Study Retrieval Processes with Numbers of Included/Excluded Studies for Methodological Studies



Note: This flow chart is a continuation of the review process from the end of the application studies stage as shown in Figure 8a. This chart ends with the selection of the 10 methodological studies following the critical review and quality evaluation process.

Charting the Data.

The 14 methodological studies, before the critical review and appraisal stage, were initially sorted and organized in a chart to show general characteristics. Later summaries, after the critical review and appraisal stage, show information relevant to the research questions and guiding the scoping review. The charting process targeted information captured through the coding process including the authors of the study and their discipline, publication type (published/ unpublished), type of reference (journal article, book chapter, dissertation etc.), and the targeted MMRS framework (name/label, citation). Review notes highlighted key issues considered relevant to the research questions. Table 1 in Appendix C presents an initial summary of the identification information for the set of the selected studies per the review protocol. A consolidated summary of these studies leading into the critical review phase is presented in Appendix A and Table 6. The included sources consisted of 1 wiki page, 1 manual, 1 dissertation, 2 books, 3 book chapters, and 6 journal articles. The authors of the publications were mainly located in western countries with 6 from the UK, 7 from the USA, 1 from Canada, and 1 from Australia. Four of the authors were oriented in health disciplines, 10 within social sciences, and one in the physical sciences. Summaries for in-depth details were guided by the study coding form and are provided later in Table 3 Appendix C. Quality evaluation was also assessed during the coding process and is discussed under the critical review and appraisal of studies stage. Summaries for the scoping review results are presented and reported in the next stage.

Assembling, Summarizing, and Reporting Results

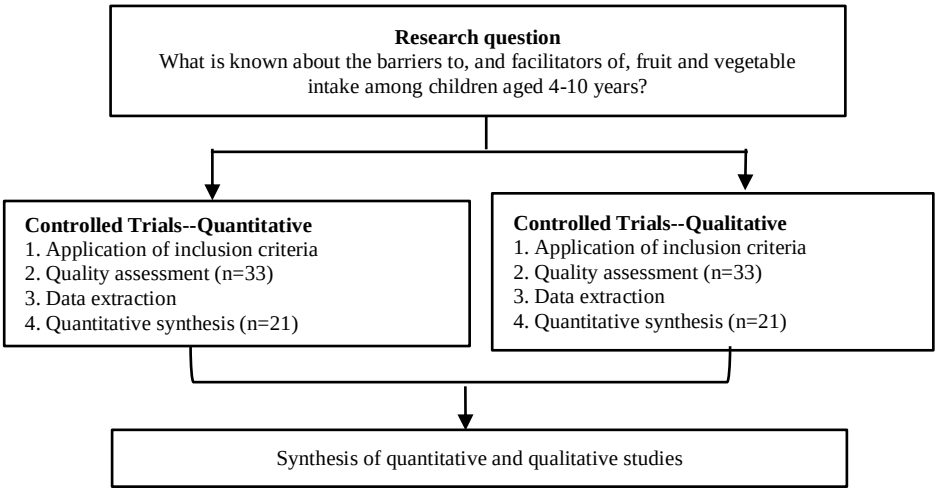
To effectively organize and report the results of the scoping review, a thematic framework (Arksey & O'Malley, 2005; Daudt et al., 2013; Pham et al., 2014) was adopted to complement the subsequent steps for the critical review. The framework aligned with the research questions for the scoping review at this stage. Categories match the identified MMRS conceptual frameworks from the selected studies. Review of the final set of 14 studies resulted in the identification of twelve frameworks. [2]Two categories, major and minor, delineate the frameworks based on their comprehensiveness, application, and citations. The subsections are correspondingly identified by the names for the major frameworks. The subsection "*other frameworks*" covers minor frameworks. These groupings represent the themes discussed in the next seven subheadings. The themes informed the critical review and appraisal phase.

The Evidence for Policy and Practice Information and Co-ordinating (EPPI) Center's Approach. Introduced by the EPPI-Center team (Thomas et al., 2004) this approach was motivated by the need to achieve evidence-based results. Initially published in a review about healthy eating among children, this framework has three key stages, namely the research question, the segregated review of controlled trials and qualitative trials, and the synthesis of qualitative and quantitative studies. Improvements on this framework have followed (Gough et al. 2017). This study focused on the initial version by Thomas and Others (2004). Figure 9 shows the summary for this approach.

[2] Note that the terms 'framework/s' and 'conceptual framework/s' are used interchangeably with 'approach(es) to refer to proposed procedural guidelines for executing mixed methods research synthesis (MMRS) studies in the literature.

Figure 9

Stages of the EPPI-Center review framework (Thomas et al., 2004)



Note: Reproduced from "Integrating qualitative research with trials in systematic reviews," by Thomas, J., Harden, A., Oakley, A., Oliver, S., Sutcliffe, K., Rees, R., Brunton, G., & Kavanagh, J., 2004, *BMJ, 328(7446),* p. 1010 (https://doi.org/10.1136/bmj.328.7446.1010). Open source by the BMJ.

The research question stage involves the formulation of the overall question of interest. The parallel sub-reviews of controlled trials and qualitative trials form the second stage. Conventional systematic review processes leading to this stage including searching, screening, and quality assessment of appraised studies are discussed in detail within the paper. Four processes; the application of inclusion criteria, quality assessment, data extraction, and synthesis are provided for each of the sub-reviews. Because of the separate syntheses for the controlled trials and the qualitative trials, this approach is classified as a segregated approach to mixed methods reviews (Heyvaert et al., 2014; Sandelowski et al., 2006). The third and final stage is the cross synthesis of quantitative and qualitative studies which involves the synergy of results from the two separate syntheses to inform the overall research question. The illustrated study with the initial approach for the EPPI-Center framework utilized the matrix approach to comparatively synthesize findings from the separate analyses.

The framework appears simplistic and can be misleading to a novice researcher. The accompanying paper presents additional details to help a reader and/ or a review researcher gain a better sense of the process. Quality evaluation appears critical for the framework. Separate criteria delineate the quality evaluation for the qualitative and quantitative studies. Later applications of the framework highlight suggestions for improvements and expound on the processes for various stages (Gough et al., 2017).

Realist Synthesis Approach. Realist synthesis (Pawson, 2006; Pawson et al., 2005) is an emergent and less prescriptive approach compared to other MMRS frameworks. Pawson and Colleagues (2005) proposed five steps for realist synthesis.

The first step is intensive, requiring consultations of all involved stakeholders, and focuses on three key and essential issues. To clarify the scope of the review, the reviewer needs to define and refine the overall research question; situate the purpose for the review within the defined theoretical program boundaries with clear 'policy import' and prospects for change and spell out essential theories to guide the review.

The second stage involves an initial exploratory search, an examination of empirical evidence demonstrating the usage of identified theories, and a refined search to inform the set of program theories grounding the synthesis. Emergent search strategies and purposive sampling are central to this stage, making it complex to understand due to its iterative nature.

The third stage involves quality assessment and data extraction. Quality evaluation is critical to the realist review process though no clear guidelines inform the

decisions made. The iterative nature of data extraction is noted with note taking and annotation identified as essential characteristics.

The synthesis process and fourth stage should align with the scope of the review as earlier defined. The realist approach sets itself apart from other review approaches because of its unit of analysis which is program theory rather than primary studies.

The final stage involves propagation of results using understanding gained from knowledge translation methods to allow for the transmission and use of information (Saini & Schlonsky, 2012).

Pawson (2006) presents a six-step approach to the realist review framework where the third step is split into two steps: ‘appraise primary studies’ and ‘extract data’. The capability for realist synthesis to accommodate diverse sources of evidence makes it appropriate for mixed methods reviews (Pope et al., 2007; Saini & Schlonsky, 2012). Despite its usefulness, clarity on integration of evidence (Saini & Schlonsky), the value placed on all evidence as equally authoritative (Dixon-Woods et al., 2005), and the quality assessment process need further development and evaluation. These concerns alongside its iterative nature raise questions about complexity in the application of the realist synthesis approach to MMRS studies. Despite this argument, the realist review approach provides insights for MMRS approaches and is widely cited and applied in the context of MMRS studies. Table 3 shows the realist synthesis framework per Pawson and Others’ (2005).

Table 3

Stages of the Realist Synthesis Review Framework (Pawson et al., 2005)

Key Steps in Realist Review
Step 1: Clarify scope a. Identify the review question Nature and content of the intervention Circumstance or context for its use Policy intentions or objectives b. Refine the purpose of the review Theory integrity – does the intervention work as predicted? Theory adjudication – which theories fit best? Comparison – how does the intervention work in different settings, for different groups? Reality testing – how does the policy intent of the intervention translate into practice? c. Articulate key theories to be explored Draw up a 'long list' of relevant programme theories by exploratory searching (see step2) Groups, categorize or synthesize theories Design a theoretically based evaluative framework to be 'populated' with evidence
Step 2: Search for evidence a. Exploratory search to get a 'feel' of the literature b. Progressive focusing to identify key program theories, refining inclusion criteria in light of emerging data c. Purposive sampling to test a defined subset of these theories, with additional 'snowball' sampling to explore new hypotheses as they emerge d. Final search for additional studies when the review near completion
Step 3: Appraise primary studies and extract data a. Use judgment to supplement formal critical appraisal checklists, and consider 'fitness for purpose': Relevance - does the research address the theory under test? Rigour – does the research support the conclusions drawn from it by the researchers or the reviewers b. Develop 'bespoke' set of data extraction forms and notation devices c. Extract different data from different studies to populate evaluative framework with evidence
Step 4: Synthesize evidence and draw conclusions a. Synthesize data to achieve refinement of programme theory – that is, to determine what works for whom, how and under what circumstances b. Allow purpose of review (see step 1b) to drive the synthesis process c. Use 'contradictory' evidence to generate insights about the influence of context d. Present conclusions as a series of contextualized decision points of the general format 'If A, then B' or 'In the case of C, D is unlikely to work'
Step 5: Disseminate, implement, and evaluate a. Draft and test out recommendations and conclusions with key stakeholders, focusing especially on levers that can be pulled in here-and-now policy contexts b. Work with practitioners and policy-makers to apply recommendations in particular contexts c. Evaluate in terms of the extent to which programmes are adjusted to take account of contextual influences revealed by the review: the 'same' programme might be expanded in one setting, modified in another and abandoned in yet another.

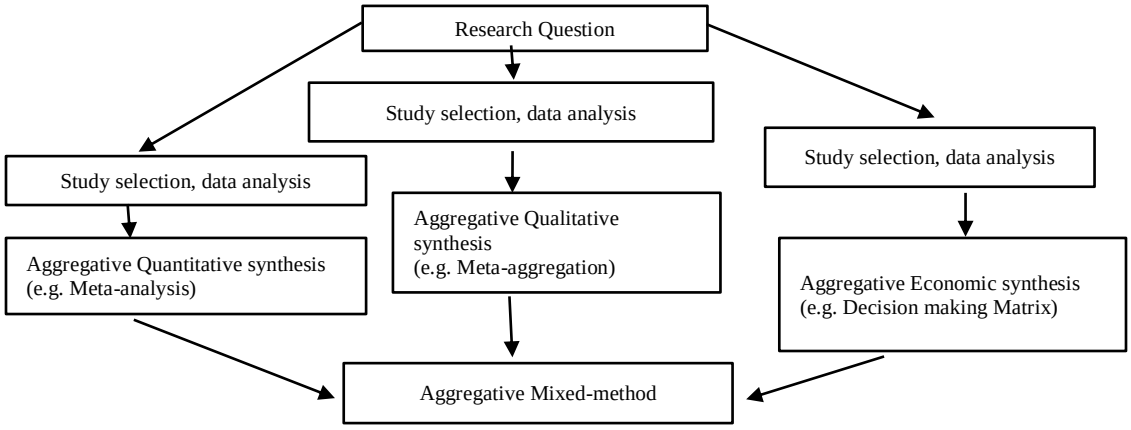
***Note*: Adapted from "Realist review—A new method of systematic review designed for complex policy interventions," by Pawson, R., Greenhalgh, T., Harvey, G., & Walshe, K., 2005, *Journal of Health Services Research & Policy, 10(1_suppl)*, p. 24. https://doi.org/10.1258/1355819054308530

The Joanna Briggs Institute (JBI) Approach. Advanced by the JBI center, this approach offers an alternative approach to mixed methods reviews. The approach, extensively discussed in the Institute's 2014 manual, follows the segregated design of mixed methods reviews covered by Sandelowski and others (2006), but utilizes the Bayesian approach to the synthesis of findings in review studies. This approach, like the EPPI-center one, synthesizes evidence per type (per methodology) of studies then integrates the evidence using Bayesian methods. The use of Bayesian methods for

synthesis differentiates this approach from the general segregated approach by Sandelowski and others (2006). Guidelines for implementing Bayesian approaches and for the mono-method syntheses and supported by specific systems developed by the JBI team define the JBI framework. An updated handbook with additional considerations for the JBI approach as improvements is available (JBI, 2019; Jordan et al., 2019). Figure 10 illustrates the steps for the JBI approach.

Figure 10

The Joanna Briggs Institute (JBI) Model for Mixed-Methods Synthesis (Pearson et al., 2015)



***Note*:** Reproduced from "A mixed-methods approach to systematic reviews," by Pearson, A., White, H., Bath-Hextall, F., Salmond, S., Apostolo, J., and Kirkpatrick, P, 2015, *International Journal of Evidence-Based Healthcare, 13(3),* p. 130. https://doi.org/10.1097/XEB.0000000000000052

Various systems for managing JBI single-method reviews including the Comprehensive Review Management System (CReMS), the Meta-Analysis and Statistics Assessment and Review Instrument (MAStARI) and the Qualitative Assessment and Review Instrument (QARI) are utilized. Mono-method reviews are brought together using an appropriate mixed-methods protocol independently developed, and the JBI's 'Mixed Methods Assessment and Review Instrument (MMARI) module (Pearson et al., 2015). The CReMS system allows for the possibility for conducting the mixed-methods review while allowing for the respective extraction of the individual-method syntheses.

The Integrative Review. The integrative review approach is inclusive of diversity in the review of primary studies for evidence-based results. The definition of integrative reviews is expansive in relation to the type of primary studies reviewed and the purpose for the review. This approach incorporates theoretical or empirical evidence from studies with diverse methodological orientation to inform a given topic. This flexibility allows for the use of integrative reviews to understand difficult concepts, theories, and questions. As noted in the literature (Heyvaert et al., 2016; Sandelowski et al., 2006), the ability for integrative reviews to accommodate studies with diverse methodological backgrounds present it as a viable framework for MMRS. Guidelines for using integrative reviews in the context of MMRS studies require further clarity with criticism focusing on the subjectivity and rigor in application. Whittemore and Knafl (2005) illustrate and discuss five key stages for an integrative review namely; problem formulation, literature search, data evaluation, data analysis, and presentation.

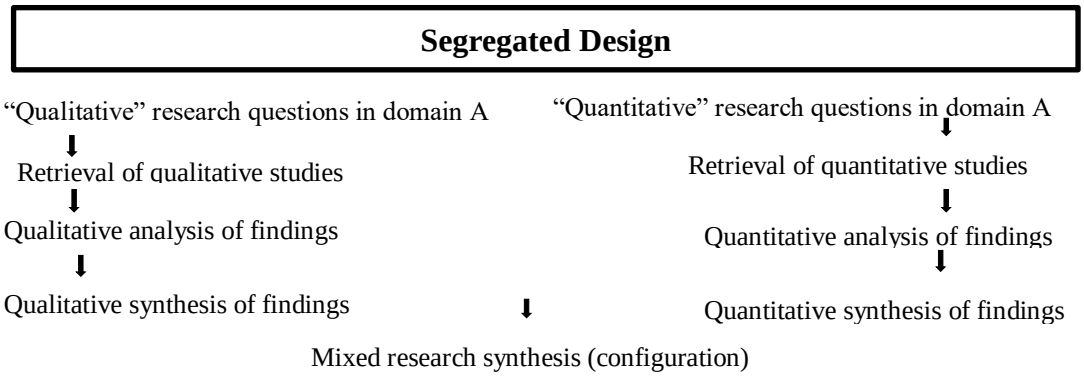
Sandelowski et al. (2006) Approach. This approach emphasizes design for mixed methods reviews. It is founded on the concept of design for MMR studies. The authors use the term 'mixed research synthesis,' and propose three designs: segregated, integrated, and contingent.

The Segregated Design. This design maintains the notion that qualitative and quantitative research is distinct. It's used to complement rather than confirm or refute research claims, and when the review is configurative, not assimilative (See Figure [3] 11)

[3] **Note**: Figures 11, 12 and 13 are extracted and adapted from "Defining and designing mixed research synthesis studies," by Sandelowski, M., Voils, C. I., and Barroso, J., 2006, in *Research in the Schools : A Nationally Refereed Journal Sponsored by the Mid-South Educational Research Association and the University of Alabama, 13(1),* 29, Table 1.

Figure 11

The Segregated Design for Mixed Methods Reviews (Sandelowski et al., 2006)

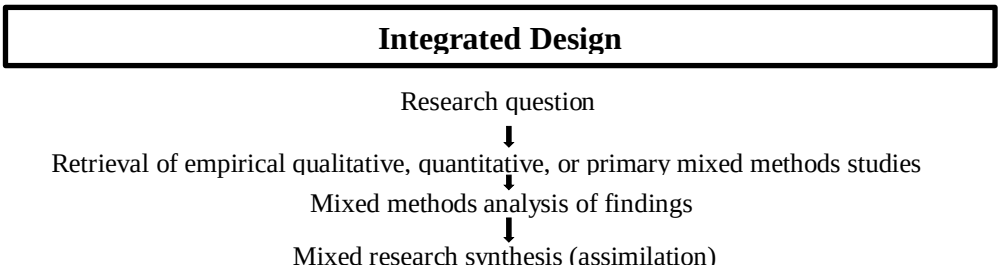


This design assumes that:

a. Quantitative and qualitative studies are completely different entities and therefore ought to be treated separately;
b. Quantitative and qualitative studies are readily distinguishable from each other;
c. Differences between quantitative and qualitative call for separate analyses and syntheses of findings;
d. Syntheses of qualitative findings requires methods developed just for synthesizing qualitative findings; and
e. Syntheses of quantitative findings requires methods developed just for quantitative findings (p. 6).

The Integrated Design. This design rests on a belief in the fluidity of transforming findings across methodologically diverse studies, thus diminishing methodological differences in the review of qualitative and quantitative studies. For this design, studies in the review should align to the commonality in addressing the same research questions or facets of a phenomenon of interest. To consider the integrated design, the findings in reviewed studies should confirm, refute, or extend the research interests amidst methodological diversity, with the definition of mixed research synthesis reflecting assimilation rather than configuration of the findings. See Figure 12.

Figure 12
The Integrated Design for Mixed Methods Reviews (Sandelowski et al., 2006)



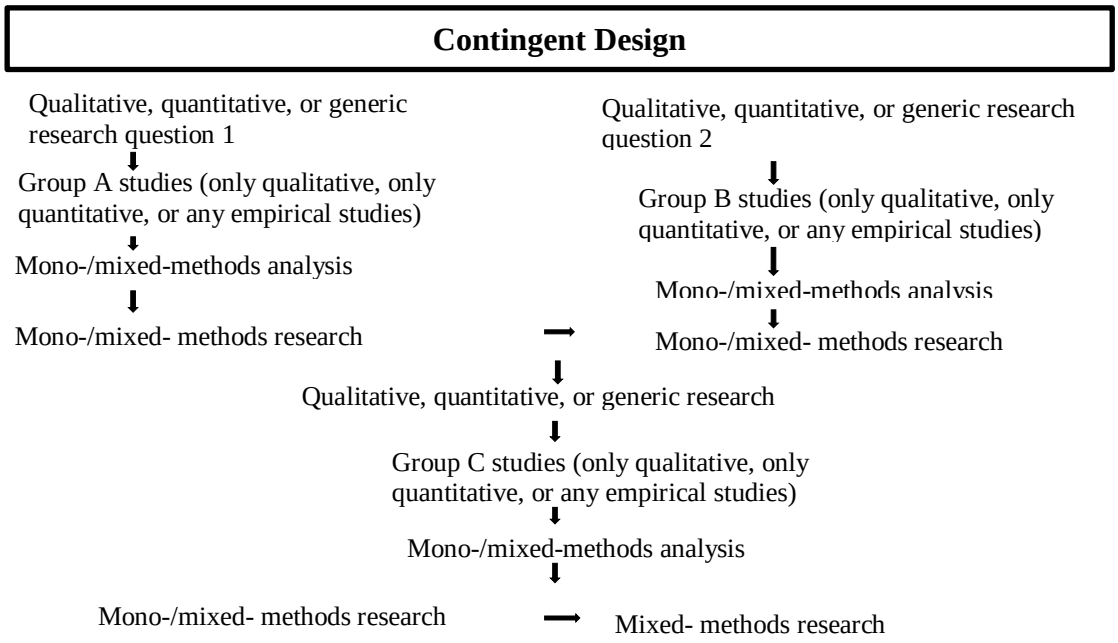
The following assumptions guide the application of this design:

a. Any nonexistent differences between qualitative and quantitative studies do not call for separate analyses and syntheses of their findings
b. Studies designated as quantitative and qualitative are not necessarily distinguishable from each other
c. Both qualitative and quantitative studies in a common research domain can address the same research purposes and questions
d. Syntheses of both qualitative and quantitative findings can be produced from methods developed for qualitative and quantitative findings (p. 8).

The Contingent Design. This design is exclusively emergent in nature and based on a set of objectives with an initial research question leading to a second, and possibly a third one. The singular reviews adhere to the respective review approaches aligning with the methodological orientations of the set of studies answering the given research question. Synthesis methods follow the same prospect where the cycle of review continues until the review researcher achieves a comprehensive research synthesis speaking to the targeted objectives. The rigidity in differences traditionally assigned to qualitative and quantitative studies and the respective methods of synthesis may be of key concern or not depending on the researcher. Contingent designs can conform to the processes of either segregated or integrated designs. Contingent designs are largely distinguishable due to their sequential nature. Figure 13 illustrates the contingent design.

Figure 13

The Contingent Design for Mixed Methods Reviews (Sandelowski et al., 2006)



Pluye and Hong (2014) present a modified approach to fitting mixed methods reviews into existing mixed methods research frameworks. The approach follows the traditional designs for mixed methods studies, namely: sequential explanatory, sequential exploratory, and convergent designs.

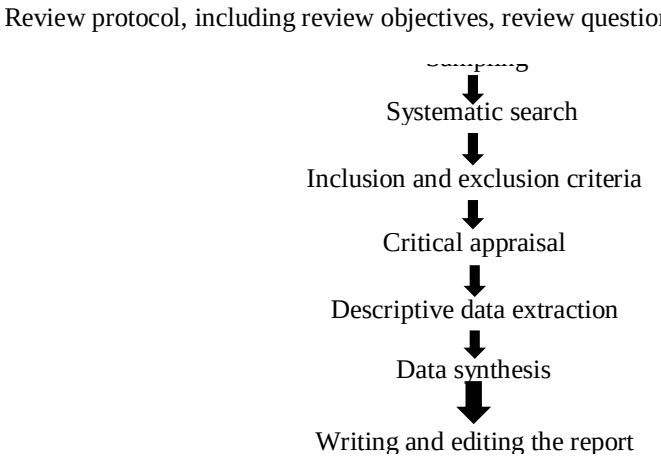
Hannes (2015) revisits this approach, emphasizing the importance of mixed methods reviews in comprehending intricate interventions. She highlights three phases linking questions in a mixed method review process and illustrated by a research inquiry on determining the most useful program to promote breastfeeding. The illustration, based on Saini and Schlonsky's (2012) proposition for review process stages highlights key issues for each step in three phases. Phase 1 includes scoping, logic model development, review questions, and the definition of the intervention of interest. Phase 2 considers the moderators, barriers, and facilitators. Phase 3 includes the evaluation, outcome of the

intervention, and exploration. Hannes' (2015) discussion deliberately deviates from technical issues of 'mixing' or integrating qualitative and quantitative evidence when deciding on mixed methods review approaches encouraging review authors to rely on predefined and emergent review questions for guidance.

The Mixed Methods Research Synthesis (MMRS) Approach. This is one of the most recent and comprehensive framework for mixed methods reviews. Heyvaert and colleagues (2017) consider extensive theoretical and methodological debates and advances in the field of mixed methods research synthesis, leading to the proposition of the MMRS framework. They provide and discuss eight stages for conducting MMRS reviews illustrated in Figure 14.

Figure 14

Stages for Conducting MMRS Literature Reviews (Heyvaert et al., 2017)



Note: Reproduced from "Using mixed methods research synthesis for literature reviews," by Heyvaert, Mieke, Hannes, K., and Onghena, P., 2017, p. 8 Sage Publications.

Though the development and literature on this framework spans a period of about 5 years, with the initial work originating from Heyvaert's dissertation (Heyvaert, 2011), the book (Heyvaert et al., 2016) comprehensively covers the framework.

The first phase involves key preparation processes for the review, outlining steps that guide initial and subsequent decisions. Before this step, the review researcher or team should have a good idea about background information of the team such as their expertise for different aspects of the review. Moreover, preparations for the protocol development process like identifying and clarifying the argument for the review and a scoping review to familiarize the team with the extent of literature on the topic of interest are necessary (Heyvaert et al., 2017; Pham et al., 2014). Choosing a design is also important at this point although the authors argue this might not always be possible in some cases. The protocol should consist of the "background of the review, the objectives and questions for the review, the methods for searching and synthesizing data and a reference section" (Heyvaert et al., 2016, p. 37). This leads to the subsequent set of steps.

The second phase involves three key steps, sampling, systematic search, and the inclusion and exclusion criteria. These steps are the most extensive for the review researcher. They demand proper organization and management of information. The search process targets primary studies, which are the sampling units for the MMRS review. Various sampling processes are possible and are dependent on the design for the MMRS review informed by its topic and purpose. The findings in the primary studies provide the data for the review. The reviewers should identify a reference management platform for the search process and consider clear inclusion-exclusion criteria. Proper documentation and reporting for steps and decisions made are imperative for these processes. Of subsequent important for the review, is quality evaluation of included studies, referenced as the 'critical appraisal' stage and is discussed next.

Critical appraisal is the third phase addressing the fifth stage of the MMRS framework. Issues on assessing quality and related debates are discussed in relation to how they impact MMRS studies. Suggestions and existing guidelines are dependent on methodological factors, transparency in reporting of decisions made, and the relevance of selected quality evaluation approaches. The purpose of the MMRS study and the design employed are imperative in decisions about quality evaluation process. Quality evaluation precedes the data extraction stage.

Descriptive data extraction falls under the fourth phase and the sixth stage. Four processes define this stage, namely a decision on data to be extracted alongside the formulation of an initial protocol and coding guide; piloting the form and the coding guide; carrying out the data extraction; and discussing similarities and differences in extraction among reviewer authors. Various factors influence the data extraction decision including the phenomenon of interest and the target population. Testing the extraction form and coding guide on a small sample richly informs the actual review process. A follow-up pilot test is recommended to resolve any issues arising in the initial test. During the descriptive data extraction process, the forms can be completed electronically or manually. It is preferable that two or more reviewers are engaged with the process of data extraction to reduce instances of recorded errors and bias. Finally, comparisons in data extraction findings should be discussed and differences addressed per set guidelines. It is possible to quantify the degree of agreement and to determine a reliability estimate in the MMRS report though this is not the norm for MMRS studies.

Data synthesis is the seventh stage of the framework and in the fifth phase. Data synthesis depends on the choice of MMRS design. The MMRS design impacts the procedural steps employed in an MMRS study. For example, the segregated approach requires separate syntheses before integration, while the integrated entails synthesis across diverse study types, and the process of synthesis is emergent in the contingent design (Sandelowski et al., 2006). The dependence of the choice of synthesis on the design forces the review team to consider other factors such as the expertise and knowledge of the review team. Since the choice of the design is dependent on the research question, the reviewer/s should be open to outsourcing aspects of the synthesis process if not competent in the necessary skills.

Other Frameworks. This category consists of six frameworks. These frameworks are not necessarily inferior to those discussed earlier; rather are less elaborate or minimally applied and/or cited based on the reviewed literature. These include the meta-needs assessment (Gaber, 2000), meta-modelling (Lemire, 2017), comprehensive literature review (Onwuegbuzie & Frels, 2016), a meta-framework for conducting mixed research synthesis for stress and coping research and beyond (Onwuegbuzie et al., 2010), mixed methodology Interactive Literature Review Process (ILRP) framework (Combs et al., 2010), and the Question Eligibility Source Identification Selection Appraisal Extraction Synthesis (QESISAES) framework (Pluye et al., 2016).

Meta-needs Assessment (MNA) (Gaber, 2000). Cited in the MMRS literature as one of the foundational frameworks, MNA targets needs assessments geared towards human services within public, private, and non-profit organizations. The MNA approach

utilizes past records and works for needs assessments as the data. The MNA framework is founded on the premises of meta-analytic and mixed methods research strategies to facilitate triangulation when conducting needs assessments. Closely aligned with the processes for meta-analysis, MNA adheres to five major steps, namely, problem formulation, document definition, collecting relevant documents, evaluating collected data, and data analysis. MNA deviates from traditional review studies by using reports, records, and plans as the source of data. Moreover, MNA simultaneously utilizes qualitative and quantitative processes to make sense of the records as the sources of data for the study. Narrative and vote counting are provided as examples of processes to focus the review for qualitative and quantitative data respectively. For this approach, it is hoped that the reviewer achieves convergence for validity and credibility.

Existing challenges of MNA include the comparison of differing research plans that utilize different types of data. The author acknowledges the value for mixed methods research in informing the process of integration. MNA in this way closely reflects the integrated approach to mixed methods research synthesis (Sandelowski et al., 2006).

Meta-Modelling (Lemire, 2017). The meta-modelling approach is sequential with qualitative and quantitative syntheses being carried out before the integration of findings in a mixed synthesis process. Lemire presents six steps emulating the Harden and Thomas (2005) framework. These steps include defining the research question, searching and retrieving studies, conducting relevant appraisal, implementing meta-summary within and across studies, conducting an effective meta-summary with the calculation of an effect size if possible, and, finally, meta-modelling where qualitative comparative

analysis (QCA) and causal recipes and narrative are the mixed synthesis approaches used.

Table 4 summarizes the meta-modelling approach steps as presented by Lemire.

Table 4

The Six Steps of Meta-modelling (Lemire, 2017)

Step 1: Define the scope of the synthesis

- Define research question in terms of Population, Intervention, Context and Outcome (PICO)
- Conduct scoping review to determine scope

Step 2: Search and retrieve relevant studies

- Define search terms and inclusion/exclusion criteria
- Conduct search for empirical papers by using multiple avenues
- Maintain a log for all the identified studies

Step 3: Conduct a relevance appraisal of the studies

- Appraise each study abstract for its relevance to the research question
- Appraise each study on the basis of full read

Step 4: Develop the implementation meta-summary

- Identify core program components (within study)
- Develop meta-summary of the critical program components (across studies)

Step 5: Develop the effectiveness meta-summary

- Calculate the effect sizes (within study)
- Develop meta-summary of the program effectiveness (across studies)

Step 6: Develop the final integrated meta-model

- Integrate implementation and effectiveness findings using QCA
- Develop and describe the causal recipes for the program

****Note**: Reproduced from "Meta-modeling social programs: Methodological reflections on a practical application," by Lemire, S. T., 2017, [*Doctoral dissertation, UCLA]*. p. 27 https://escholarship.org/uc/item/2nc16490 and as adapted from "Diffusion of innovations in service organizations: Systematic review and recommendations," by Greenhalgh, T., Robert, G., Macfarlane, F., Bate, P., & Kyriakidou, O., 2004), *The Milbank Quarterly, 82(4),* 581–629. https://doi.org/10.1111/j.0887-378X.2004.00325.x

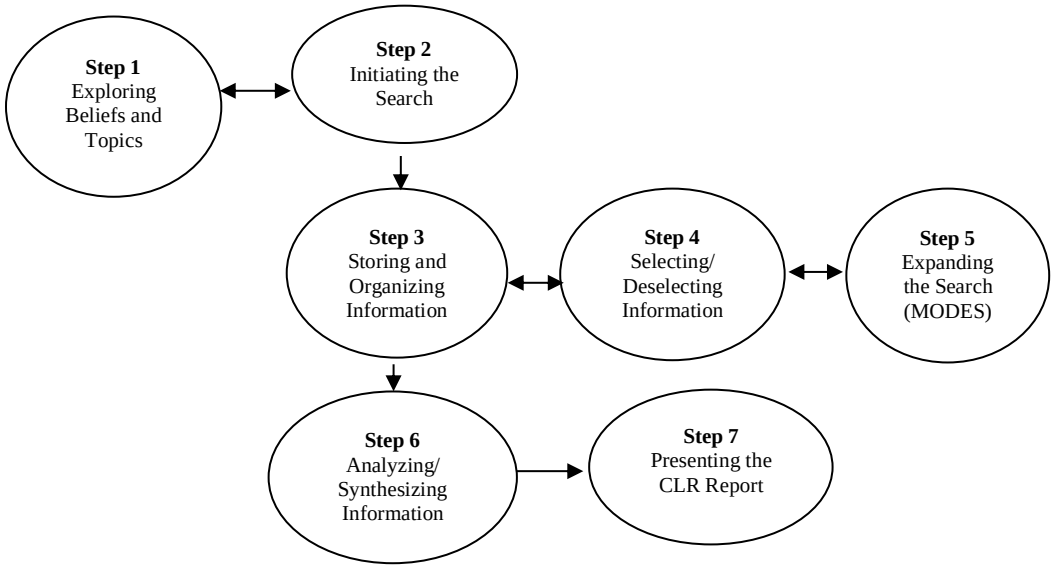
The meta-modelling seeks to address existing criticism for mixed methods synthesis on inadequate transparency and guidelines on the integration of findings. A scoping review is suggested as a precursor to defining the research question. Additionally, the meta-modelling approach prioritizes methodological reflections over

inclusion/exclusion restrictions to allow for diverse and richer evidence in selected studies. Qualitative comparative analysis (QCA) is used for integration to illustrate its application to mixed research synthesis and provide direction for this stage in MMRS studies.

Comprehensive Literature Review: A Multimodal and Cultural Approach (Onwuegbuzie & Frels, 2016). This seven-step approach is contextualized in three phases. The three phases are the exploration, interpretation, and communication phases. Figure 15 illustrates the CLR approach to MMRS studies.

Figure 15

The Seven-Step Model for Comprehensive Literature Reviews (Onwuegbuzie & Frels, 2016)



Note: Reproduced from "7 steps to a comprehensive literature review: A multimodal and cultural approach (First edition)," by *Onwuegbuzie, A. J., & Frels, R.,* 2016, p. 58. Sage Publications.

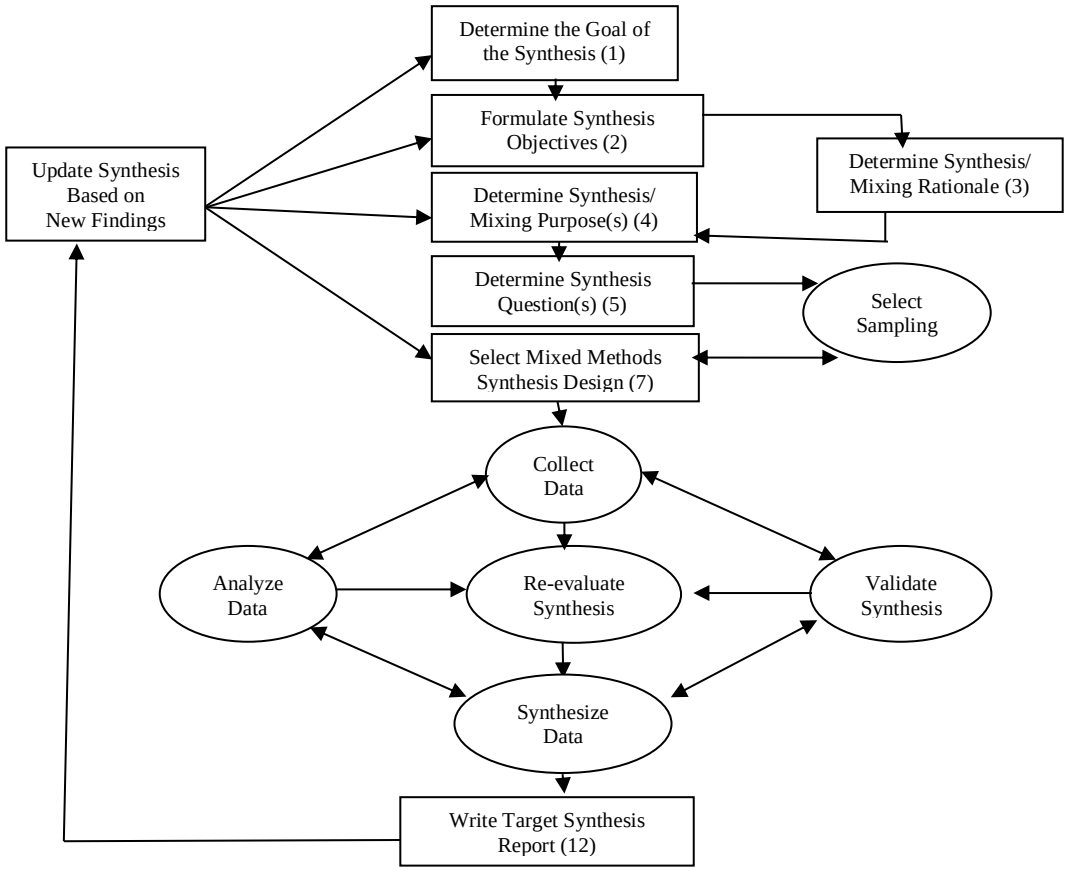
The exploration step entails five steps namely, exploring beliefs and topics, initiating the search, storing and organizing information, selecting/deselecting information, and expanding the search to include one or more MODES (Media,

Observation(s), Documents, Experts(s), Secondary Data). The interpretation phase involves the analysis and synthesis of information, while the communication phase includes the presentation of the CLR report. The seven steps of the CLR meta-framework are described as "multidimensional, interactive, emergent, iterative, dynamic, holistic, and synergistic" (p. 54). As a cyclical process, the CLR meta-framework emphasizes cognizance of a review researcher's cultural competency, awareness, and identity when engaging in the review process.

A Meta-Framework for Conducting Mixed Research Synthesis for Stress and Coping Research and Beyond. This framework is based on a 13-step mixed research synthesis process is based on work earlier conceptualized by Collins and Colleagues (2006). Three major stages delineate the 13 steps; i.e., the synthesis formulation stage, the synthesis planning stage, and the synthesis implementation stage. The synthesis formulation stage has five steps; determining the goal of the synthesis, formulating the synthesis objective(s), determining the rationale for the mixing of qualitative and quantitative data in the synthesis, determining the purpose(s) for mixing the qualitative and quantitative synthesis in the data, and determining the question(s) appropriate for the synthesis. The synthesis planning stage has two steps; selecting the sampling design and the mixed research synthesis design. The third stage has six steps; data collection, data analysis, and data synthesis, revisiting the synthesis question to validate/legitimate the synthesis, writing the target synthesis report, and updating the synthesis based on reviewer's study findings. Figure 16 shows this framework.

Figure 16

Steps in the Mixed Research Synthesis Process (Onwuegbuzie et al., 2010)



Note: Reproduced from "A meta-framework for conducting and writing rigorous, comprehensive, and insightful literature reviews for stress and coping research and beyond," by Onwuegbuzie, A. J., Collins, K. M. T., Leech, N. L., Dellinger, A. B., & Jiao, Q. G., 2010, *In Jiao, Q. G., Onwuegbuzie, A. J., & Collins, K. M. T. (2010). Toward a broader understanding of stress and coping: Mixed methods approaches*. P.179. Infomrstion Age Publishing (IAP).

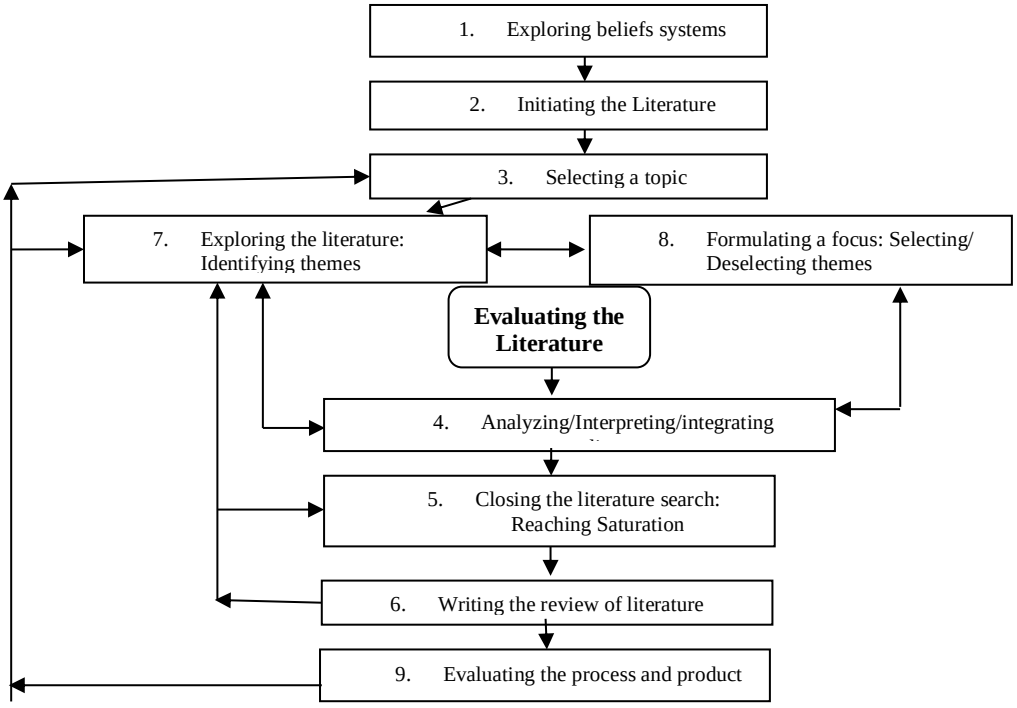
The Mixed Methodology Interactive Literature Review Process (ILRP)

Framework. This framework is informed by Vygotsky's (1978) theory of social development. The Information Search Process (ISP) model (Kuhlthau, 2004) and the framework for debriefing the researcher (Onwuegbuzi et al., 2008) are integral to the ILRP meta-framework. The ILRP is a rigorous and evolving process that promotes interaction and cooperation among involved parties such as dissertation advisors and their advisees. The approach targets high quality literature reviews and it utilizes mixed

methods. The approach is characterized by nine stages; exploring belief systems, initiating the literature search process, selecting a topic, exploring the literature: identify themes, formulating a focus: selecting/ deselecting themes, analyzing/ interpreting/ integrating literature, closing the literature search: reaching saturation, writing the review of literature, and evaluating the process and product. The stages are intertwined allowing for fluidity as new ideas emerge and are polished (See Figure 17)

Figure 17

Interactive Literature Review Process (ILRP) (Combs et al., 2010)



Note: Reproduced from "A mixed methods approach to conducting literature reviews for stress and coping researchers: An interactive literature review process framework," by Combs, J. P., Bustamante, R. M., & Onwuegbuzie, A. J., 2010, in *GS Gates, WH Gmelch, & M.Wolverton (Series Eds.) & KMT Collins, AJ Onwuegbuzie, & QG Jiao (Vol.Eds.), Toward a Broader Understanding of Stress and Coping: Mixed Methods Approaches*. P. 218. Information Age Publishing (IAP)

The Question Eligibility Source Identification Selection Appraisal Extraction Synthesis (QESISAES) Framework. This framework is under development as a Wiki page (Pluye et al., 2016) targeting the practice and reporting of mixed studies reviews (MSR). Eight stages guide the process for mixed methods reviews. A final reporting stage is included. Suggestions and comments are considered for continuous improvement of the framework and the Wiki page. Contributors are accorded acknowledgements. The Framework promises to stay up to date with MMRS literature due to the possibility for Authors to contribute real time information towards the developed guidelines. The Wiki page is interactive, allowing users to click on each stage for more details on related context and content. The Eight stages include: formulating a review question, define the eligibility criteria, deciding on sources of information, identifying potential relevant studies, selecting relevant studies, appraising the quality of selected studies, extracting data from selected studies, and synthesizing included studies.

The scoping review of frameworks highlights diversity in purposes and contexts leading to the development of different mixed methods reviews frameworks. Considering the identified frameworks, the final comprehensive review of the final set of 14 studies guided subsequent stages for the critical review, directly addressing the research questions, and leading to the developed framework. This section covers the final stages for the critical review and builds up on the scoping review in the previous section, resulting in the developed framework as the sole focus of this study.

Critical Review and Appraisal of Studies

This phase involved a closer evaluation of the [4]14 studies included after the final review phase for the scoping review focused on identified MMRS frameworks. The comprehensive critical review and quality evaluation processes were central at this point. The revised inclusion criteria required that identified resources substantially contribute to methodological developments of the respective MMRS framework relative to others in the literature. Sources that contributed information to MMRS framework development but failed to address the entire process were excluded. Assigned quality evaluation scores for the final set of studies, along with considerations for information on prevalence and usability of frameworks proposed in the studies within the literature and their citations factored into the final exclusion decision. Studies failing to meet the inclusion criteria and with low quality evaluation scores as noted in the quality evaluation step were eliminated. Four studies were eliminated at this point.

Two studies did not substantially contribute to the methodological development of existing MMRS frameworks. One study (Hannes, 2015) comments on the approach proposed by Sandelowski and team (2006) providing suggestions for better application of the approach. Hannes emphasizes the need for review researchers to carefully consider the best combinations of "methods, techniques, and approaches" (p. 95) to answer questions defined prior to the review and emergent ones. A second source (Oliver et al., 2015) provides insightful information for reinforcing the EPPI-Center approach but the

[4] Note that 14 studies were included at the end of the scoping review stage. These studies were utilized for the subsequent review stages leading into the critical review process represented by the critical review and appraisal stages.

core concept is not impacted. Two other sources (Onwuegbuzie et al., 2010; Combs et al., 2010), were excluded as they preceded the development of the framework by Onwuegbuzie and Frels (2016). The frameworks discussed in these two sources also leaned heavily towards informing the practice of traditional literature reviews considering diverse sources rather than MMRS reviews. Ten studies were included in the final set (see last part of Figure 8b). Appendix C and Table 3 summarize this final set of studies with quality evaluation scores.

The final set of ten studies were reviewed based on thematic analysis. Frameworks identified in the literature and within these ten studies directed this analysis. These frameworks included the mixed methods research synthesis (MMRS), the meta-modelling framework (Lemire, 2017), the Sandelowski and colleagues' (2006) framework, the EPPI-Center (Thomas et al., 2004) framework, the Integrative review (Whittemore & Knafl, 2005), the meta-needs assessment (Gaber, 2000) framework, the realist review (Pawson et al., 2005), the Comprehensive Literature Review (CLR) (Onwuegbuzie & Frels, 2016) framework, the Question Eligibility Source Identification Selection Appraisal Extraction Synthesis (QESISAES) (Pluye et al., 2016), and the JBI model of mixed-methods synthesis (Pearson et al., 2015). Evidently, all frameworks had both positive and negative features. It appeared that the number of strengths or weaknesses was independent of the usability of a given framework. The following discussions critically examine the identified frameworks in this final set of studies.

The Mixed Methods Research Synthesis (MMRS) Approach (Heyvaert et al., 2017)

The MMRS is well rooted in the literature as evidenced in the handbook. The framework appears comprehensive given the proposed number of steps and the discussions on the relevance of each step. It is notable that the framework fails to address specific issues about the actual implementation of critical steps such as integration. Several studies employing specific techniques of MMRS frameworks illustrate some of the steps advanced in this framework. These examples inform potential users of the framework on how to apply and adapt it to their studies. A shortcoming of this approach is that a user needs to read the book to legitimately adapt and apply the framework. Moreover, potential users need to have prior basic understanding of important MMRS practices and how they relate to or deviate from general review processes.

The Meta-Modelling Framework (Lemire, 2017)

This approach is more recent and innovative in nature. This approach focuses on the use of qualitative comparative analysis (QCA) as an integration technique for diverse evidence in an MMRS study. It illustrates the use of meta-modelling in integration of evidence across mixed methods review studies. Primarily informed by the EPPI-Center approach, this method has an evaluation-centered focus. A key strength of this approach is its focus on a specific integration technique for synthesis of evidence to inform an MMRS study which many MMRS frameworks fail to provide. The meta-modelling approach focuses on synthesizing effectiveness and implementation studies making it more appropriate for evaluation research. Given its focus on effectiveness studies, the

meta-modelling approach is appropriate for the presented application study. The illustrated application study provides a user with clear details on using the technique.

Shortcomings of this approach include its specificity in targeting the types of evidence and integration, and emulating an existing approach, which aligns with only one MMRS design (the segregated design). While the specific focus on the type of integration is important, this approach might not work for other types of evidence and contexts for certain research and evaluation questions. Moreover, relying on the EPPI-Center approach allows flexibility only when applying parallel and/or segregated MMRS designs. This limits the application to MMRS studies where the researcher assumes a clear distinction between qualitative and quantitative primary studies. In addition, the use of QCA as an integration technique might not work sell for other types of evidence. Therefore, for MMRS studies that might not align with some of the Author's assumptions, one has to determine effective logistics and techniques.

Sandelowski and Colleagues' (2006) Framework.

This approach focuses on the broader picture of design rather than methodological issues. Highlighting three key designs adhering to the definition of 'design' in primary mixed methods research, this framework presents a solid grounding for design issues in MMRS studies. The three designs (segregated, contingent, and integrated) are widely recognized in the field. Other researchers present alternative views of design in MMRS reviews (e.g., Hong et al., 2017; Pluye & Hong, 2014). Pluye and Hong (2014) conceptualize mixed methods review studies in the traditional sense for mixed methods research designs (i.e., sequential explanatory, sequential exploratory, and convergent).

One can argue there are several weaknesses and strengths of the various proposals but the approach by Sandelowski and her team (2006) is well articulated in the literature.

A major advantage of the designs proposed by Sandelowski's team (2006) is that they conceptualize diverse methodological possibilities relating to the practice of MMRS reviews. These designs allow for consideration of diverse perspectives associated with differences in the integrated evidence, and the process of combining it, while respecting the methodological orientations of the primary sources. Examples and elaborate discussions on when each of the designs is suitable for application provide additional guidelines to the user. However, the frameworks for each design, like other approaches, can be challenging to apply without additional reading and background knowledge on expectations for each step. Moreover, users require a strong theoretical grounding to especially understand certain terminology and MMRS practices.

The EPPI-Center (Thomas et al., 2004)

This framework presents one of the pioneering published works on MMRS frameworks in the literature. Developed by researchers at the EPPI-Center, this framework assumes a clear distinction between primary qualitative and quantitative studies thoughout the analysis and synthesis stages and before finally integrating them to address the overall research questions. Though the initial framework is primitive with fewer details on application (besides an illustrated example), improvements have been proposed and implemented over time. For example, the improvement by Oliver and colleagues (2005) enhanced the EPPI-Center framework with consideration for engaging stakeholders throughout the review process. The continued work by researchers at the

EPPI-Center ensures that continuous developments are dedicated to better future applications for this approach. Major shortcomings of this approach are that the foundational concept initially leaned more towards a positivist perspective. Also, the framework emulates a segregated design for MMRS studies, leaving it to the user to determine extending this approach to research that requires other designs.

The Integrative Review (Whittemore & Knafl, 2005)

The integrative review considers a wider range of evidence (empirical or theoretical) across methodologies (e.g., experimental and non-experimental) and does not necessarily focus on key issues of MMRS studies such as integration. Though this approach is widely cited in the MMRS literature, it is not clear that it was developed with this intent in mind. The collection and extraction of data are well addressed but the analysis, synthesis, and conclusion of studies using this approach are not well established. As an approach that emphasizes use of diverse evidence to inform a review question, this approach provides a basis for designing and implementing MMRS studies. MMRS literature shows that this approach has widely informed the development and proposition of other MMRS frameworks.

The Meta-Needs Assessment (Gaber, 2000) Framework

This framework is focused on the amalgamation of needs assessments evidence within human services agencies. The approach closely follows meta-analytic procedures with consideration for qualitative evidence, hence supporting the use of evidence across methodological divides. Vote counting and narrative procedures are recommended to ensure the analysis speaks to the needs of the community. The consideration of

qualitative evidence to strengthen the validity of the findings is discussed. Different approaches to integration and analysis are discussed but no specific approach is suggested. This approach is sequential and maintains a clear methodological distinction between evidence types informing the research. As such, little guidance and information is provided on its replication and usage considering MMRS applications. An illustrative example provided with the source offers some basis guidance for users that might want to apply this framework.

The Realist Review (Pawson et al., 2005)

This framework is grounded in the realism philosophy. It deviates from the focus on program effectiveness and considers answering complex evaluation and research questions. The suggested processes are continuously emergent. Though cited by many MMRS researchers as one of the better approaches, some realist review researchers argue that it does not necessarily align with the structures of MMRS studies. Some strengths for this approach are a strong theoretical grounding, comprehensiveness, and clearly outlined steps and procedures. A major shortcoming of this approach are the complexities involved in its application. Users should have a good understanding of realism coupled with some training before attempting to utilize this framework. The emergent nature makes it harder to understand important decisions that go into the process, complicating its application even for users that might have a good background in MMRS reviews.

The Comprehensive Literature Review (CLR) (Onwuegbuzie & Frels, 2016) Framework

This framework highlights the importance of the cultural context of both the research reviewed and the researcher to the MMRS process. The framework is comprehensive and well-grounded in the literature. It addresses the major need for MMRS frameworks to consider context of both the primary study and the research question. The iterative and emergent nature of the framework is reinforced as well. Despite this, the framework appears complex to follow and apply. Additionally, a user must read the accompanying book before application. Finally, the framework is adaptable to various MMRS designs. A major disadvantage of this framework is that though many issues regarding MMRS studies are discussed in accompanying literature, it is not clear how they are integrated in the framework. This is especially true for integration of evidence. It is not clear how a user of this framework can consider integration. Secondly, the framework seems to be geared more towards general literature reviews rather than MMRS reviews. This is because there is more emphasis on the synthesis of general information, rather than on information to answer a given review question.

The Question Eligibility Source Identification Selection Appraisal Extraction Synthesis (QESISAES) (Pluye et al., 2016) Framework

Presented as a Wiki tool, this framework offers a platform for ongoing debate and development of guidelines to better address MMRS reviews. The framework initially consisted of 6 stages that were later expanded to 8. Comprehensive information regarding each step is presented with examples making it easily accessible to interested users. The

consideration for diverse perspectives and input from different contributors is grounds for the development of a richer framework. Despite this consideration, on reviewing the site, it is notable that there has not been much contribution from others besides that of the original authors. A great strength of this tool is that it is collaborative, practical, and ongoing. A shortcoming of this tool is that one would need continuous access to the internet to utilize the resources. This tool is a pioneering innovation in the MMRS field.

The Joanna Briggs Institute (JBI) Model (Pearson et al., 2015)

Like the EPPI-Center framework, the JBI group advanced this approach. The initial framework, proposed in 2014, emphasized the use of Bayesian approaches to translate information for integration. This approach emulated the EPPI-Center one, reinforcing a clear distinction between qualitative and quantitative studies but differing in its consideration for qualitizing or quantitizing information using Bayesian methods. The JBI argues that integration of information is considered through translation of information to enlighten the overall MMRS question using Bayesian methods. Like the meta-modelling approach, basing the framework on the EPPI-Center design limits its applicability. In addition, translation of results from one form to another requires expertise that many users cannot apply without prior training. On the other hand, having a manual with user instructions and guides is a meaningful way to encourage application and replication of the framework in different contexts. Like the EPPI-Center approach, the institutional commitment to advancing research on the application and use of this approach ensures continuous development.

Recent advances to the JBI approach have resulted in a newer manual (2017) that considers various key factors not covered in the earlier user manual. For example, the issue of design is emphasized and guidelines for integrating evidence given the various MMRS designs are considered (Jordan et al., 2019). Specifically, convergent segregated and integrated approaches for integrating evidence are comprehensively discussed and examples provided. Additionally, the importance of clearly identifying the phenomena of interest and context (e.g., sub-cultural or cultural factors, and geographical location) is highlighted (Jordan et al.). These additions reflect continuous efforts to improve the practice of MMRS despite its newness.

In addition to thematic analysis of selected studies, other factors contributing to understanding the studies hence frameworks in the 10 methodological studies were considered. These included citations and commentary, as well as evaluating their quality in view of the proposed frameworks. An overview of these issues, also summarized in Table 3 of Appendix C, are discussed below.

Overview of Critical Review and Quality Evaluation Findings

The number of citations and commentary in MMRS literature informed decisions on the usability of the frameworks. The integrative review had the utmost number of citations (4092), then the realist review (1631), with the EPPI-Center framework (445) falling in the third place. The integrative review and the realist review both had the same quality evaluation score of 8, while the EPPI-Center framework had a quality score of 6. From the quality evaluation scores, all three frameworks were above the average score of 5 points out of a possible 10. Complementary to these findings, MMRS scholars identify

the EPPI-Center and the realist review frameworks as the most prevalent in the field (Lemire, 2017; Saini & Shlonsky, 2012). These findings and recommendations of researchers in the field, collectively informed the decision to identify the EPPI-Center and realist review frameworks as the most prominent in the field. The integrative review was not considered despite the high number of citations because of earlier concerns about the consistency in its usage. Quality evaluation scores of the 10 methodological studies provide more insight on the findings from this process and are discussed next.

Quality Evaluation of the Final set of Methodological Studies

The *study evaluation form,* developed during the preceding review stages, directed the quality evaluation process for the final[5] set of ten methodological studies associated with the frameworks reviewed above. Two main attributes grounded the *study evaluation form*. These issues included the methodological clarity, and theoretical underpinnings informing the development and/or improvements of the framework in the final set of reviewed studies. Methodological clarity here referred to precision in the language utilized in the framework and the ease with which one can articulate the procedural aspects of a given framework. Questions on methodological clarity addressed issues such as the steps within the framework, and guidelines linked to them.

Theoretical underpinnings on the other hand, referred to situating a given framework within existing literature on MMRS frameworks and articulating what it would add to current knowledge. Issues identified in referenced studies and relating to

[5] The quality assessment of the final set of 10 methodological studies was carried out by considering aspects of methodological and theoretical clarity associated with the respective frameworks advanced by these studies respectively. The scores played a role in the final decision informing the inclusion criteria. This step further informs the reader of the value of included and reviewed studies.

identified frameworks complemented these aspects. As a result, ten questions were formulated to collectively address the quality of the selected studies. Seven questions targeted theoretical issues and three targeted methodological aspects. Additional details on the development of the quality evaluation form are presented in Appendix A. The quality evaluation scores are presented alongside other study characteristics in Appendix C and Table 3. These scores informed the quality evaluation of the selected studies in the critical review stages.

Overall the quality evaluation scores for the 10 methodological studies had a range of 3 points with scores falling between 6 and 9, a median of 8 points, and a mode of 8 points. The overall mean quality score calculated from the assessment of the methodological studies was 8.9 points. The lowest score was 6 indicating that the methodological studies scored above the average score of 5 points out of a possible 10 points reflecting their clarity relative to methodological and theoretical aspects. Similarly, a high score of nine out of a possible 10 points showed that the methodological and theoretical clarity of identified methodological frameworks was relatively good. These scores show that on average the reviewed set of methodological studies are of high quality according to this evaluation form and the researcher's understanding of them. Individual quality scores informed the researcher regarding the strength of the selected studies although these scores did not impact the final inclusion decision for studies. Studies were not disqualified because of the quality evaluation process. The results from this evaluation are important to enlighten readers about the perspectives of the researcher's for the final set of studies. To complete the critical review, the content of the

methodological studies was reviewed with issues viewed as important to MMRS frameworks in mind. As such, ensuing findings informing the development of the new framework were critically evaluated in the context of the selected methodological studies and synthesized as is discussed next. Table 5 shows the quality evaluation form.

Table 5
Quality Evaluation Rubric

Question(s)	**Responses**
	Yes (1)/ No (0)
Part A. Theoretical Clarity	
1.) The rationale for proposing the methodology is well outlined/ articulated	
2.) The literature review is comprehensive and up-to-date	
3.) The goal/ purpose of the source is clearly identified	
4.) Key issues to MMRS studies such as integration, precedence etc. are addressed	
5.) The publication substantially contributes to the MMRS process and practice	
6.) The discussion is comprehensive a (covers existing frameworks, notes related issues, and what the publication contributes)	
7.) The terminology/ Language used is consistent with what is in the field	
Part B. Methodological Clarity	
8.) The publication presents the process for the framework in steps that are easy to follow	
9.) The steps for the framework are presented in a language that is common	
10.) The source considers key synthesis attributes akin to qualitative, quantitative, and mixed methods synthesis processes	

Synthesis and Critical Analysis of Findings

The final set of studies were further assessed to inform the development of the new framework. Thematic and content analysis (Beck & Woynar, 2017) were employed to individually identify and review aspects relating to the identified conceptual

frameworks. The themes aligned with issues of critical importance to MMRS frameworks and the strengths and weaknesses of respective frameworks. Issues critical to MMRS frameworks, as identified across the review of methodological studies, application studies, and general MMRS literature review for this study affected the entire review process and the decisions made. These included:

1. The title and topic for the review,
2. The research questions and purpose of the review.
3. Theoretical Framework:
    a. The overall theoretical framework, and
    b. The theoretical frameworks informing various stages and key methodological decisions,
4. Managing retrieved studies and evidence,
5. General systematic review processes including methods of data collection, and data analysis, and what guides the respective decisions
6. Quality evaluation processes and tools specific to the diverse primary studies included,
7. Synthesis procedures e.g., Bayesian, QCA and realist,
8. The complex and iterative nature of the methodological processes and related challenges

The Title and Topic of the Review

The title selected for a review is crucial to clearly delineate the study from other types of reviews (Hevaert et al, 2016; Onwuegbuzie & Frels, 2016). It is imperative for a

review researcher to consider the stidy's charateristics, especially the topic, research questions and goals, when defining the title of an MMRS study. The topic of interest is critical when deciding on the title and in directing subsequent processes. Studies reviewed in MMRS reviews have to align with the topic of interest with the chosen title complementing the search and selection process for MMRS reviews (Lemire, 2017). Some of the frameworks propose a collective overview while others recommend considering the respective qualitative and quantitative strands before working on the overall title. For example, the realist review (Pawson et al., 2005), under 'clarifying the scope of the review', propose extensive steps with the the research questions in mind, 'the context of the study', and the goal of the study with the intent to ensure the topic is well situated for this type of a review. The EPPI-Center and the JBI approach on the other hand, consider the research questions with respect to how they inform the overall study in decisions regarding the overarching topic. Sandelowski and colleagues (2006) emphasize the significance of the research question/s and purpose of study in informing the study topic and in directing the choice of the design for MMRS reviews. It is therefore evident that title and topic are consequential aspects for shaping the direction of an MMRS review.

The Research Questions and Purpose of the Review

The research questions, whether specific to the individual strands or the overall study, are central to decisions directing the MMRS review as discussed earlier (Heyvaert et al., 2016). On the other hand, the purpose of the study, informs decisions that shape the research questions and subsequent processes (Claes et al., 2017). Methods of data

analysis including integration and synthesis are critical to answering the research questions. As such, careful thought is necessary for the choices of the analysis methods, considering both the needs of the study and the expertise of the reviewers. In case of teams, as is the case with MMRS reviews, consultations on important decisions should be a significant part of these discussions. Moreover, the expertise of the team should be examined and necessary discussions with qualified individuals planned for credibility. The MMRS (Heyvaert et al., 2014), the realist review (Pawson et al., 2005), and the EPPI-Center frameworks emphasize the need for such consultations before and during the review although this information is not always apparent from the presented framework steps. Mertens (2018) proposes a framework, not included in the critical review, which reinforces the importance of including stakeholders and especially the users of the review in all stages of MMRS reviews.

Quality Evaluation Processes and Tools

Quality assessment is identified as a key step of any review. While this process is straightforward for studies within the same methodological orientation, and especially quantitative syntheses, the case for MMRS reviews is not as simple. Considering diversity in evidence and debates on what constitutes quality when evaluating studies for inclusion in reviews, this step is especially crucial for MMRS reviews. The Mixed Methods Appraisal Tool (MMAT) (Pluye et al., 2011) was developed for appraising studies for inclusion in MMRS studies. However, the MMAT is subject to controversy (Crowe & Sheppard, 2011). Many frameworks recommend quality appraisal without clearly stipulating guidelines for the process and what informs decisions on appraisal

tools for MMRS studies. Moreover, the definition of quality is evolving while quality evaluation tools are still developing and are surrounded by ongoing debates (Nakagawa et al., 2017; Noyes et al., 2019; Trainor & Graue, 2014). These concerns translate to MMRS reviews raising questions on addressing quality in the field.

Theoretical Framework

Theoretical frameworks are important to guide and situate the philosophical and ontological assumptions that orient research studies (Pawson et al., 2005). It is essential that reviewers clearly identify theoretical frameworks aligning with their work (Mertens, 2018; Onwuegbuzie & Frels, 2016). In methodologically singular reviews, identifying the overall review framework and that for selected studies and how they inform the review is important (Mertens). This need was not highlighted in the reviewed frameworks but is articulated in related literature.

The Overall Theoretical Framework. MMRS reviews will mostly encompass more intricate philosophical and ontological assumptions than regular reviews. These assumptions might inform the various processes that go into the various stages and methodological decisions that go into shaping MMRS reviews. Moreover, primary studies selected in any review embody their own views. As such, it is vital that MMRS frameworks consider the theoretical framework as an aspect of the review process worth articulating.

Theoretical Frameworks Informing Various Stages and Key Methodological Decisions. MMRS studies include composite steps and processes. Because of inclusion of diverse evidence, various decisions have to be made shaping the review. Moreover, as

an application of MMRS studies, pragmatisim accompanies any underlying theortical perspectives. Therefore, it is important that these views are spelled out to best inform users of the reviews. Frameworks should in turn articulate the importance of this characteristic.

Managing Retrieved Studies and Evidence

Information management is an undeniable part of review research. To comprehensively and fully review retrieved studies, one must be knowledgeable about how to manage the information (Gough et al., 2017). This is especially necessary for complex review applications such as MMRS. Many reviews acknowledge consultations with librarians as a key aspect of the review process (Gough et al., 2019). Though noted as a step of the review process, none of the identified frameworks single out this step, besides noting the selection and inclusion process of primary studies. While this might not be a problem for experienced review researchers, novices might find data management challenging when attempting to replicate MMRS reviews.

Heterogeneity in the Definition of the Phenomena of Interest

In the initial stages of the identified frameworks, the definition of the topic/title and scope of the study is noted as a key part of MMRS studies. It is, however, not clear how this definition factors into the information gained from the reviewed studies in relation to the phenomena of interest. While emphasis is given to the title or scope of the study, the phenomena is not given as much emphasis. The definition of the construct is highlighted in recent research as an important aspect of complex reviews. It is important that studies brought together to inform a specific cause are directed towards the same

issue. In this case, what is researched or evaluated should align in meaning and context. If caution is not taken when considering diversity in methods and theoretical frameworks, it is possible that the problem of 'apples and oranges' is extended even further in MMRS reviews and related approaches. In addition to these specific issues, two overall concerns were noted across the frameworks. These were the lack of simplified user guidelines and addressing the issue of integration.

Integration and Synthesis Procedures

Integration is central to the MMRS application due to its association with MMR studies (Lemire, 2017). Furthemore, the need for comprehensive and diverse evidence reinforces the importance of integration to MMRS reviews. Considering ongoing debates about the concept and definition of integration, its impact on the MMRS review cannot be overstated. Current efforts pinpoint important developments on the techniques, usage, and definitions of integration. Examples of integration techniques include the matrix method (Mertens, 2018; Thomas et al., 2004) and qualitative comparative analysis (QCA) methods (Lemire). It is worth noting that there exists a multitude of misuses and misapplications of integration. For example, MMRS review and MMR researchers do not always articulate or identify how they integrate evidence besides discussing findings, usually from individual evidence strand syntheses (Fetters & Freshwater, 2015). It is important that the evidence for MMR and MMRS studies is integrated to legitimize the need for the respective applications (Creswell, 2015a, 2015b; Mertens) MMRS frameworks need to highlight this aspect as an important MMRS process. Moreover, integration is primarily impacted by preceding evidence synthesis steps.

The decision about synthesis is important for MMRS studies given many options for the diverse evidence collected. Some frameworks propose specific synthesis approaches while others offer recommendations. For example, the EPPI-Center approach recommends individually synthesizing the evidence per methodological divide, while the JBI approach initially considered a similar approach with suggestions for using Bayesian approaches for integration. Lemire (2017) suggests beginning with the synthesis of qualitative evidence before the quantitative for better theory formulation. Recent improvements to the JBI approach suggest considering the MMRS design to select an appropriate synthesis approach for integration (Jordan et al., 2019). Additionally, there are different options for synthesizing evidence within and across pardigmatic fields. The expertise of the review team further adds to the reasons to consider decisions on appropriate synthesis approaches. As is evident from examining the frameworks, the synthesis step is especially vital for the process of integration, which is essential for MMRS reviews.

General Systematic Review Processes

As an application of traditional reviews, general review processes are foundational to the methodological developments of MMRS studies. These processes include searching and search strategies, selection and retrieval of studies, reviewing selected studies, and synthesizing the evidence. It is important to note that MMRS studies deviate from traditional reviews with respect to the complications associated with these steps (Gough et al., 2012; Heyvaert et al., 2016). Specifically, general systematic review processes are more extensive and demanding in the context of MMRS studies (Gough et

al., 2019; Pluye & Hong, 2014). It is therefore important that frameworks carefully consider this difference when defining steps. For example, searching and data retrieval strategies might require more focused expertise considering the extent of evidence considered for MMRS studies. In addition, the iterative nature and challenges that accompany these steps, as well us how they interact to shape the MMRS review process is worth noting.

Besides strengths and weaknesses of identified frameworks, it was evident that none of them provided guidelines for interested users. The JBI framework, which is part of a larger handbook, is the only one that currently offers user guidelines. Most of the other frameworks reference application studies as illustrations for applications, but this can be challenging given variability in context and purposes for MMRS studies. Additionally, current frameworks are presented as part of larger publications or books, making it necessary for users to read extensively about the framework before considering its application. The researcher notes this as a shortcoming of current MMRS frameworks and related literature. MMRS as an approach geared towards evidence-based results should bridge the gap between research and practice. As such, MMRS frameworks needs to speak to diverse audiences and users. Including simplified user guidelines should better inform the usability of MMRS. Additionally, integration, which requires specific training and expertise, is not differentiated from the synthesis of evidence specific to the data sources which are methodologically diverse. The framework developed in this study considers these shortcomings and includes simplified guidelines for application and a separate integration step.

Methodological Reflections

This Chapter focused on the implementation of the methods proposed in the previous Chapter. A critical review complemented by a preceding scoping review were the basis of this Chapter. The first two research questions were answered by these processes. The scoping review was essential in mapping the search strategy and in understanding the MMRS literature with respect to existing frameworks and their usage. As such, the scoping review revealed common MMRS frameworks, laying out the diversity in their usage across disciplines, geographical boundaries, active authors in the field, and common MMRS synonyms used in the field. Furthermore, the scoping review informed subsequent stages for the critical review which informed the development of the new framework which corresponded with the third research question.

Critical review stages, after the scoping review, focused on assessing the selected methodological studies, leading to the identification of key frameworks in the MMRS literature. The themes and discussions resulting from this stage formed the basis for the new framework guiding and shaping its development. Furthermore, the scholars identified as active and influential were essential for the final phase of the study which required solicitation of feedback on the new framework from experts in the field. The new Framework is discussed extensively in the next Chapter, and is complemented by the expert review process and results which inform revisions to this framework.

CHAPTER 4

THE NEW FRAMEWORK: COMPREHENSIVE RESEARCH SYNTHESIS

This chapter details the process for the second and final stage of this study. This section focused on the development of the new framework, termed comprehensive research synthesis (CRS), preceding and after the expert review. The processes adhere to the procedures laid out in Chapter 2 and shown in Figure 4. The first part addresses Phase 1 of the second research question focused on the initial development of the CRS and informed by the critical review. The initial framework, developed based on the literature, is presented at the beginning of this section under the heading, 'Defining CRS.' The revised CRS considering the expert review is presented at the end of this section. The second part addresses the second phase of the second research question and details the process for refining the developed framework based on the views of experts in the field.

Defining CRS – the New Framework

CRS comprehensively considers issues arising from the critical review and from the literature. These issues span aspects noted on MMRS frameworks and discussed earlier, their strengths and weaknesses, and the perceptions about their application by diverse audiences in the field. Matters noted as critical to MMRS review frameworks ground the developed framework. The CRS framework (initial draft), developed by the researcher in this study comprises seven steps. These steps are reviewed in detail below after the presentation of the initial framework. Table 6 illustrates this framework.

Table 6

Initial Comprehensive Research Synthesis (CRS) Draft

The Comprehensive Research Synthesis Framework (Initial Draft)
Step 1: Scope of Study • Define topic of interest • Identify problem and research question(s) • Identify philosophical assumptions for the study and researcher's • Purpose of the MMRS study and justify application • Develop a protocol and seek IRB approval **OR** consider ethical issues • Consider review team, expertise, and resources • Scoping search if unfamiliar with topic/ area
Step 2: Evidence Search • Literature search • Define search strategy/ strategies • Conduct a scoping search if necessary • Identify sampling strategy ---consider diversity in evidence sources • Identify information management strategy and/ or software
Step 3: Evidence Retrieval • Define inclusion/ exclusion criteria (per evidence type) • Define construct of interest to guide criteria • Consider context for primary studies and related evidence • Clearly document the study selection process
Step 4: Quality Appraisal • Consider the diverse evidence types and sources • Identify tools used (defined or researcher developed tools) • Consider issues of validity/ legitimacy
Step 5: Data Analysis and Synthesis • Reflect on design if chosen or make choice • Data extraction and related strategies • Data analysis---consider diversity in evidence types • Evidence synthesis---consider diversity in evidence
Step 6: Integration/ mixing • Consider how evidence informs overall problem and research questions • Techniques for integration and translation of evidence to answer research questions • Transparency in decisions made.
Step 7: Writing the Report • Consider intended audience and initiate discussions respectively if needed • Intended purpose of the study and report • Other factors (e.g., consultations with stakeholders) • Researcher reflexivity on process and personal beliefs

As stated earlier, this framework does not present a new concept, rather it builds on information from other MMRS frameworks to propose a more comprehensive and informative approach to the MMRS process. As such, traditional steps for reviews ground the framework while processes specific to MMRS reviews are adapted given findings from earlier analyses. The framework highlights the complex procedures and practices unique to MMRS reviews such as integration and quality evaluation of diverse sources of evidence respectively. Some steps are separated or combined with the goal to better inform the application and implementation of MMRS studies. The framework addresses the need to improve the application of MMRS studies, and includes aspects informing this purpose later in the Chapter and after the expert review. The framework also reinforces critical methodological concerns for MMRS studies. Details about each of the steps for the developed framework are presented below. It is essential to note that these steps are iterative rather than fixed. This implies that reviewers constantly reflect on preceding and subsequent processes as they engage with the review process.

Step 1: The Scope of the Study

Defining the scope of a review study is fundamental for establishing boundaries and focusing it (Whitemmore et al., 2014). This step ensures clarity in the study purpose through addressing issues of problem identification along with an understanding of the variables of interest to the study (Claes et al., 2017). When well addressed, the scope of the study grounds and directs subsequent steps for the review (Pawson, 2006; Thomas, Kneale et al., 2019). In this framework, the author considered seven issues for establishing the scope of the study: defining the topic of interest, identifying the problem

and research questions, identifying the philosophical orientation for the study and the researcher, defining the purpose for the MMRS study and justifying its application, developing a protocol and seeking IRB approval/ considering ethical issues, considering the review team's expertise and available resources, and conducting a scoping search if unfamiliar with the topic/area.

Define the Topic of Interest. Stating the topic of interest is essential for grounding the MMRS review. It is important that it is established from the start (Heyvaert et al., 2016; Pawson, 2006). The topic of the study sets the study apart, identifying the area and focus of research while guiding its essential and initial processes such as founding the problem and research questions. This sets the stage for all subsequent stages of the review. It is vital that the researcher constantly reflects on it throughout successive steps.

Identify Problem and Research Question. The problem of study and research question situate the review within the larger picture in the field of research. Like any research, the problem and research question shape the direction and context of the review. This step is important in guiding later steps. It is also a point of constant reflection and is continuously developed and improved throughout the review process (Gough et al., 2012).

Identify Philosophical Assumptions for the Study and the Researcher. Philosophical assumptions are fundamental in guiding our beliefs and influencing the way we engage with research (Baškarada & Koronios, 2018; Pawson et al., 2005). As such, they shape and inform important decisions in the review. Given the complexity of

MMRS reviews, it is inevitable that a researcher's background and philosophical assumptions crucial when defining the review. Moreover, the reviewed studies are guided and informed by diverse philosophical assumptions (Baškarada & Koronios). Current frameworks do not place enough emphasis on the value and need to consider this in a review. The comprehensive literature review framework touches on this, providing guidance on how to consider it for mixed methods reviews (Onwuegbuzie & Frels, 2016). In discussing the extension and potential for mixed methods systematic reviews in evaluation and for the social justice branch, Mertens (2018) provides guidance on this application, highlighting the role of philosophical assumptions in the review process.

Purpose of the MMRS Study and Justification of the Application. To build on and support the preceding issues, a clear purpose for the review is pertinent to focus its goal (Claes et al., 2017). Moreover, it is necessary that a rationale for applying the MMRS approach is provided (Thomas, Kneale et al., 2019). As a complex review application, the research questions should guide and inform the choice to apply the MMRS review to any study.

Other Issues to Consider. These issues are not necessarily part of the logical procedures for the framework steps; rather, they are suggestions for strengthening the legitimacy of the MMRS review process and product. These include consideration for developing a protocol and seeking IRB approval/considering ethical issues, the review team's expertise and the resources available, and a scoping search if not familiar with the area of study (Heyvaert et al., 2016). After issues of problem identification, review

questions and its purpose of the review, the reviewers should develop a protocol to guide major steps and decisions for the study.

The protocol highlights key steps that would go into the review process and is not an all-inclusive document. The steps reflect key aspects of the selected MMRS framework or note if the steps are adapted from diverse frameworks. In some cases, it is expected that a protocol be submitted with a proposal before the review study is approved (Heyvaert et al., 2016). For studies such as dissertation studies, one might consider IRB approval. While review studies are traditionally exempt from IRB review, it is important for institutions to track the types of studies executed within their realm. MMRS reviews are geared towards providing comprehensive answers to research and evaluation questions that might impact policy and major decisions within corporations on specific topics. As such, ethical implications should be considered through proper documentation of decisions that guide the review. This ensures that the users are well informed of the strengths and limits of the review product.

The complexity of MMRS reviews requires specific skills for proper implementation (Noyes et al., 2019). Therefore, it is necessary that in preparation for the review, the expertise of the reviewer or the review team is examined (Gough et al., 2019). Plans should be made for ways to outsource input on areas where the expertise of the reviewer or the review team falls short. Additionally, the process of MMRS reviews is time consuming. Thus, the reviewer/review team and other stakeholders should be aware of the extensive resources necessary to successfully complete a project. In addition, given the evolving nature of MMRS reviews, the parties should be pragmatic about emergent

issues that could impact set plans, affiliated resources and timeline for the project; and strategize accordingly.

Finally, given the complex nature of MMRS reviews, it is rare that a reviewer is knowledgeable about multiple study sources and methodological issues that inform the review. Therefore, when putting together a review team, it might be necessary to consider diversity in knowledge and skills across a team. Most importantly, despite the knowledge and skills of the reviewer/s, conducting a scoping search to become familiar with the topic, the extent of available study sources, and other issues that might affect the review process is beneficial. A scoping search ensures that even individuals who might be familiar with a certain topic reflect on ongoing issues within current research before initiating the review (Gough et al., 2019; Noyes et al., 2019).

The first stage of the review is taxing as it encompasses foundational aspects that call for comprehensive decisions that ground the review and direct consequent stages.

Step 2: Evidence Search

In traditional reviews and current MMRS frameworks, the evidence searches and retrieval stages are covered under one step. In MMRS and other complex review applications these stages are more demanding and involve several iterations in addition to requiring specific skills (Pluye & Hong, 2014). These skills mimic general processes for traditional reviews including the search for the literature, defining the search strategy/strategies, identifying a sampling strategy, and identifying an applicable information management strategy and/or software. These stages are more daunting for an MMRS review and require clearer and more comprehensive documentation of decisions

compared to traditional reviews given the broad range of included evidence (Heyvaert et al., 2016). Decisions must be made to accommodate the diverse evidence types included in the review for general and specific processes. A scoping search is also recommended at this stage if the reviewer or team is not familiar with the literature. Though noted in the initial stage, the scoping search during this stage is critical as it impacts the evidence included in the review, thus shaping the overall review. Finally, while information management strategies and/or software are mentioned in review studies, it is necessary to highlight this as a crucial issue for MMRS reviews (Thomas, Noel-Storr et al., 2019). Collecting review evidence across multiple sources requires knowledge of existing sources and differences that might be anticipated across these sources. Decisions about how to manage and store the information impacts the breadth and quality of the retrieved information and so subsequent review stages.

Step 3: Evidence Retrieval

As previously noted, this step is separated from the evidence search process. It involves the final definition of the inclusion/exclusion criteria, definition of the [6]construct of interest to orient the defined criteria, and a clear record of the procedures for selecting studies. During this stage, the evidence selected for consideration is closely examined for inclusion in the review. It is therefore necessary to define clear inclusion/exclusion benchmarks for the final set/s of studies to be retrieved (Sutton et al., 2019).

[6] The term 'construct' in this case is used to refer to the understandings accorded to the phenomenon/ phenomena of interest in a given research study when considering the affiliated cultural, political, and social contexts within which they are examined. Several levels of constructs are identified in the literature to characterize the understanding accorded to the phenomenon we study. These include; 'first order', 'second order', and 'synthetic constructs' others (Dixon-Woods et al., 2006; Noblit & Hare, 1988).

The MMRS review departs from traditional reviews in the sense that the defined criteria should reflect the types of evidence included in the review (Pluye & Hong, 2014). With consideration for the diversity in the nature and type of evidence, it is essential to define the construct of interest. The definition of the construct sets the review study apart by making it useful in practice as an evidence-based research tool (Dixon-Woods et al., 2006). Unlike other frameworks, the importance of the construct in legitimizing included studies is emphasized in the CRS framework. The inclusion criteria should precisely define the target construct for the retrieved studies to ensure that they are addressing the same phenomena. This issue speaks to concerns about the 'apples versus oranges' problems in traditional reviews that carries over to complex review applications (Cooper et al., 2009). Though documentation in MMRS reviews is emphasized for ethical reasons, keeping a clear record of the study selection process is highlighted as a vital aspect for reflection during later stages and for users of the review (Heyvaert et al., 2016).

Step 4: Quality Appraisal

Quality assessment has been part of reviews since their inception (Cook et al., 2017; Cooper, 1998; Gough et al., 2019). Efforts have focused on defining quality standards for quantitative and then for qualitative studies (Talbott et al., 2018). Recent efforts have concentrated on developing guidelines for evaluating quality for mixed-methods studies (Hong et al., 2018; Pluye et al., 2011). Despite these developments, a major criticism of existing rubrics and review tools is that their characteristics align more with positivistic views, thus favoring quantitative reviews. Given existing limitations in reviewing diverse evidence, assessing the quality of studies is essential for defending

their inclusion/exclusion. There concern about the evaluation of quality for primary mixed methods studies (Hong et al., 2018). Debates about quality evaluation for mixed methods center on whether considering overall quality versus strand (e.g. quantitative, qualitative strands) quality is more favorable (Gough & Richardson, 2018). Given the ongoing debates, this framework recommends consideration of quality evaluation where the reviewer makes clear the decision on tools used or the process for quality evaluation of retrieved primary studies.

Step 5: Data Analysis and Synthesis

This step is adapted from existing frameworks and modified for clarity. Rather than separating [7]data analysis and synthesis, these steps are merged into one step. Though synthesis of the data from the retrieved studies is traditionally considered a part of data analysis in reviews (Heyvaert et al., 2016; Lemire, 2017), it is separated out in this framework as it may require different expertise and negotiations that lead to making sense of the evidence collected and informed by the research questions. Questions should be asked about whether the evidence is meeting the expectations for the research questions/s (Gough et al., 2019). Strategies for data extraction should align with the review questions and the purpose of the study (Claes et al., 2017). This step is also influenced by the choice of design, whether made earlier or as the process unfolds. The processes for synthesizing the diverse evidence from retrieved primary studies are delineated according to the various designs leading into the integration of evidence.

[7] Data analysis refers to the process of using applicable tools and methods to understand research information including issues of importance to a given study presented numerically for quantitative or as phrases for qualitative research. In mixed methods data analysis includes both numeric data and phrases addressing specified questions of interest in a study.

Step 6: Integration /Mixing

Integration, sometimes termed mixing, of evidence is a critical aspect of mixed methods research, hence MMRS reviews (Creamer, 2018; Creswell, 2015a, 2015b; Heyvaert et al., 2016; Olofson & Garnett, 2018). Current frameworks touch on integration without providing guidance on its implementation. In this framework, it is important to separate the integration process from other synthesis processes since it involves exclusive strategies that require expertise differing from that of general analysis and synthesis processes. The process for translating extracted evidence through integration to address the overall problem, in this case the mixed methods question, should be cautiously selected. Integration processes are further dictated by the MMRS design (Lemire, 2017). Decisions about choices should be justified for transparency (Templier & Paré, 2018). This is because changes in the choice of the integration approach could have differing implications. The integration/mixing answers the overall mixed methods research question and justifies the MMRS application (Heyvaert et al.; Olofson & Garnett, 2018).

Step 7: Writing the Report

The final stage of writing the report, though seemingly obvious, is important for various reasons. The intended purpose of the study should be revisited at this stage (Noyes et al., 2019). The means and modes of presenting the report should clearly speak to the intended audience. Discussions to ensure better communication of the findings should be initiated before this stage and sustained to the completion of the report (Mertens, 2018). Given the complexity and nature of MMRS reviews, though mainly

stated in the initial stage, consultations with involved parties and stakeholders should be sustained to this end to achieve a meaningful product. Moreover, given a tendency for researcher bias in review studies, researcher reflexivity on the various processes and decisions and how these interact with their personal and/or collective beliefs as well as their philosophical assumptions or those identified within included studies should be discussed (Onwuegbuzie & Frels, 2016).

Following development of the proposed framework, an expert review process solicited feedback from seven specialists in the MMRS field and is discussed next.

The Expert Review

This stage of the study answered part two of the second research question as the final piece of this dissertation. The proposed framework was presented to a select set of experts along with other materials. Feedback and recommendations, captured via internet interviews, were considered for improving the CRS and leading to a final version. The process is discussed, followed by the findings, before presenting the final version of the CRS framework.

Preparation

After defining the CRS, first, the instruments necessary for this stage were refined prior to soliciting experts' input. Two advanced doctoral students, one with a quantitative background and another with a qualitative background, critiqued the instruments developed for the expert review (see Appendix B). The researcher sought general feedback on the content, flow, and structure of the rubric along with accompanying tools. The tools were then revised, followed by consultation with two professors, one with a

quantitative background and measure development expertise, and the other with a mixed methods, evaluation, and review research background. Feedback from these consultations informed the final version of the rubric for evaluating the two most used frameworks identified as the EPPI-Center and realist review frameworks. The researcher findings, presented as summaries, along with other tools and materials as discussed in the methods section, were provided to experts. Table 2 in Appendix B shows the summaries of the evaluations of the two most prevalent frameworks.

The Expert Review Processes

The expert review involved interviews with seven experts in the MMRS field. The expert reviewers actively engage in debates on the application of MMRS studies and related methodological issues. An initial list of experts was compiled, giving priority to first authors of foundational work followed by authors appearing multiple times on contributing works. Foundational work was gauged by its contribution to the MMRS field and per the number of citations through recent propositions for MMRS frameworks.

Based on these criteria, first authors on the 10 key frameworks identified in the critical reviews were included. Sampling was purposeful. Additional names were included if they appeared on at least two other works contributing to MMRS methodological debates. A list of forty potential participants was created and a target of 5 to 7 positive responses set. Contact information for the identified participants was sought through onlie searches across various platforms including Google searches and relevant institution websites. Preparations were then made to contact the potential participants.

An introductory email requesting the participation of the selected experts was sent out to the first set of prospective participants soliciting their interest to participate in the study. This initial email was tailored to each participant and provided a brief background of the study. The email asked participants to provide phone contacts if willing to participate. A response to the email indicated consent for participation. The initial dates for the set interview timeline were revised based on the participants' responses. The initial email was first sent out to a total of 25 potential participants. Three emails failed to go through, 4 participants could not participate in the study, 15 did not respond to the email, 1 participant initially agreed to participate but later declined participation before the set interview date, and 2 agreed to participate in the study but suggested different participation times than those anticipated. A third participant who initially did not respond to the email responded a week later and consented to the interview. Subsequent emails were sent out until all forty participants were contacted. One participant consented to the study from these emails. The initial timeline for the study was amended to coincide with the availability of those who agreed to participate. Two participants requested to use Skype in place of a phone interview. Interview dates were then set based on the participants' individual availability and a Google Calendar invite shared with them. The generic version of the initial email is presented in Appendix B.

A second email with comprehensive study details was shared with the four participants who consented to the study, one week before their interview dates. The material included an interview protocol, the three frameworks, and a summary of the researcher report on the evaluation of the three frameworks. The email provided the

logistics and more details about the study, allowing the participant time to prepare for the scheduled interviews with sufficient background information. The researcher provided options for scheduling the interviews, and for electing to use an alternative platform.

Additional experts were identified by snowball sampling where two interviewees volunteered names and contact information for potential participants following their interviews. The suggested names were not included in the initial list. Out of seven referrals, an additional three experts were identified, and they consented to the study resulting in a total of seven expert reviewers. At this point, recruitment was closed.The follow-up email, the three frameworks (the researcher developed framework, the EPPI-Center framework, and the realist review framework), the researcher's summaries from evaluating the three frameworks using the developed rubric, and the interview protocol are presented in Appendix B.

Two of the additional three participants suggested using Skype, an online platform, rather than a phone call. All interviews were contacted via Zoom to accommodate participants' diverse preferences. Participants were notified and agreed to the use of this platform. Communication details along with Google reminders were shared with participants before the interviews. The use of Zoom was convenient given different time zones and anticipated logistical and cost concerns associated with long-distance communication. Interviews were completed and recorded over a period of six weeks. All participants who consented to the study were interviewed. Table 7 below shows the list of the seven experts. One participant requested to adjust their interview time by one week following technical challenges on the initial set interview time.

Table 7
List of Expert Interviewed for the Expert Review Stage

Interview Date/ Info?	Area of Expertise	Disciplinary orientation	Found via…
April 25th at 7:30 AM (Changed to May 1st)	Mixed methods research synthesis	Social science	Literature
Not avail on the 11th of April----To Skype	Mixed Methods	Social science	Literature
April 18th – Morning	Mixed methods research, mixed methods reviews	Evaluation	Literature
May 1st, 7:00 AM (MDT) and14:00 PM (BST)	Realist reviews	Evidence-Based Medicine	Reviewer Reference
April 18th, Morning	Transformative mixed methods research	Evaluation	Literature
May 1st	Joanna Briggs Institute (JBI) approach	Social science research	Reviewer reference
May 22nd	Meta-evaluation/ Evaluation synthesis	Evaluation	Reviewer reference

The interviews were coded manually, and the transcripts saved in a Microsoft word document. Important phrases were identified and highlighted to allow for emergent patterns leading to the development of themes (Kuntz, 2010). Tables were used to organize "key phrases" identified across participant transcripts for easier interpretation, analysis, and comparisons. The resulting summaries later informed use of *in vivo* codes to support the identified themes (Creswell, 2013; Kuntz). The themes emphasized issues emanating from participant discussions regarding various issues in the field and on MMRS frameworks. For example, the theme on diversity was identified following examination of participant discussions on similar issues and noting vairations in their views. These themes were them reinforced by giving voice to particpants' perspectives through referencing some direct statements from their discussions.

Emergent themes informed the main research questions and CRS revisions. Additional information from journal notes taken by the researcher during the interviews and artifacts shared by the [8]interviewees were also analyzed. One expert reviewer rated the frameworks using the rubric provided and shared the document for comparison with the researcher ratings (See Figure 1, Appendix E). Another participant shared a copy of a meta-evaluation report to illustrate knowledge of MMRS studies (Noltze et al., 2018). This information added to the richness of the interviews and provided more context to the participants' responses and views. These documents are presented in Appendix E along with other interview results and analysis materials. The results from the expert review interviews are presented and discussed next.

Expert Review Results and Findings

Cross case analysis of the interview findings (see Appendix E) highlighted similarities and differences across participants' stances on issues (Creswell, 2013; Gibbs, 2008). The conclusions of the expert review interview process are presented as the patterns from the findings (Yin, 2009). Information adding to the refinement of the CRS framework is identified. This framework is discussed in detail under the next section. Additional findings are discussed as relevant information for the field and for the application of MMRS. The results are discussed under five sections identified through the cross-case analysis process and by examining the questions for similarities. These sections are presented in Appendix E with related scripts, notes, and documents. Table 8 summarizes key findings and emergent themes for these sections.

[8] Note that the expert reviewers are also referred to as interviewees and participants in this study since they were engaged in an interview study seeking feedback on the CRS framework as discussed in this Chapter.

Table 8

Summarries of the Five Sections Covering the Results of the Expert Review Process, Key Findings, and Emergent Themes

Section and Key Findings	Emergent Themes

Section 1: General Characteristics
• Diversity in
  o Background, locations, gender, review experience, pragmatic stances, and fields of practice & context
  o Knowledge and familiarity with MMRS and MMRS frameworks
  o Perspectives about MMRS and MMRS frameworks
• More theoretical than practical/ empirical knowledge
	Developing Field
	Gap between theory and practice
	Ongoing debates/ developments

Section 2: Issues Pertinent to MMRS and MMRS Frameworks • Basic systematic review steps inform process • Suggestions for some process specific to certain frameworks • Criticisms of some practices and processes • Integration central to process • Diversity in views, and stances on ideal practices and process.	Gap between theory and practice Developing Field Challenges in steps and processes

Section 3: The Two 'most Prevalent' Frameworks
• Issues of concern on frameworks
  o Transparency, clarity and limited guidance
  o Classification, philosophical grounding, ethical aspects
• Issues of agreement on frameworks
  o Realist review for specific questions
  o EPPI-Center less complex, easier to apply and understand than realist
  o Online website and resources useful for realist
• Feedback on rating
  o Need for more information on information on rating process
  o Concern about assigning scores for certain aspects
  o Clarity on intended purpose of rubric
  o Clarity on terminology, concepts and items, and language on rubric
  o Need for inter-rater reliability
	Developing field
	Gap between theory and practice
	Debates from primary research and traditional review processes

Section 4: The Developed Framework • Basic systematic review steps ground MMRS processes • Purpose, goals, and processes for frameworks • Clarity in language, concepts and terminology • Use common language (see PRISMA) • Challenges implementing certain steps and processes • Importance of quality evaluation and integration • More clarity, specificity, and guidance useful for application • Diversity in suggestions, beliefs, and perspectives	Issues from other reviews and primary studies Developing field
Section 5: Other Issues • Classification of MMRS frameworks---Realist • Purpose, context, and use of frameworks • Effect of debates from primary research and traditional review types • Translating theory to practice	Developing field

The five sections were: general characteristics, issues pertinent to MMRS and MMRS frameworks, the two prevalent frameworks (researcher ratings and weaknesses and strengths), the researcher developed framework, and other issues. The findings from the interview results are summarized for each of the five sections identified above. A general discussion of overall findings for the expert review where emergent themes are discussed concludes this section. Emergent themes are later discussed, leading to the revised CRS framework and the conclusions for this section.

General Characteristics. This section summarizes responses from five interview questions (1, 2, 3, 6, & 8). The questions; "How many years have you been working/did you work in the field?", "On a scale of 0 to 4, with '0' being no experience and '4' being high experience, how would you rate your experience with the following concepts on…", "What methodological orientation/s do you primarily ascribe to?", "What mixed methods research synthesis frameworks are you most familiar with?", and "Have you used in your research the realist review framework and/or the EPPI-Center framework…" respectively informed this theme. See the full items in Appendix B.

Summary of the Results for 'General Characteristics. This summary is focused on participant information including their backgrounds pertaining to general research, the MMRS field, MMRS frameworks, and professional affiliations. This information contextually situates the results of the expert review process. The results are discussed per participant followed by an overview of the findings. These results are summarized in Appendix E and Table 1.

The *first* participant is an expert in realist synthesis and evaluation with a background in the medical field. He works as a general practitioner in London, United Kingdom. He works with the evidence synthesis of complex health and social interventions primarily using realist reviews. He has been engaged in the field of reviews for 10 years. He claims average theoretical and practical experience in qualitative synthesis, moderate theoretical and average empirical experience with quantitative synthesis, and average theoretical and empirical experience with mixed methods research synthesis. The participant emphasized having high theoretical and empirical experience with realist reviews which he strongly argues should not be classified under MMRS frameworks. With regards to his position on the classification of realist reviews, he argued, "… I wouldn't necessarily say that realist review is a form of mixed methods review, it's a form of theory driven review which its ultimate product is a theory or theories, which isn't necessarily the case for other forms of reviews." The participant was mainly familiar with the realist review approach and its variants, citing Pawson's (2006) five step approach. Sharing his perspective about frameworks in general, he added,

"So that would be the framework, if you want to call it that, the sort of… it's not a cookbook. I mean, he's very clear about the fact it's not a cookbook, because actually this is a sort of a very intellectual type exercise. It's a journey of curious discovery… It's systematic in the sense that…it has a series of processes which are open and amenable to adaptation…"

He had conducted up to 20 realist reviews in practice but despite having knowledge of the EPPI-Center review, he had not used it in practice.

The *second* participant, a key figure in the MMRS field, works with the EPPI-Center in London, United Kingdom. Having participated in pioneering works on MMRS frameworks, he argues that the center does not have a specific framework label as is referenced in the literature. Despite encountering the label '*EPPI-Center review,* in the literature, he discredits its use because the frameworks used by their team are dynamic and emergent as they consider numerous issues of value to the review, focusing on the needs of the review users. He cited the approach discussed in Chapter 8 in the second edition of the book, '*An Introduction to Systematic Reviews'* (Gough et al., 2017) to illustrate improvements on the approach contrary to the version referenced in the expert review process (Thomas et al., 2004).

This participant is largely involved in debates in the MMRS field and has 16 years of experience with systematic reviews. His work focuses on qualitative and mixed methods reviews. Despite their work being focused on health the participant engages in systematic reviews across diverse policy areas. The participant adamantly stated he was against methodological orientation classifications, as they are losing meaning in contemporary research contexts. When questioned about methodological orientation, he claimed to have a quantitative background, and works with network meta-analysis. He acknowledged having strong experience across the three methodological classes with moderate theoretical and high empirical experience across all three. He was familiar with both the realist and EPPI-Center review approaches, and has used both in practice, though he has used the EPPI-Center more than the realist approach. For the frameworks he is most familiar with, in addition to the realist and EPPI-Center approach, he

mentioned critical interpretive synthesis (Dixon-Woods et. Al., 2006), the matrix approach (van Grootel et. al., 2017), and Sandelowski and colleagues' (2006) approach.

The *third* participant, a practitioner and evaluator, works at the German Institute for Developmental Evaluation (DEval) which focuses on evidence-based evaluations and related work. His work is centered on "cutting-edge" evaluation designs in the context of complex evaluation projects. He has worked in the review field for the last 3 to 4 years, concentrating on mixed methods designs and evaluation. He has been engaged in meta-evaluation on sustainability over the last 2 to 3 years utilizing qualitative or mixed methods approaches. Despite having a quantitative background, he is recently transitioning to mixed methods approaches which he considers more meaningful to his work. He primarily identifies with mixed methods research evaluation designs. He has moderate theoretical and average empirical experience with qualitative and quantitative synthesis, but average theoretical and empirical experience for mixed methods research synthesis. He is less familiar with the realist and EPPI-Center review approaches but notes similarities in the realist framework to the realist evaluation approach. In his words,

"…I mean not really about the synthesis frameworks or the review frameworks, but the realist framework is very close to how we would actually follow what we call a realist evaluation approach and so… I have no experience with a review approach, but I can understand it a little bit when I read it".

He states that he and his team design their own meta-evaluation frameworks while borrowing from those used in different organizations such as USAID and the World Bank. He further notes that a large number of mixed methods review designs in the

evaluation community are not always known to the social science research community and vice versa. He cited a recently published meta-evaluation project (Noltze et al., 2018) with references from frameworks that informed it.

The *fourth* participant is a recent graduate whose dissertation focused on developing an MMRS approach, specifically utilizing qualitative comparative analysis (QCA) methods for integration. He has a social science and evaluation background but was in the industry as a practitioner before his doctoral studies. He has worked in the mixed methods research synthesis field since 2013, a period of about 6 years. He has high theoretical experience across qualitative, quantitative, and mixed methods research synthesis. On the other hand, he has moderate practical experience on both qualitative and quantitative synthesis, but high practical experience on mixed methods research synthesis. He primarily aligns his research with mixed methods but cites a pragmatic view, preferring not to affiliate with any methodological camp. He is familiar with both realist and EPPI-Center review approaches but has only utilized them theoretically to inform the metamodeling approach. He believes the realist approach, has a long history in evaluation. He further notes that he has encountered other approaches at conferences that are less familiar in research like the meta-modelling approach.

The *fifth* participant is also a recent graduate whose research and studies focused on mixed methods research synthesis. She is based in the United Kingdom, working with the EPPI-Center, but completed her studies in Canada. Currently working in a non-academic setting, she notes that she has about 5 years' experience in the field. She primarily affiliates with mixed methods noting that she has more theoretical than

practical experience across the three research synthesis paradigms, with the least experience in quantitative synthesis. Specifically, she has moderate theoretical but average practical qualitative synthesis experience, average theoretical but minimum practical quantitative experience, and high theoretical but moderate practical mixed methods synthesis experience. The participant is most familiar with the EPPI-Center, realist, and JBI review approaches as well as the QESISAES review approach which she collaborated on for the development. She disputes the classification of the realist review as a mixed method review approach. Despite being familiar with the EPPI-Center and realist review approaches, she has not used either in practice.

The *sixth* participant is a key figure in research and evaluation, specifically invested in transformative evaluation. She currently works as a consultant after retiring from the academy. In a recent publication, she acknowledges the value of mixed methods research synthesis, which she refers to as 'mixed methods systematic reviews', as a useful and valuable development for transformative evaluation. She further proposes a mixed methods research synthesis framework rooted within transformative views. She holds 35 years of experience in research and evaluation, particularly emphasizing her seminal work in transformative evaluation. She has long appreciated the value of reviews and is receptive towards the development of MMRS reviews but cautions against the lack of "user focus" across MMRS frameworks. She has high theoretical and empirical experience across qualitative, quantitative, and mixed methods research synthesis and primarily ascribes to transformative mixed methods approaches. She is mainly familiar with transformative mixed methods research synthesis approaches discussed in her

publication despite having knowledge of others and has not applied either the EPPI-Center or the realist review frameworks in her work.

The *seventh* participant is an experienced researcher and practitioner working with the Joanna Briggs Institute (JBI), a world-wide leading organization focused on evidence-based research located in Australia. Having worked with JBI for over 16 years, the participant mentioned extensive experience across quantitative and qualitative synthesis, acknowledging transition towards mixed methods research synthesis over the past four years. Despite having a strong quantitative background, the participant considers her experience with qualitative synthesis to be average theoretically and empirically, but that for quantitative and mixed methods synthesis to be moderate across the two domains. Moreover, the participant is familiar with several MMRS frameworks including the JBI, Sandelowski and colleagues' (2006), Pluye's and Hong's (2014), and Heyvaert and Colleagues'' (2017) approaches. The participant and her colleagues have used these frameworks along with guidelines from the Campbell collaboration group to theoretically inform improvements to the JBI approach, with a new version just recently availed on their website (Jordan et al., 2019). Despite this extensive knowledge of various MMRS frameworks, the participant admits to not have used any in practice including the one developed together with her JBI team. She further states that they anticipate emergent lessons that might inform the theoretical frameworks given known differences when applying theoretical frameworks in practice. She reinforces the importance of going beyond the theoretical models and testing them in practice.

Overview of Findings for 'General Characteristics.' The views of the seven experts differed across observed aspects. These differences influenced participant responses in relation to their familiarity with the MMRS field, and their knowledge and perspectives on important issues. For example, participants with more experience in the field had stronger views about practices and beliefs while those with less experience were more pragmatic. Familiarity did not always align with experience and methodological orientation. Some of the participants with more experience in the MMR or MMRS field were not always familiar with certain aspects and concepts. For example, the two participants who were recent graduates with primarily theoretical knowledge were more informed on ongoing debates and developments in the MMRS field such as design issues than the more seasoned participants.

It was also clear that knowledge gaps persist in the MMRS field akin to other areas of research per the participants' characteristics and statements. In general, participants had more theoretical knowledge than practical knowledge in MMR and MMRS fields. One participant, who was more practitioner oriented lacked basic theoretical knowledge. Additionally, two participants had strong views about specific review approaches. While one participant favored realist reviews, the other favored the transformative approach to MMRS reviews. These strong beliefs highlight critical rifts in conceptualizing MMRS practices and framework classifications. It also emerged that there are ongoing debates about the classification of realist reviews under MMRS frameworks--an issue that was not evident in the literature before the expert review process. Differences in knowledge were also evident in participant discussions. One of

the participants, a seasoned review researcher, when defining MMRS frameworks and synthesis approaches, listed the matrix approach as one of the frameworks. In the literature, the matrix approach is identified as an integration technique (Mertens, 2018; Thomas et al., 2004). These observations of variability in experience, knowledge, backgrounds, and areas of professional specializations across participants reinforced the idea of a developing field.

Discussions associated with these issues in later sections provided additional context as the participants delved deeper into the interview questions. The 'general characteristics' laid some background and provided context for understanding the "how's" and "why's" for some of the participants' responses hence informing developing themes and discussions.

Issues Pertinent to MMRS and MMRS Frameworks. This section addressed three interview questions (4, 5, & 7), namely; "From your point of view, what are the steps for designing a Mixed Methods Research Synthesis (MMRS) study?", "In mixed methods, the type of design is very important for integration. How would you address design in the context of MMRS?", and "From your perspective, what critical issues need to be considered when conducting an MMRS study…" This section directly spoke to the research questions to build on earlier findings in this study regarding the MMRS field and MMRS frameworks in general. Understanding the participants' beliefs and views about key aspects in the field and on MMRS frameworks informs the main purpose for this dissertation, the researcher developed framework. Given the nature of these questions, a summary of the results for each participant is presented for each item followed by a

general overview of the findings. Table 2, Appendix E summarizes the participant responses for the items in this section.

A Summary of Results for Item 4. This item addressed the steps for implementing MMRS studies. The *first* participant grounded his answers within the context of [9]realist reviews stating,

"…Literally, I would just follow the one that is set out in Pawson's book 'evidence-based policy: a realist perspective.' I mean, it's got something like five steps in it. There is elaboration of those five steps, but in effect, you need to kind of do the obvious type of things".

He proceeded to name several steps he believed were necessary for a realist review, including developing a research question with the objective of answering it using a realist review, focusing the research question, evaluating the content expertise of the review team, developing a program theory, and searching for data formally rather than informally. He emphasized the importance of the research question in directing the realist review agenda noting, "… In this case, the objective is to answer it (the research question) using a realist review… they have to be of a particular type of research question otherwise you wouldn't bother to do a realist review..." Despite this, he listed practices he considered necessary for any review, asserting: "…there is the usual sort of boring stuff that everyone does for reviews…" before continuing to list and discuss them. These included sifting through the data, database searching including backward and forward

[9] Despite the participant's claim to not consider realist review as an MMRS framework, their responses are analyzed in the context of MMRS reviews in line with the classification from literature. The debates on whether to classify the realist review approach under MMRS frameworks if discussed later in the findings and conclusions with implications for the field and further research on the topic.

citation tracking, ensuring the search is purposive, setting inclusion/exclusion criteria with emphasis on the need for a good librarian, retrieving and scanning the full texts, making decisions on the relevance and sufficiency for each source by considering rigor with a specific focus on its ability to inform program theory, going through the data to refine program theory 'authoritatively,' and progressively refocusing the question as needed based on what is available. He finally suggested concluding the review with some recommendations that are 'realist' in nature.

The *second* participant was intentional in clarifying his stance on mixed methods and the MMRS. Basing his response on his work to inform government policy, he stated,

"…It's interesting because… I've got papers where I've written about mixed methods… the mixed methods literature is very keen on this division between qualitative and quantitative which I am not so, Interested in. And in a way, you know, we've done a recent sort of retrospective look at our reviews and you know, really what we think we do are multi component reviews… I don't think of mixed methods in the same way as the traditional mixed methods literature..."

In terms of the question, he considers three steps necessary prior to the review. He recommended defining the problem to inform policy in light of consultations with policy makers before beginning the review process, a step he considers crucial, stating, "… if we've got quite a strong underpinning principle of the way that we do these reviews voices of people who are affected by it too are sometimes sort of ignored in terms of research processes and decision making." He further explained that the first step would involve examining the research question and problem at hand to understand the intended

use of the evidence sought. Following this step, it is neccessary to contemplate the types of evidence that would best answer the question of interest. In his view, the decision about the type of review is retrospective to the type/s of evidence considered. As he stated, “At that point, we might say to ourselves, oh; we've got something that looks like a mixed methods research study here. But that's a source of the outcome of that process at the beginning.” In summary he noted that it is important to start with the problem, develop the research question, and then determine the evidence that would best inform the research question. In this way, one should not begin with a set review approach in mind, rather the approach should be dictated by the problem and question at hand.

He further notes that after deciding on the approach, assuming it is an MMRS study, it is pertinent to deliberate on the value added by bringing together evidence from the various sources to inform the overall research question, stating,

“…is sort of think up front about the way in which the different types of evidence are going to answer our question… what value is added by bringing them together … What work is done by that deliberate juxtaposition or integration of different types of research perspectives... different types of evidence.”

This comment stresses the centrality of integration for MMRS studies. This participant considers the issues above important to set the stage for other steps universally akin to systematic reviews such as drafting necessary protocols before engaging in an MMRS study which he prefers to call ‘multicomponent review’.

The *third* participant answered this question, reflecting on a recent meta-evaluation project he had worked on with an evaluation synthesis design. He noted

several things that would be important in the first step. The first issue would be clarifying the research/evaluation background by thinking about the evaluation or research object, the context of the evaluand, the goal of the study, and the leading questions of interest. The second issue would involve identification of the area of interest for the synthesis study while specifying the focus. Specifically, the team would need to decide on whether to primarily include causal or non-casual research questions depending on focus of interest (causal/non-causal). The third issue would consider the relevance of the intervention.

The second step would encompass establishing the theory behind the area of interest by being clear about the generic theory of change and the main mechanism behind it. To explain what he meant by mechanism he stated, "…with mechanisms I mean the ways or the assumptions behind the different outcome hierarchies. So, the way you can come from A to B and not only being explicit about A and B, but also being explicit about the way A leads to B…" As an afterthought, he felt that being clear about the theory behind the evaluation object, in this case the mixed methods research design, could be another step. He argued that this step would inform the reviewer of potential mixed methods designs within the databases to be searched or sample selected thus enlightening the search strategy. Apparently, one would anticipate some analysis approaches that would best accommodate studies with given mixed methods research designs.

The participant believes the third step, defining the inclusion/exclusion criteria, is informed by previous steps. This is then followed by the actual searching for the data,

then appraising the quality of the selected sample. He noted that he would recommend having separate quality assessment criteria for the different sets of evidence (qualitative, quantitative, and mixed methods) to closely examine for example, how data were triangulated, the methods, and research perspectives among other things. He further explained that in evaluation, the quality appraisal process is referred to as 'meta-evaluation' (the evaluation of evaluations). The participant was specific with the fifth step where he would choose thematic synthesis to synthesize the findings. The subsequent step would involve a follow-up thematic data analysis with the quality assessment where the evidence is weighted based on the quality evaluation process results earlier on. The final step would then be writing of the report.

The *fourth* participant stated that the first couple of steps would be identical to those in traditional systematic reviews. In his view, the first step would include clarifying the scope of the study, considering several issues. These issues could include carefully formulating the research questions, and maybe implementing a scoping review to understand the extant literature on the program of interest and outcomes that might be relevant. In practice, the participant stated that he uses the PICO (Population, Intervention, Context, and Outcome) framework (Higgins & Green, 2008). The second step, which the participant likened to traditional reviews, would be coming up with a search strategy by defining some relevance criteria. The actual search for evidence would follow though the participant wasn't sure whether to have this as a separate step or not stating, "…I don't know if that would be a separate step or it would be the same step… Usually in classic literature it says that is one step, I think in practical terms in my

experience it involves some back and forth." Next would be screening involving at least two rounds of the titles, abstracts, and then introductions before delving deeper to determine the most relevant studies. In the context of MMRS, this step would also include some sorting for the different types of studies (i.e., qualitative, quantitative, or mixed methods) involved. The synthesis steps would then follow depending on the design of choice (e.g., parallel, sequential). The participant preferred sequential steps where one would first synthesize one type of evidence (e.g., qualitative) before the other. Personally, he preferred starting with qualitative which he believes allows one to create hypotheses about how and why the program works before going onto the quantitative strand to determine the outcome patterns. He would then move onto integration of the findings before concluding the study with reporting.

The *fifth* participant reiterated the previous participant's view that an MMRS study is a systematic review and thus it would involve basic systematic review steps. Specifically, she stated that, for the first step, one would define the review question, then the criteria for study inclusion, before developing a search strategy to find studies. She noted for the search process, one had to decide on where to search, then search for the sources, before embarking on screening of the titles followed by the abstracts then the selection of the full texts. Quality appraisal would follow, then synthesis and interpretation. Clarifying her stance, she stated that while these steps conclude a systematic review; an MMRS study differed by considering other sources of evidence besides randomized controlled trials (RCT) for evidence.

The *sixth* participant succinctly discussed a recent approach aligning with transformative perspectives (Mertens, 2018). This approach illuminates the inclusion of users of the review findings in the study with the purpose of better meeting their needs. Six steps are discussed on the referenced pages. The first step is defining the questions to be investigated with consideration for marginalized populations, bearing in mind existing barriers and facilitators. The second step involves designing the protocol such that it reflects issues of importance to the marginalized populations. Next, expand the search to consider information of relevance and especially of cultural or contextual nature, not usually found in sources normally considered for traditional reviews, based on consultations with community members. The fourth step comprises expanding the analysis by employing strategies besides those used in quantitative meta-analysis studies for the existent data. Next, contemplate an appropriate integration technique such as the matrix approach. Finally, develop appropriate mechanisms for disseminating the results of the study to different stakeholders and members of the community.

The *seventh* participant mentioned steps she viewed as obvious for an MMRS study and for any systematic review. These included developing a clear review question and objective, an inclusion/exclusion criterion, a search to locate all potential relevant studies or papers, critical appraisal of the methodological quality of selected studies/ sources leading to the extraction, analysis, and synthesis before finalizing with the presentation and interpretation of the results. The participant stated that because of the complexities associated with MMRS reviews, reviewers should be more concerned with the extraction, synthesis, and integration phases.

Overview of Findings for Item 4. Interviewees approached this question from different perspectives with respect to the underlying assumptions and beliefs guiding their responses. Two participants answered this question within the context of specific review approaches in mind. One participant placed their responses within the context of realist reviews, citing a specific framework for and emphasizing steps unique to this approach. The second participant, maintained a transformative perspective stance citing the framework by Meterns (2018) which emphasizes the inclusion of the voices of the 'users' of the review results and particularly those directly impacted by the program/ intervention of interest. One participant reinforced the importance of allowing the problem and research questions to guide the decision on the type of review to engage in before considering steps for MMRS reviews. Three participants did not outright acknowledge a specific approach, but in their discussion it was apparent that they were assuming the implementation of an MMRS review. The final participant, while not insinuating a specific approach, assumed the application of an MMRS approach though the steps he discussed in many ways mirrored practices emphasized by the first participant as applicable to realist reviews.

Similarly, each participant highlighted unique aspects they considered relevant for MMRS reviews though there were obvious similarities in what was considered basic steps for any systematic review and for MMRS studies. These were things that the participants felt should be done for any review regardless of the type. These included developing a research question, searching, setting inclusion/exclusion criteria, retrieving and scanning the sources, quality appraisal, analysis, and reporting. The participants

discussed these steps in different ways with some separating some of the processes and others merging them under one step. For example, one participant in identifying the first step 'define the scope of the study' listed three things; describe and formulate research question, and maybe conduct a scoping review and further listed defining the relevance criteria (or inclusion/exclusion criteria) under the second step, 'come up with a search strategy.' Another participant listed the first three steps as; define the review question, define eligibility criteria, and develop a search strategy. Some of the participants provided more details on the actual processes for each step while other were less explicit; for example, one participant proposed using the PICO framework (Higgins & Green, 2008) for the first step, define the scope of the study, and using a sequential approach specifically starting with the qualitative before the quantitative evidence for synthesis. Similarly, one participant reinforced the need to ensure the research question is intended for a realist review at the start, while two others highlighted the importance of stakeholder involvement in defining the problem and hence research questions.

In terms of differences in the steps outlined by the participants, most issues were not subtle, while some were either confounded within other steps or assumed obvious by some participants and thus not mentioned or discussed in detail. Examples of these steps included integration, synthesis, and drafting the protocol. Clear differences emerged across steps and processes that participants stated were for specific approaches. For example, the first participant provided examples of things unique to review steps in order to meet the standards for realist reviews such as the review question and the importance of theory development. Notably, there were many similarities in the steps identified by

the participant with meta-evaluation experience and evaluation background to those of the realist review such as in focusing the research question and the role of theory in shaping the review. On a different note, some steps were exclusively mentioned as important for MMRS reviews by some participants but not by others. For example, three participants mentioned integration as a separate step, while four participants exclusively presented synthesis as a separate step. Other participants did not touch on these steps though they are considered crucial for MMRS studies in the literature. Additionally, certain steps were highlighted by different participants and not touched on by others. These steps included sorting which one participant believed was an additional process for MMRS reviews given diversity in evidence, another participant touched on the necessity to evaluate the review team's expertise at the beginning of the study despite focusing on realist reviews, while another considered extraction a separate step. Interestingly, the term 'analysis' was only used by two participants when listing the steps, with one of the participants further citing the matrix approach as one of the analysis strategies beyond quantitative analysis approaches. While the context of citing the matrix approach is arguably correct, in the MMRS literature, the matrix approach is classified as an integration technique (van Grootel et al., 2017).

Overall, there were evident differences in beliefs informing the participants' diverse stances on processes, differences in the approaches taken for similar steps, and positions taken regarding ideal MMRS review practices. Moreover, issues of classification and terminology were persistent across most of the participants' responses when discussing the MMRS steps. For example, there is less clarity on the process of

integration and synthesis. It appears the purpose and context of the reviews play a major role in determining the processes to be undertaken. Moreover, diversity in professional backgrounds is a key factor. These issues reinforce the need for more focused discussions on the processes of MMRS studies as a complex application of systematic reviews.

Summary of Results for Item 5. This item addressed the issue of design in MMRS studies. Like item 4, the results are summarized per participant, before an overview of findings across the seven participants is presented. The *first* interviewee, taking a realist perspective, emphasized the importance of having an ontological stance to inform the epistemological claims and methodological practices. In his view, the study would be meaningless otherwise. He was not familiar with the use of other terms such as segregated and contingent for design in the context of MMRS studies.

The *second* interviewee, building on discussions from the previous question, discussed design in MMRS studies within the context of the review process, clarifying that the decision on design should be emergent and dependent upon the views of the users of the results of the study. On this note, he argued,

"…as I mentioned before… if we're thinking about ensuring that the perspectives of the people who are affected by the intervention are given a priority…in one review, what that might mean, is that we prioritize the outcomes that particular groups of people talk about. We might get those perspectives in, by going and talking to people and having that sort of engagement with people or… in this context what we're doing is we're bringing that perspective in through research…. Through what Might be called qualitative research that is with interviews and focus groups".

He argued that after consulting with or interviewing users about a review study, it might be more meaningful to prioritize certain outcomes. This will impact the decision about which design best meets the need. In this case, an 'empirically grounded conceptual framework' is established to guide the other parts of the review. In practice, the interviewee suggested using this stage of the review to develop things like logic models, theories of change, and causal pathways to later ground quantitative studies.

The *third* interviewee, who admitted in a follow-up question that he was not familiar with established MMRS designs, answered this question based on his practice and experience with meta-evaluation. In this case, he suggested examining design across the selected sample of studies to determine how they impact the review results. He first suggested subgroup analysis, where primary mixed method studies in the sample would be classified per design such as sequential or nested to determine whether there are differences in findings, for example. He also suggested considering a full sample analysis and controlling for different design across primary studies. He anticipated differences in conclusions based on the study design. In a follow-up question regarding his understanding of existing designs in the MMRS literature he explained,

"…I have to say that I'm actually not so familiar with established designs. We build our own synthesis framework for our recent meta-evaluation, but I think there we were influenced by more meta-evaluation designs. There's also a range of designs available which come more from the side of the evaluation community which is sometimes a little bit separated from Social Science Research on… I don't have much experience."

The *fourth* interviewee favored the EPPI-Center approach and answered this question in that context. He explained that he preferred carrying out separate syntheses for the qualitative and quantitative studies. Furthermore, he preferred the sequential design with the qualitative synthesis preceding the quantitative one arguing, "I would emphasize the quantitative synthesis follow the qualitative because I believe it is important that you do not use the same data for both generating hypotheses and testing them." He believed that in this way, one can first generate hypotheses then test them with the subsequent set of data (in this case the quantitative studies). Defending this stance, he shared an example of using fidelity and implementation studies in his work stating, "For the qualitative studies… component of course when we talk about what that would look like. I tend to focus on implementation studies, fidelity studies. So, studies that are really good on identifying the critical ingredients of interest." He believed such an approach would better isolate valuable components of interest and allow for one to better postulate some claims about the program/intervention that would inform the quantitative synthesis step. In his view, the subsequent synthesis would be a 'classic meta-analysis' providing unbiased effect estimates for the outcomes that would be followed by integration.

The *fifth* interviewee first requested clarification on the definition of design to ensure it aligned with her understanding. She acknowledged the importance of design not only for MMRS reviews but for guiding research stating, "… design is important because it will help you… Like in research, any, type of research, designs are there to guide you into how to present and how to conduct your review." For MMRS reviews, she reinforced the challenge of including diverse evidence sources leading to the important step of

integration to legitimize the application. Citing Sandelowski and colleagues' (2006) work, she explained, "Also, the designs are there to guide you into how the integration could be done. So Sandelowski suggests like the three different types… if you go to one of them, you can gauge what question you can ask, how to present, how to conduct…. I think that design is very important." She further highlighted differences and diversity in MMRS designs by discussing her work (Pluye & Hong, 2014) proposing two approaches (convergent and sequential) that are grounded in the mixed methods research literature as basic MMRS approaches and acknowledging the existence of more complex ones. She further clarified her stance on existing designs, affirming, "… there's not one design that is better than the other, it depends on your question."

The *sixth* participant reinforced her earlier stance on the transformative approach to MMRS reviews. She was critical of other approaches, specifically singling out the segregated approach which separately synthesizes the qualitative and quantitative evidence before integration stating, "… by segregated if you mean quan and quant stay separated and by integrated they come together, then it's not really mixed methods if you segregate." Restating her stance on transformative mixed methods design, she reinforced the need to engage with populations impacted by the intervention/ program throughout the review process. She explained, "...I wouldn't do any of those… I would do a transformative mixed methods design. That would mean that I would be engaging with populations throughout the study and using input from the various populations to inform next steps. So, I think it's a different design…"

The *seventh* interviewee cited the recently revised JBI approach, which she claimed considered the integrated and segregated MMRS approaches and was strongly informed by the works of Sandelowski and colleagues' (2006) as well as Pluye and Hong's (2014). Reinforcing an opinion by another participant, she emphasized that the research question should inform the decision on design. She explained "…what I am trying to say is it really relates back to the nature of the question and what the question is trying to answer."

Overview of Findings for Item 5. Overall, the participants indicated in their responses that design is important in MMRS studies. The responses varied in terms of what was considered meaningful in either informing the process of, or decision on design. Furthermore, reflecting on the participants' backgrounds, it was clear that the responses from those with more theoretical knowledge had more in common than those with more practical knowledge. Two participants chose to focus their responses on specific designs, realist and transformative though from their conversations, it was evident they had some knowledge of other MMRS designs. A third participant had limited knowledge of MMRS designs and primarily answered this question considering design in the sample of selected primary studies for the review.

The participants offered diverse perspectives on design and its significance in MMRS studies. One participant believed that differences in design among selected primary mixed methods studies for an MMRS study would impact the results and findings. A second participant stressed the importance of taking a theoretical stance (ontologically and epistemologically) to direct the stages of the review, specifically

singling out realist reviews. Two participants considered design an emergent aspect of the review. One advanced the need to engage users in the initial stages leading to the research question and selection of evidence, before deciding on the suitability of an MMRS approach then the design. The other participant reinforced the need to include the perspectives of users throughout the review process. One participant was more specific about the approach he would use (the EPPI-Center) and the design. He preferred the segregated sequential approach beginning with the synthesis of qualitative evidence before the quantitative, followed by integration. The responses for the other two participants were more theoretical in nature with more weight being given to the decisions made by the researcher. These participants did not mention the consideration of views of stakeholders. They both considered the research question and type of evidence crucial to informing the decision on design for MMRS studies. One of these participants further singled out the inclusion of diverse evidence sources and integration as critical factors in determining suitable MMRS designs. They valued the consideration for theoretically established designs. The other participant preferred the integrated and segregated MMRS designs based on her theoretical knowledge of MMRS designs.

In summary, differences in opinion and preferences signify ongoing debates and developments. These dissimilarities apply to opinions influenced by theoretical and practical issues, as well as methodological decisions and inclinations. Furthermore, there is evidence of a persistent gap in research and practice based on knowledge across the participants about MMRS studies given their professional orientations (practitioner/ researcher and practitioner) and context of their work. For example, the two participants

engaged in policy-oriented work were keener on engaging the people impacted by the intervention/program in question in the review process.

Summary of Results for Item 7. This item spoke to issues relevant to MMRS studies given the diversity in evidence sources. The question asked participants to provide responses considering the three synthesis components (qualitative, quantitative, and mixed methods) for an MMRS study. Like the earlier two items, the results are presented for each participant followed by an overview of the findings.

The *first* interviewee answered this question, reinforcing his focus on realist reviews, by stating, "...I mean, it will only be about realist reviews. I don't really use any other approaches. So, I can't really talk about anything else…I wouldn't feel either comfortable or wish to make any claims that I know about anybody else's ways of doing things." He proceeded to cite the REMESIS project and the quality, reporting, and publication standards as well as training materials provided on the website as important guides for a review. He further referred to an eight-item quality checklist for ensuring the review follows recommended steps. Some of the things addressed include asking a relevant question, using the appropriate logic of analysis, employing reasonable search strategies, and ensuring reporting is specific to the assumptions and review approach taken. In conclusion, he noted the big difference between having a theoretical framework and using it. This sentiment highlights the continuous challenge of translating theoretical knowledge into practice for the field. He explained this observation, stating,

"So that's been fairly, well, as clear as one can be with these things set out. I think there's a big difference between having a series of frameworks and then actually being

able to do them. Because I think that the unit... one is a bad experience and the other is about a… theoretical knowledge."

The *second* interviewee identified two key issues necessary for an MMRS review given the three synthesis strands: the objective of the study and the theory behind it. For the objective, the reviewer should always reflect on the goal and purpose of the study throughout the process. Secondly, the review should stay true to the theory behind it. Specifically, one should understand the intended goal for the review in relation to the question/s to be answered. For example, whether a causal relationship exists or not. To further elaborate he explained,

"…understanding of…if there's a causal relationship in there you know, what is it really and that kind of thing. And you can get that from the more qualitative literature, and so you can sometimes publish that as a standalone piece of work which you can then take to the quantitative".

This sentiment favors the segregated sequential design (Sandelowski et al., 2006). Despite this, he cautioned that reviewers need to always stay true to the motivation for an MMRS study (i.e., the qualitative and quantitative strands should inform each other), reinforcing the centrality of the process of integration for MMRS studies by explaining,

"The whole point of doing the mixed methods is so one informs the other. So, if I critic this… it's the fact that it is a mixed methods study and there's no point in pretending that they're… two different bodies of evidence. But you've got an overarching research question that you need to use them to answer".

The *third* interviewee responded to this question citing the realist evaluation approach and considering a recent meta-evaluation project he had worked on. He noted the need for researchers to be wary of variability within the standard categories for design in primary studies across the three components, stating,

"…the components, the qualitative, quantitative, and mixed method components, they have to be quite flexible because there is actually a huge range of variation between or within these components for all three of them. So, I mean, there are the standard designs the studies follow, but they are always adapted to the context, to research questions, to Logistical backgrounds of the studies and so on".

Reinforcing an earlier comment, he reiterated the value of understanding the theoretical background and purpose of the study (causal/non-causal nature). Explaining this position, he clarified,

"…it's very essential to distinguish between what I said in the beginning, the causal and non-causal focus of the observations, so the primary research…there are huge differences in the components, when it comes to causal questions or to non-causal interests of the study…most of the time we're interested in causality, when we think it will work with our evaluations…when it comes to the causal focus the components have to be… explicit probably about whether what the analysis is focusing on was in case analysis. So, meaning having case study approach where you are mostly interested in your internal validity and you work mostly with qualitative methods and having internal valid conclusions later on, compared to cross case analysis where you have a comparison of different observations on specific objectives and usually the aim is to have external

validity. And I think oftentimes it's not so clearly distinguished between the two concepts and I see this especially in the mixed method community."

Referring to the political science community and the work of Gary Goertz, he noted the failure by the mixed methods community to concisely address causality in their designs.

The *fourth* interviewee considered the individual synthesis components and how they relate to the overall MMRS study. Starting with quality appraisal, he noted its significance for MMRS reviews and highlighted persistent challenges in the process, while calling for more caution due to existence of many frameworks across different types of evidence with less guidance on which to use and when. Starting with the qualitative synthesis component he mentioned the need for clarity on quality appraisal due to diversity in existing designs and how to design a framework for collectively assessing their rigor. Moreover, it is more challenging to decide on the information to extract from qualitative primary studies. While extraction is much clearer for quantitative synthesis, he noted that this is an ongoing discussion for qualitative synthesis. To explain this concern, he stated,

"If you look at the quantitative synthesis component, it is usually pre-given in the sense that when you are doing meta-analysis, you know exactly what you need. You need the types of information from the study that will allow you to calculate Cohen's D…But with your qualitative studies, what is it that you are looking at? Are you looking at any testimonies by participants in the program, are you looking at the final concluding remarks summarized by the authors of the article? It is much more difficult to figure out

what is it that you are extracting and how do you do that. Do you use specific analytical strategies? I use causation coding, but there are many many other coding strategies that you could use. So that's a much bigger question in qualitative synthesis components."

With this sentiment the interviewee highlighted concerns about challenges with extracting information from qualitative studies, selecting appropriate coding strategies and settling on the information to extract from the studies. He further stated that debate continues regarding focusing on only studies with specific designs in a given review versus consideration of all available evidence.

For the quantitative synthesis component, the existence of only a few studies on a given project is a persistent concern. Addressing variability across limited numbers of studies as is the case for meta-analysis remains a shortcoming, necessitating alternative review approaches. This carries over to alternative approaches, thus raising the question of how to best include the quantitative evidence during integration, for example.

Finally, for the mixed methods component, he considered integration a major concern. Alluding to the need for systematic approaches and lack of transparency on the process, he noted the need to clarify what it looks like, the moment of integration, and the analytical strategies applicable, providing examples such as QCA and matrix approaches.

The *fifth* interviewee answered the question considering the three synthesis strands. In discussing the significant issues, she admitted that the challenges encountered for systematic reviews are amplified in the context of MMRS studies, due to the diverse sources of evidence. She addressed five challenges including developing the research question, setting the search strategy, quality appraisal, synthesis design and integration,

and an expansive diversity in terminology. In developing the research question, one must decide separate questions for each strand or an overall research question. This aspect is not clear in the literature. Similarly, for the search strategy, the reviewer should carefully consider an approach to efficiently retrieve applicable sources, by planning on having individual search strategies for the strands or one for the overall topic. Quality appraisal is more challenging and time consuming given the diversity in evidence. Choosing a synthesis approach and linking it to the overall design requires a thoughtful decision. Moreover, integration as a central aspect of the MMRS review should be a major factor in making this decision. Finally, differences in terminology are a major issue for MMRS studies, hampering their utilization due to labels that sometimes do not signify major differences. These differences stem from issues inherent to MMR such as the approaches to mixing different evidence sources. Moreover, there are ongoing debates about the mixing of studies, sources, and evidence within the MMRS community adding to the terminology challenge.

The *sixth* interviewee reiterated the importance of engaging communities through the full range of stakeholders from the beginning stages and in every single stage of the review process. In her view, this is the efficient way to meet the major goal of MMRS reviews--to provide evidence-based results. For example, in developing the research questions, it is critical to understand what and how they are developed by considering perspectives of the community rather than those of the reviewer based on the literature.

The *seventh* interviewee addressed issues specific to the various synthesis strands as well as for MMRS studies overall. She pointed to concerns about reflexivity,

extracting data verbatim, and aligning with the stated approach considering the diligence of reviewers to adhere to these aspects in a given study for qualitative synthesis. She noted that the methodological quality of selected primary studies impacts the review findings and related interpretations. In her view, issues of reflexivity, extraction, and ethics impacted both qualitative and quantitative synthesis alike. For quantitative synthesis, she further noted concerns about interpretation of findings, double data entry, the technique or analysis used, heterogeneity among studies, and inclusion/ exclusion of studies. For mixed methods, she named data extraction and integration as major issues. Specifically, questions regarding the technique of integration, transforming data if applicable, whether to qualitize or quantitize, among other issues call for transparency and require sufficient knowledge to inform the reviewer's decisions (Jordan et al., 2019).

Overview of Findings for Item 7. Participants answered this question in two ways. Five participants collectively reflected on issues impacting the three synthesis components in the context of MMRS studies while the other two reflected on the individual synthesis components, alluding to how some of the issues might impact the general review. Considering the overall perspective, one participant referenced the use of set standards (REMESIS project) to guide the review process to ensure important issues are considered specifically for the realist review. Two participants declared the objective and theory behind the study as crucial factors, with one of them specifically referencing realist evaluation. They both recognized causality as an important aspect for the research question. Despite this collective view on causality, one of them expounded on its value in directing reviews by further identifying the diversity in designs for included primary

mixed methods studies, a factor he believed critical to the review, while the other commented on the ability of the qualitative strand to better direct theory development cautioning against losing track of the central goal for MMRS reviews about the strands informing each other. The fourth participant, addressing the synthesis strands collectively, highlighted the added challenge for implementing review steps in the context of MMRS studies given the diverse sources of evidence that is further complicated by the inconsistent terminology in the field. The fifth participant focused on the overarching need to engage stakeholders in all stages and decisions for the review.

The two participants who addressed the synthesis strands individually highlighted similar critical issues for MMRS studies. They both identified quality appraisal and extraction of data as challenging and critical aspects for the synthesis of qualitative studies. For mixed methods, they both singled out integration as a crucial but challenging aspect due to lack of clarity on the process and techniques. One of them included extraction as a concern for this strand. For quantitative synthesis, one focused on the limitation in the number of studies applicable to a certain topic in meta-analysis, while the other named interpretation, the technique and analysis, double data entry, and heterogeneity as concerns.

Diverse perspectives reinforced the developing nature of the field regarding acceptable practices for MMRS reviews. Moreover, the prevalence of concerns for issues carrying over from traditional reviews such as quality appraisal, terminology, and integration emphasize the need for more caution and for more investment in deciding on and implementing methodological processes given the complexity of MMRS reviews.

The Two 'Most Prevalent' Frameworks. The third section covered the questions on the two most prevalent questions (Items 9 and 10). These questions addressed the strengths and weaknesses of the two frameworks, the realist and the EPPI-Center review frameworks, and feedback sought on their evaluation by the researcher based on the developed rubric. Two items; "In your view, what are the strengths and weaknesses of these frameworks?" and "I provided you with a summary of my ratings for realist review and EPPI-Center frameworks. I would like to get some feedback about my ratings…" were analyzed. The raw responses to these questions are summarized in Table 3, Appendix E.

Summary of Results for "the Two 'Most' Prevalent Frameworks." These questions addressed the two frameworks and are therefore discussed collectively for each participant. The third interviewee did not respond to these two items. Responses for the other six interviewees are presented and then an overview of the findings is provided.

The *first* interviewee mainly provided feedback on the realist review framework. For the strengths and weaknesses, he highlighted the specificity of realist reviews in addressing questions with outcomes that are context sensitive and have complex open systems. These are questions needing a deeper understanding of the context within which an intervention is presented to comprehend its effectiveness or lack thereof. Such understanding goes beyond the simplistic question of whether an intervention or program works or not. To reinforce the deviation of realist reviews from other approaches he was clear that inquiring about the effectiveness of an intervention does not require a realist review. Other approaches such as a meta-analysis would be more meaningful. To

reinforce this argument he contended, "…You would definitely not do a realist review of those particular things. Don't do a realist review to tell you whether drug X is efficacious. It's a complete waste of time!"

On rating the frameworks, to begin with, the interviewee was skeptical about the idea of using a rubric to gauge the strengths and weaknesses of the realist review and especially the process of assigning points to certain features. He made this clear with his opening statement for this question, stating,

"…what you're doing is actually quite a difficult task…maybe for other review processes it's kind of okay because they may or may not have specific ways of trying to do things…I've got the document rubric with descriptions. There's going to be great difficulty in trying to assign points to some things…certainly when you're talking about, for example, something like the realist review…"

Despite this initial view, he proceeded to examine the ratings and provided feedback on various elements on the evaluation of the two prevalent frameworks based on the researcher developed rubric. He thought some things were sensible to assess, but was uncertain about other issues, primarily in the context of realist reviews. He felt that language/terminology, logic and flow, clarity, and procedures were sensible to evaluate and related to transparency. He also agreed with consideration for quality of integrity and structure. On structure, he cautioned about the need to think about the purpose of the review and the possibility for differences in resulting outcomes, stating,

"…to structure, I think that's the easiest bit. Where in effect you just ask people to lay out what they're doing… if review types are going to be coming up with other

theories or explanations, then… whilst you might still follow the structure, you might end up with slightly different interpretations of the data".

He was cynical about the evaluation of quality of design, citing an epistemological challenge given the goal for theory development in realist reviews. Despite acknowledging the value of examining the quality and trustworthiness of the data, he highlighted the need to deliberate on the aspects of theory behind the data and how good they are. He critiqued this as a missing aspect of the rubric in relation to the qualitative, quantitative, and mixed methods components. He then argued for the need to consider the worth of the arguments and the process for assessing the quality of the theories in selected sources. For clarity, he reinforced the need to be explicit about quality assessment for theoretical output stating,

"It's interesting. It's important that people do have supportive arguments, but then they have to tie that to the data and I can see, then why you have quality, but then you then need to move up one further step; how do you judge that something is supportive. Coz ultimately it's an interpretation and it's very much in the eyes of the beholder, hence the need for transparency".

Arguing for supportive arguments as an aspect of integrity, he stressed the need to consider underpinning theories. He cautioned that, in realist reviews, though arguments that best support the theoretical aspects of a phenomenon are valued, the extra step of judging the supportiveness of a given characteristic is subjective, requiring transparency.

The *second* interviewee critiqued both frameworks. Starting with realist reviews, he appreciated the philosophical and conceptual framework grounding the approach,

recognizing the use of scientific realism. He noted existing heterogeneity in present realist reviews but appreciated that the framework is a good 'communication tool 'both conceptually and by embedding the intervention within context. He criticized the framework for lacking clarity in directing the review process and ambiguity on the "relationship between empirical justification for knowledge claim and knowledge claim." Expounding on ambiguity, he identified the challenge of balancing between empiricism and rationalism. To provide more context on this stand he argued,

"…the very process you are digging for nuggets… Where you can get useful findings from bad research… it's quite ambiguous…the underlying message is a much more fluid one in terms of whether or not the research design matters. And the degree to which bias is something which you should worry about. And so, I think that for that reason, I think that's where I find it less useful because…the reviews that we do… is they need to stand up to external critique… there is this notion of you know, you can get the right or the wrong answer depending on how you ask the question or what you do, if you lose part of that, then it becomes much more difficult then to justify empirically"

On the EPPI-Center approach, referencing an improved approach rather than the one utilized for the ratings as discussed earlier, the participant appreciated the first step involving extensive scoping and mapping complemented by consultation with the review users as a major strength. For additional context, he noted that this offers a theoretically grounded framework and allows for the exploration of diversity in finding trials while ensuring the perspectives of those affected by the intervention are considered. Notably, results from trials or interventions could differ based on how one goes about this step.

On the rating of the frameworks, the interviewee was critical of the use of rubrics to judge characteristics of the frameworks in general. He was mostly against aggregating the scores which he argued indicated equal weighting of the various characteristics. He noted difficulty understanding the researcher-assigned scores without additional context informing the decisions. Explaining his reasoning regarding the scoring process and understanding the rating process, he noted the similarity in addressing these challenges when critically appraising primary studies. He also lamented the lack of clarity about the object being rated (i.e., whether it was the review studies, or the approach implemented in them). Specifically addressing the rating for the realist review, he criticized the sampling process mainly on the lack of 'proper' guidance. In his view, he considers this a weakness for the framework given varied and non-justifiable decisions by diverse authors. He discusses this further by explaining,

"… I don't think that you can defend an approach which doesn't have an obviously justifiable basis for making sort of authors do different things…That doesn't mean that purposive sampling and that kind of thing is not good. But if you're making claims that…I've looked at these interventions and they don't work, or they do work. If someone can come along and say, well, you've missed, half of them over here. And you can say, well, you know, I didn't look at those. But that immediately undermines… anything else you got in the review. I think… if you're doing a piece of research, the data that you're working off, you know, the sampling frame however you call it, however you construct it needs to be defensible."

In conclusion he argued that frameworks need to have clear guidance and effective processes to inform the course of the review, stating, “I think you've got to really think through the adequacy of the quality of the guidance and operationalizability. But also sort of what's underpinning it and how that will affect the way in which the review in itself is done and is perceived.”

The *fourth* interviewee provided strengths and weaknesses for both frameworks. For the realist review, he applauded the approach for its theory-based component focused on making sense of mechanisms. On the shortcomings, he listed the lack of clarity and the inclusion of a broad range of evidence. He was cautious that this would make it challenging for integration, which is central to MMRS studies. He was also concerned about the impact of the sequence for introducing evidence to the resulting conclusions. For additional context on this concern, he explained,

“So, you take some set of evidence, iterate an initial hypothesis, and then you keep adding and it seems that the sequence in which you introduce the evidence could potentially influence the outcome that you end up with. And that is an issue. The conclusion shouldn’t be influenced by the sequence with which you introduce the evidence. I am concerned about that.”

For the EPPI-Center approach, he appreciated the structure which he believes is easy to follow, understand, and implement. Specifically, he welcomed the idea to lay out the synthesis strands separately but was not sure about the parallel strands. He felt the sequence could be different. He also liked that the approach was transparent in terms of steps and procedures, and that it advanced the understanding of ‘how and why programs

work or don't', beyond providing their effectiveness. Finally, the use of the matrix method for integration was specific and well described for this approach although he felt exploring other techniques such as QCA would improve the applicability of the framework.

On the rating of the frameworks, the participant asked for clarification on the intended use of the rubric (rating MMRS frameworks or MMRS reviews applying certain frameworks), and the specific description of the framework used pertaining to the EPPI-Center approach. He felt that the rubric was more useful for rating application studies employing MMRS frameworks than for rating the MMRS frameworks. He referenced some items on the rubric to explain his views. For example, he wondered how one would assess and assign a value for the item; logic and flow, 'sentence structure is complex and challenging to follow' and the item; development, 'The development of the framework fails to address key issues about mixed methods research synthesis studies'. He felt these were complex issues requiring more nuanced details in practice and that could not be fully conveyed when illustrating and presenting a framework.

He, however, agreed with evaluating the quality of sampling and the listed items. Under quality evaluation for design, he questioned the context of the evidence referenced in the question for the qualitative component, 'The quality of the design for the qualitative component is not addressed. Supportive arguments and evidence are not provided.' He felt that if he were to apply that statement to evaluate a framework, he would not have clarity in its meaning. He also pointed out that the items structure, logic and flow, and reporting could be analogous depending on the definition. In conclusion,

while the participant appreciated the use of rubrics based on his experience as a consultant, he noted several things that would be concerns including understanding the assignment of specific ratings without background information on what informed the process and the actual materials that were evaluated for inter-rater reliability.

The *fifth* interviewee addressed strengths and weaknesses for both review approaches. For the realist approach, she noted the deviation from positivism and the use of realism as a worldview as a strength. Moreover, the fact that the realist approach addresses specific questions that are broader (about what works, for whom, under what circumstances) compared to other systematic reviews is a positive. In terms of weaknesses she argued that the realist review approach is complex, time consuming, and requires prior training for implementation. It particularly takes more time to understand the process and literature for a realist review because it is theory-based and confounded within realism. Despite this, she acknowledged the well-established REMESIS network and website for guidance on the realist review process. On the EPPI-Center approach, she felt that it is a good example of a mixed method review framework given that it is easy to apply, uses vocabulary familiar in the systematic review field, and includes integration which is crucial for MMRS reviews. Further, the approach advances the matrix approach for integration which is debatably easy to understand and apply. On weaknesses, she identified the lack of a comprehensive website such as the REMESIS one to guide the review process but recognized the simplicity of the EPPI-Center framework as a possible reason for this scenario. Also, despite the clear definition of the synthesis processes, few details are provided on implementing them. As such, it is easy for one to misunderstand

by carrying out the separate syntheses for the qualitative and quantitative strands then presenting an overview rather than the integrated findings for the final synthesis.

On the ratings of the frameworks, the interviewee sought clarification on criteria for assessing them and on some of the terms used to describe the items on the rubric. In terms of the criteria, she was unsure about commenting on the ratings in the absence of additional details about what informed the evaluation process. She proceeded to highlight some terms she considered synonymous such as 'reporting,' 'organization,' and 'outline' used on the rubric. Moreover, she pointed out the prevalence of items assessing different concepts. For example, under clarity and on the item on steps, the question "steps are unclear and complex" address two concepts; clarity and complexity explaining, "… It's the two concepts and your description…procedure and step… I didn't really know the difference, because for me, procedure is composed of steps…it can be unclear, but complex, for example, realist synthesis is very complex, right?" Another example under structure and the item organization, "Organization is unsatisfactory, and the ending is unclear." She felt that, in addition to having two concepts, it was confusing to have 'organization' and 'ending' in the same question. Regarding general observations about the rubric, she felt that having the mixed methods component in the context of MMRS review also represents integration. In this case, the rubric should only have one of these terms. Moreover, under quality of sampling, using the term 'mixed methods component' added to the confusion on whether one was examining the primary mixed methods studies selection or not. Second, based on her theoretical knowledge, she believed there was less focus on the 'leading component' in the mixed methods field noting that this

should not be a factor in evaluating MMRS frameworks and suggesting using the term 'coherence' instead. Finally, she felt that differentiating between component and design in relation to the synthesis process would offer more clarity.

The *sixth* interviewee critiqued the two frameworks about the possibility of challenging the status quo by empowering the researcher to dictate the review process. This is because besides providing steps that are straightforward to follow and implement, she felt that current MMRS frameworks generally fail to consider the views of those impacted by the program/ intervention in question. Regarding the ratings, she reiterated her stance about frameworks incorporating the value of engaging marginalized communities within proposed procedures explaining, "...depending on the extent to which you had criteria that considered engagement with marginalized communities or full range of stakeholders you know. If those things aren't there, then I would say the ratings would need some revision."

The *seventh* interviewee addressed the strengths and weaknesses of the two frameworks. For the realist framework, she recognized its flexible and iterative nature, and its consciousness to context as strengths. Moreover, she highlighted its ability to address research on complex interventions as an overarching advantage complemented by the possibility to confirm findings with theory. In terms of weaknesses, she was wary of the limited guidance on the actual processes--a challenge to other MMRS frameworks as well. Additionally, she was concerned about legitimizing MMRS processes given limited transparency in justifying decisions taken considering the iterative nature of the procedures--a scenario that hampers reproducibility. For the EPPI-Center approach, she

believed that the use of one type of evidence to complement, affirm, or inform the other validates and advances triangulation for MMRS reviews. As such, this process is good for identifying gaps in the literature. In terms of weaknesses, she noted limited guidance on some of the processes due to dependency on reviewers' judgments and lack of transparency and inadequate guidance on addressing conflicting results from the two synthesis strands. To explain this perspective, she stated,

"…there is some issues… because you are relying on the judgement of the reviewers and that kind of transparency…and…based on the fact that there isn't a lot of guidance how do you deal with data when you know the two synthesis have conflicting results. So what do you do? So it's kind of that subjective objective side of things."

On the rating of the frameworks, this interviewee's responses differed from other participants since she attempted to rate the frameworks using the rubric and compared her results to the researcher ratings. She noted that supporting background information would have better informed her answers to this question. For example, the documents for the rubrics lacked sufficient information to guide the assessment. She felt that given more details on the frameworks, her ratings could have been higher. Largely, her ratings were generally lower than the researcher's. Overall, compared to the researcher scores, she admitted to assigning lower scores by one point to one point and a half for each characteristic. Specifically, her ratings for 'clarity' reflected those for the researcher, but other components differed. In her ratings, 'integrity' had the lowest scores for framework 1, design scored poorly for both frameworks, and sampling had scores between 2 and 3

for both frameworks. Strikingly, she felt that she understood what 'clarity' meant, but this was not the case for the other aspects covered on the rubric.

***Overview of Findings for "the Two 'Most' Prevalent Frameworks**."* The participants' views and perspectives about the two most prevalent frameworks were mostly similar across the two questions. Notable differences were evident across their observations regarding the rating of the two frameworks. For the strengths and weaknesses of the frameworks, overall, it appeared the participants favored the EPPI-Center review approach, hence agreeing with the findings for the researcher ratings.

Clarity and transparency relating to processes was a concern for both frameworks. This concern aligns with ongoing discussions in the MMRS field to consider transparency an ethical issue for MMRS reviews given their complex nature (Heyvaert et al., 2016; Noyes et al., 2019). The realist review, though cited under MMRS frameworks in the literature, is intended for specific research questions and objectives. Seemingly, the specificity in the nature and context of questions addressed by realist reviews position it as a well-developed review tool, but the complexity accompanying the proposed steps reduce its usability (Petticrew et al., 2019). This raises a question regarding MMRS frameworks and intended purposes. Is it possible to have a universal framework informing the practice for MMRS studies or would there be need to develop different frameworks based on different purposes and theoretical aspects? Despite this challenge a few participants agreed that the strong online network and website provide a way for interested parties to learn about the approach. Perhaps this suffices as a way the MMRS

community could learn from attempts to improve the usability and growth of the field as well as applicable frameworks.

The EPPI-Center approach, on the other hand, was mostly praised for its straightforwardness that makes it much easier to apply. Despite this, suggestions to improve its applicability consider the inclusion of the voices of stakeholders and those impacted by the intervention/ program of interest. Moreover, it is evident that both frameworks are adaptable to various contexts. This is a strength that emerged implicitly from some of the participant responses.

On the rating of the frameworks, all six participants who answered this question provided responses on the process except one whose feedback was complemented by an attempt to rate the framework provided using the rubric. Key issues emerging from the feedback on the rating process included concerns about clarity in the language and terms used on the rubric, insufficient background information to aid in understanding the rating process, assigning values and weights to assess the frameworks' characteristics, and the intended use of the rubric. One participant suggested revisions to the rubric that would examine how well frameworks included the voices of users across proposed steps.

Overall, all participants voiced concerns about the lack of sufficient information to assist them to better comprehend the rating process such as what informed decisions leading to certain scores. As a result, they could not attempt to compare the researcher ratings with their own for inter-rater reliability. One participant suggested this as a next step towards validating the rubric. With respect to the language used, one participant suggested using language common to the field, and vouched for the use of PRISMA to

ensure better comprehension of the rubric. Most of the participants asked for clarification of terminology used on the rubric, implying ambiguity in language while another participant noted the need to split concepts addressed within certain items on the rubric for more clarity.

Four of the participants who closely reviewed the rubric were concerned about the quantification of the assessment process, though they did not provide alternatives. Two of them further suggested that the rubric was more appropriate for application studies rather than the rating of MMRS frameworks, indicating the rubric did not clearly reflect the intended purpose. This issue calls for a reflection on the process for developing MMRS frameworks and what would be considered a useful tool for informing MMRS studies.

The Researcher Developed Framework. The fourth section focused on the researcher developed framework and on items 11 and 12. The items: "… In your view, what would you say are the strengths and weaknesses of the framework I developed?" and "… What would be one or two things I could change in this framework to improve it?" were analyzed for this section. All participants responded to this question. Like previous sections, the results for this section are discussed per participant followed by an overview of the findings. Table 4 in Appendix E shows a summary of the raw responses.

***Summary of Results for 'the Researcher Developed Framework**.'* The questions for this section were complementary. The results are therefore summarized per participant and are based on responses for both items.

The *first* participant responded to this question from the perspective of a realist review. He fully agreed with the first and third steps on the framework titled "scope of

the study" and "evidence retrieval." He believes that, in the context of realist reviews, one's philosophical assumptions are informed by realism and they should have some understanding of what that means and be accepting of this idea. For the second step, evidence retrieval, he clarified that searching is repetitive rather than exhaustive adding that consideration to work with librarians for this step is essential. For step four, quality appraisal, he noted subtle differences in the inclusion/exclusion process where included sources were valued more for their contribution to theory rather than the strength of their data or the rigor with which they are produced. Expounding on this, he noted the challenge in classifying some resources such as expert reports and the fact that many appraisal tools are developed based on traditional classifications of research as qualitative or quantitative, "…ultimately in the realist review… you're not that necessarily concerned what… form of data you have. So, narrowing it down to qual and quan I think is slightly unhelpful." For further elaboration, the participant echoed a sentiment by another participant on the classification of research based on paradigmatic differences as less meaningful for the review process. Providing an example, he explained,

"…how would you count an expert report by American Medical Association? On a condition is that qualitative data? And the question is I don't know, right? Coz it's a mixture of both. Actually…it's a consensus statement or some description, an expert opinion. I wouldn't classify that as qualitative data, not in the traditional sense. So hence I think that's why using…the term mixed methods is actually meaningless… I prefer… if you're gonna call them anything, I prefer multi method."

For step five, data analysis and synthesis, he made it clear that rather than consider diverse evidence types, data analysis employs the realist logic of analysis. In this case, the goal for evidence synthesis is to produce a realist program theory. To evaluate the quality of the theory in a given resource, the reviewer considers the arguments on which it is based and the data informing those arguments, a decision that is judgmental hence subjective. In this case, he agreed with the need for transparency in many steps, including the data analysis and synthesis under step six. For this step, he argued that realist reviews are intended to produce realist program theory using specific means to explain causation that are applied using a consistent logic through the analysis and synthesis process. He also believes that the terms integration or mixing are pointless in this context. For step seven, writing the report, he suggested adding a note about conflicts of interest and funding sources, and the limitations and strengths of the review for clarity. Generally, he suggested a step on developing program theories between the scoping, searching, and evidence synthesis steps as a formal aspect for realist reviews.

The *second* interviewee, from the perspective of the EPPI-Center approach, noted similarities in the initial steps with the works they do at the EPPI-Center. He agreed with some aspects of the first step, scope of the study, but suggested amendments to better direct the review process. First, he approved the emphasis on scoping, but suggested adding mapping as an alternative to provide a more formal scope of the evidence. Second, he advised using the scoping stage to determine the viability of doing a mixed method review study. In this case, he reiterated an earlier comment on the method being dependent on the problem and question at hand and thus emergent rather than vice versa.

He commended the need to consider the review team's expertise and available resources given the complexity of the process for MMRS reviews. On a different note, he wasn't sure the inclusion of the philosophical assumption aspect for the first step was necessary. He discussed his concerns as follows,

"...because we're informing decision making…it's hard to argue… for a philosophical approach, which has a…sort of a critical stance towards claims about reality…I don't think that speaks well to like a policy… to make a mindset… even if you started talking about…it might not be helpful. And also you are making claims about why particular approaches or particular interventions had different effects from one another…you are making claims about a real world. Even if like…a realist or critical realist sense…, you have an indirect understanding of that… you don't say it directly. You certainly can't see the mechanisms…I thought that was interesting, having that because I mean, practically speaking… it's always good for…a nice conversation."

For the second step, evidence search, he noted that consulting with an information specialist was crucial, especially if the decision after scoping was to implement an MMRS study which entails diverse evidence sources. He agreed with the appraisal, and data analysis and synthesis steps but noted the existence of varied synthesis tactics. For step six, integration/mixing, he recommended carefully gauging what the integration of the different evidence adds to the review beyond mono-method designs, an issue that should be clear from the scoping process. Finally, on writing the report, step seven, he warned about the lengths for mixed methods reviews being long and suggested consideration for what to prioritize to better inform decision makers of the results. He

proposed including integration in the findings and deprioritizing other parts that might only be meaningful to the report in the context of the review users.

The *third* interviewee answered this question at length, reflecting on his experience with meta-evaluation, but also noted some things that emerged from the expert review process in relation to MMRS reviews. At the beginning he noted the similarity of the developed framework to the realist review; hence some familiarity of many aspects to a process he has utilized for his work. Despite agreeing with some steps, he raised questions on some and provided suggestions for modifications of others. Specifically, he agreed with the first step, which he stated was worth emphasizing and spending more time on at the beginning. He noted the value of clarifying philosophical assumptions and the purpose of the study, while keeping ethical issues in mind. He also agreed with the proposition for including an initial literature search in the second step before the inclusion/exclusion criteria in the third step and an explicit separate step for quality appraisal. Overall, he appreciated the comprehensiveness of the developed framework given the complex nature of MMRS studies as well as the explicit illustration of various aspects necessary to carry out each step. He noted that such a presentation would be helpful for his work as a practitioner, despite having to adapt it to a given study. In terms of criticisms, he felt that the framework was not clear on the use of information on quality appraisal. He suggested adding another bullet for the fifth step or having a sixth step that would follow the quality appraisal step on the process of sorting out the best evidence, second best evidence, etc. He further explained that such a step would better inform the research question by determining the causal/non-causal direction for the

research which he believes would strengthen the argument for needing a mixed methods design for the review. Second, he wondered whether consideration for different designs of primary mixed methods studies (i.e., whether sequential, parallel, or nested) would influence the procedural progression of the review and if this should be included under one of the steps. Finally, he wondered how the role of causal mechanisms informed the synthesis study pertaining to the questions of interest by airing his concern,

"My main question…is it probably worthwhile to think a little bit more about this causal/ non-causal separation somehow… probably also, related to this, the role of mechanisms. So is the synthesis study more interested in the 'if answer'---to what extent, or how much questions, or more on the why---how something is related to each other…. I don't have any good idea or answer on this but I just felt, it's probably worthwhile to think a little bit more about this."

The *fourth* interviewee appreciated the steps and outline for the developed framework but suggested more specificity and procedural guidance for each. For example, providing more clarity on the process of framework selection for quality appraisal, offering specific illustrations for the process of data analysis and synthesis step, and suggesting some analytical strategies for integration along with instances when they would work best. Another example would be offering examples of frameworks an interested reviewer could use in the first step to define the scope of the study such as the PICO framework (Higgins & Green, 2008). In terms of disapprovals, he was worried about ambiguity in the meaning of some of the statements remarking that they could mean many things unless more information is provided for preciseness and clarity. He

explained, "…some of the statements there … could mean so many different things right… I would say in general, be more specific on the procedural steps involved in each step. What does a person need to do? What does an interested research synthesizer… need to do?"

The *fifth* interviewee provided extensive feedback on the developed framework. She addressed issues ranging from clarity in language and the terminology used, to steps that can be modified or excluded. These issues are discussed next under five subsections.

First, she suggested distinguishing between steps and advice for various processes across several steps. She was specifically concerned about mixing the use of verbs and action words for example 'consider' and 'define' within certain phrases. Likewise, she felt that issues speaking to decisions should be considered hints to guide reviewers on what to remember when applying the framework, rather than steps. These included things like 'transparency' under the sixth step and all facets covered under step seven. She further suggested having two columns; one including the steps and the second having respective hints on things to consider or do for those steps. For step three, bullet three, rather than 'consider context…' the phrase eligibility criteria would be more meaningful than context. Moreover, 'consider context' could be a reminder under data collection. For step four, quality appraisal, she reasoned that the first bullet, 'consider diverse evidence types and sources' is more suited for the evidence search process and as advise rather than as part of the process. She suggested including processes such as 'identify tool' and 'appraise validity using the tool' under quality appraisal. Finally, she advocated for the need to use a common term when referencing quality appraisal rather than diverse terms

like legitimacy, validity and integrity (used in rubric) stating, "…There's different terms, I would suggest to you to try to use common terms, but use one, like appraise the quality, since you have quality in your title". Despite understanding the use of certain terms, she felt that some were not common in the field and thus required revisions. These terms included, sampling under step two, and evidence retrieval for step three. To expound on this issue, she suggested reviewing the PRISMA to confirm language used is common in the field. For step five, she suggested replacing 'choose a design' with 'reflect on design…' She felt that the decision on design was dependent on emergent issues such as the evidence found and the synthesis method and should be made later in the process, though it could be considered earlier based on the research question. Similarly, and contrary to other participants who constantly spoke about data analysis when referring to the process of synthesis, she felt that the phrase 'data analysis' was more suited for primary studies rather than reviews. She suggested using the phrase 'identify synthesis method' for this step. Moreover, she felt that data analysis and evidence synthesis did not differ in meaning but rather context as described above.

Second, she proposed some changes that would improve clarity and flow in the framework steps. For example, she believed having the scoping review done under one step (preferably step 1), and before searching with explanations provided that this step could be revisited would be better than having it under steps 1 and 2. She further suggested rewriting the statement 'the purpose of the mixed methods study and justify application' to clarify whether the term 'justify' referred to the decision or rationale to do an MMRS study. On the second step, while she agreed with the diversity in sources, she

thought being more specific on the bullet 'identify information management strategy and/or software', which is new, would strengthen the framework. For further explanation, she claimed there are diverse software/ information management systems a reviewer could use with some specifically designed for reviews but not others. In step six, she felt integration could be part of step five or a separate step. Besides, she clarified that integration could be considered a part of the synthesis process that blends the information from diverse sources. On the contrary, she believes that integration is a significant part of MMRS reviews and having it as a separate step reinforces the value and necessity of different evidence sources to inform the study.

Third, she recommended excluding some processes under certain steps because she felt they are not universally applicable to MMRS reviews. For example, under step one, she contended that identifying philosophical assumptions for the study and the researcher is not the norm for MMRS reviews. For elaboration she explained, "You identify philosophical assumptions, but I would be surprised to see that. Except if you use a realist synthesis, it's clear that they will clearly identify different philosophical assumptions… but it's not always the case". On the same step, she agreed with the inclusion of the protocol development process but felt that IRB approval should be excluded since it is not always necessary for reviews. In step 5, she claimed that she was not familiar with what '…translation of evidence...' meant.

Fourth, she suggested amending some of the steps to improve the structure of the framework. For example, the first three bullets for step three, define inclusion criteria, define construct, and define context should move to the second step to precede the

evidence search process, while documenting the selection process should be a separate step. For step five, she believed data analysis and extraction are separate steps. She suggested having data extraction as a distinct step preceding data analysis and synthesis. As a separate step, data extraction could include processes such as developing a coding form and scheme, developing a data extraction sheet, and piloting the extraction sheet with at least two independent persons for rigor. She further suggested more clarity on the use of the phrase 'related strategies' with data extraction. She felt that if the term referred to transformation of the information taken out of studies, then it should be under synthesis rather than data extraction.

In conclusion, the participant advised revisiting the EPPI-Center and realist review frameworks for characteristics relating to the rubric discussed in question ten on the interview protocol. Reinforcing an earlier sentiment, she argued that evaluating the realist review and the EPPI-Center frameworks using the same rubric did not make sense. She suggested using the JBI manual or the book by Heyvaert and colleagues (2017) instead. She felt that appraising the realist synthesis for mixed methods reviews was not appropriate as it was not designed for that purpose. Regardless, she agreed that the realist review offers a viable approach for understanding quantitative and qualitative evidence.

The *sixth* interviewee, as discussed earlier, advanced the idea of designing a mixed methods systematic review with a transformative effect. At the beginning she commended the use of inclusion of 'stakeholders' in the procedures for the developed framework. Despite acknowledging the improvement over existing frameworks, she wondered about the extent to which the developed framework included strategies

necessary to engage marginalized communities for MMRS review studies. Specifically, she advocated for the inclusion of intentional strategies to advance the transformative aspect of the review arguing, "From my experience there needs to be an inclusion of an analysis of barriers that people experience, and facilitator supports that are needed for authentic engagement. Um… cuz otherwise, you know you get the people that match your thinking about, 'this is the way that data gets collected'…" She went on to provide examples of strategies to consider such as communication mechanisms and adaptive strategies that are more cognizant of the needs of the people served by the intervention/ program. Generally, she suggested paying attention to relevant perspectives that traditionally might not reach intended audiences when selecting evidence for the review to enrich the conclusions. Citing the framework by Mertens (2018, pp. 126-127), she further advised that a deliberate inclusion strategy for the use of information that considers the target audience and their diversity is worthwhile for improving the framework. In conclusion, she remarked on the importance of being culturally responsive in research and staying informed on ways to incorporate the complex cultural contexts within which research is embedded in our designs.

The *seventh* interviewee offered general comments on the developed framework before going over the steps one at a time. Overall, she praised the detail and steps in the developed framework which she claimed addressed the gap in existing frameworks. For the steps, she provided feedback on all except step four which she agreed with. For step one, she suggested having a scoping search despite familiarity with the topic. Remarking on philosophical assumptions, she felt this was not common across MMRS reviews.

Regarding 'purpose of the study and justify application' she recommended more detail for clarity. Additionally, she wasn't comfortable with having the scoping search under two steps (step 1 and 2). Furthermore, she felt that steps one and two could be meshed into one since they included things that in her perspective should be done in one phase. For step three, she recommended defining the inclusion criteria earlier before the evidence retrieval stage. After asking for clarification on the use of the term [6]construct, she suggested moving it under the first two steps during protocol development. She felt this was an important issue that she had not considered in her review work. Furthermore, it could be deliberated on later in the study under the results and discussions sections. For step five, she felt that reflecting on design, the first bullet, should be done earlier in the *a priori* protocol rather than encompassing the iterative component for mixed methods. Additionally, she requested clarity on the definition of 'related strategies' in the second bullet as well as 'evidence synthesis' in the fourth bullet. She felt that the fourth bullet should be rephrased or excluded as it sounded more like integration given that the next step, step six, is about integration. For step six she felt that integration and synthesis could occur simultaneously and wasn't particularly sure it should be a separate step. For step seven, she suggested including some recommendation for practice and further work given findings and resulting implications of the study.

***Overview of Findings for 'the Researcher Developed Framework**.'* Overall, while participants' responses differed in some ways, issues addressed, and concerns raised about the developed framework overlapped in many ways. The perspectives for four participants (interviewees # 1, 2, 3, and 6) were geared towards specific approaches

and goals for review studies although many of the issues raised informed the developed framework. In general, all participants except one directly looked at issues on the developed framework with respect to the proposed steps, processes, and outline while offering general observations they felt would strengthen it. This one participant provided general commentary on things that would strengthen the developed framework to ensure a transformative effect.

Comments directly addressing the framework targeted seven key issues. These issues included suggested revisions and modifications for steps, exclusion of some steps and processes, additional steps and processes for consideration, revisions to language and terminology use, additional details for more specificity and procedural guidance, steps and processes applicable to specific review projects depending on context and purpose and revisiting the layout of the framework. Findings relating to suggestions for each step are discussed respectively followed by other issues.

Two participants agreed with the first step, scope of the study, without recommendations for changes or improvements. One of these participants singled out philosophical assumptions, purpose of the study, and ethical issues as strong points. Three participants commented on scoping. Two of them recommended having scoping searches under step one rather than two for clarity, with one of these two advocating for scoping searches whether one is familiar with the topic or not. The third participant argued for the inclusion of mapping as an option for scoping. On exclusions, two participants favored the omission of philosophical assumptions, arguing that this was a non-issue for reviews in general, while a third participant suggested removal of IRB

approval since it is not always necessary for reviews. For revisions, the second interviewee, on evaluating the expertise of the review team and available resources, suggested adding a step on consultations with stakeholders to ensure the problem and question were appropriate for their needs. This would ensure that a determination is made early on whether MMRS is an appropriate application and would inform subsequent steps and processes. Additionally, the seventh and fourth interviewee proposed changes to the third bullet for clarity. The fourth interviewee further suggested revisions to the language.

In general, for step two, only one participant agreed with the processes. Others offered different suggestions to improve specific procedures and language but agreed with other aspects. One of the participants, the sixth interviewee, indirectly addressed processes relating to this step by commenting on the need to contemplate evidence beyond what is traditionally considered for reviews to enrich the findings and ensure voices of stakeholders are included during the evidence search process. Another participant suggested more specificity regarding information management or software, in addition, two others voiced the need to reach out to information specialists/ librarians for this process. Regarding overall comments, the first interviewee noted the specific approach to searching for realist reviews, while the seventh interviewee suggested combining the first and second steps as they were not necessary exclusive in practice based on personal observation. Finally, the fifth interviewee, despite agreeing with the emphasis on diverse sources, advised reconsidering the use of the term 'sampling' in the fourth bullet as it is not common in the field.

For step three, two participants agreed with the step and associated processes, two participants failed to offer any direct feedback, one provided indirect feedback, and the other two suggested possible improvements for the step. The participant who indirectly provided feedback addressed this step while providing examples for addressing specificity and details for the steps on the developed framework. He mentioned the importance of the reviewer/s thinking about the study types for the evidence considered for inclusion (qualitative, quantitative, and mixed methods). The two participants who directly provided feedback for this step both suggested moving the bullets associated with inclusion and context to the previous step and before the evidence retrieval stage. One of the two suggested moving the bullet with the context as well and further advised on replacing the phrase 'consider context' with 'eligibility criteria' for clarity.

For step four, one participant did not offer any feedback, three agreed with the step and procedures, while three provided feedback on different aspects for the step. One of the three who approved the step specifically appreciated that the step was separate and that the bullets were comprehensive and explicit, something he believed was appealing to practitioners. Of the three who provided feedback, one highlighted the diverse goals for quality appraisal on the context of realist reviews where theory is valued over rigor and method, while the second indirectly advocated for more detail with regards to recommending possible tools and frameworks for the process. The third participant provided feedback on restructuring the processes listed and being specific with the language, as well as using language common in the field.

For step five, one participant noted deviations specific to realist reviews for processes but reinforced the need for transparency. Two agreed with the step and processes with one noting the need for detail on synthesis techniques. One participant did not directly address this step while another did not provide feedback at all. Two participants suggested revisions on language for clarity, with one of them specifically advocating for structural changes that would separate data analysis and synthesis.

For step six, three participants did not provide direct feedback while the other had diverse opinions. One of the participants disagreed that the step did not make sense specifically for realist reviews. A second participant preferred that integration is addressed earlier on as part of the review if a decision is made to implement an MMRS study. The other two participants shared similar sentiments by suggesting that while having integration as a separate step could be meaningful to emphasize the process, it could also be done under the previous step for synthesis.

For step seven, writing the report, three participants did not provide any feedback, while one suggested excluding the listed processes and considering those as advise since they involved decisions made by the reviewer/ review team. One of the remaining three participants suggested being mindful of the audience and how the report is presented to ensure meaningful communication and better use of results. The other two participants suggested additions of specific aspects for transparency and to inform the field and further research. These included conflicts of interest and funding, limitations and strengths of the review, and recommendations for practice.

Besides the steps, participants shared sentiments on the overall structure, outline, and content of the developed framework. On the structure, three participants stated they appreciated the detail, layout, and comprehensiveness for steps and processes, while others despite similar sentiments, offered suggestions on restructuring some of the steps, omitting some of them or processes listed with them, and adding some aspects to improve the developed framework. Two participants provided specific feedback on the need for the developed framework to adhere to certain standards in order to be more meaningful for providing evidence-based results. These standards included the value of engaging with stakeholders and particularly users of the programs for which the review applies and being culturally sensitive in the processes and decisions made throughout the review process. This perspective signifies an evaluation/ applied background of the participants. Table 7 in Appendix E summarizes the issues discussed via expert review feedback on the developed framework per participant and for each item.

Other Issues. The final section, other issues, covered issues identified as important to the research questions and the study in general during the interview discussions. These were emergent issues not directly addressed by the interview questions but brought up by the interviewees during the interview process and when responding to questions in the closing section. The closing questions (13 & 14), "I would appreciate any additional thoughts about MMRS frameworks and the framework I developed" and "Are there any additional thoughts you would like to share about the study in general?" were considered for this section. A third question on the classification of the realist review as an MMRS framework in the literature emerged following one of

the participants' responses and string belief that realist reviews should not be classified with MMRS frameworks and is discussed as well. Additional questions emerging from conversations with participants are also noted and discussed. Though some issues are noted in earlier sections, they are reiterated in the findings for consistency and if the participants expounded on them. Table 5 in Appendix E summarizes these results.

Summary of Results for 'Other Issues.' All interviewees provided answers for the concluding questions except one who felt that he did not have additional thoughts beyond the discussions. Despite this, during the discussions he shared extra thoughts beyond the interview questions that inform the study and research questions at large. The results for the participants' responses including those beyond questions posed during the interview are discussed per participant. An overview of findings concludes this section and issues of relevance from earlier discussions are noted.

The *first* interviewee, clarified his stance regarding the classification of the realist review from the start, stating,

"…I wouldn't necessarily say that realist review is a form of mixed methods review, it's a form of theory driven review which its ultimate product is a theory or theories, which isn't necessarily the case for other forms of reviews. Or rather it's less explicit if that is the ultimate product. So realist reviews fit into the camp of theory driven reviews. It's very explicitly a form of theory driven review. The ultimate product is a theory."

He felt that realist reviews should be classified as 'theory driven' reviews given the goal to generate theory from diverse evidence sources. Besides, realist reviews utilize

a broader range of evidence (beyond methodologically oriented studies) than MMRS reviews to explain causation within theory. In his view, this position is not fully captured by the definition of MMRS reviews hence it diminishes the purpose for realist reviews. Moreover, despite having knowledge of other MMRS frameworks, he chose to align his responses to the interview questions with realist review perspectives, highlighting his stance on appropriate review practices within that context. For the follow-up questions, he raised concerns about the development and use of frameworks, as well as how they are perceived stating,

"…it's a developing field…one of the big problems here, it's the usual business that happens in research…everybody wants to be the first person that comes up with a method…And actually… a lot of them lack coherence…And I think the whole muddiness just comes through…what are we using different sources of data for?"

From his perspective, frameworks though useful, should be a starting point to doing any review rather than a means to an end. He specifically spoke to the concerning trend in the review field and research in general, where novice researchers and practitioners look to developed frameworks to achieve certain goals without a deeper understanding of underlying assumptions and expectations explaining,

"…the reality is that the frameworks are at best an Introduction. We, as in those of us who work within realist reviews tend to find that they are sometimes very problematic in the sense that people think, oh, I have a framework if I follow it I'm basically doing the research of this type, you know, so if I follow courses five steps I'm

doing a realist review…the bottom line is no…there's more to it than the framework and that doesn't mean frameworks are not useful."

This practice blurs the boundary between theoretical and experiential knowledge leading to misguided conclusions and misuse, and abuse of developed frameworks. On this he explained, "I think there's a big difference between having a series of frameworks and then actually being able to do them. Because I think...one is a bad experience and the other is about… theoretical knowledge." He later admitted that while framework development and critique of existing frameworks could advance the field, getting people to adhere to suggested practices can be a challenge. Also, despite his stance and belief in realist reviews being directed by the research question, he indirectly touched on the importance of available evidence in directing a review study explaining,

"…the whole problem with reviews is that you're pretty much driven by what's available. Rather than primary data collection, where you can go out and collect more data…sometimes you can ask specific research questions that you cannot actually answer because there is just no data…sometimes there's a change in the focus."

Finally, in his conversation, he highlighted other issues pertinent to MMRS reviews and his perspectives of other frameworks. First, he expressed his preference to use the term 'multi-method' versus 'mixed methods' when speaking about methodological implications associated with the term in the context of MMRS reviews. Second, he expressed his discomfort with evaluating quality particularly for qualitative studies, He felt that if the focus is on realist reviews, having the 'best quality' studies considering current evaluation techniques, wouldn't guarantee the studies significant

contribution to program theory. Third, when discussing the ratings of the two frameworks and with regards to MMRS frameworks, he shared his dissatisfaction with current efforts:

"…it might be okay for some of the other approaches…I mean my description of that will be certainly more Frankenstein. I don't think that's particularly coherent… everyone's trying to cobble things together…I am not quite sure what they're trying to cobble things together for… I find it quite hard to operationalize much of this for the greatest reason."

The *second* interviewee did not directly answer the closing questions but raised meaningful points to the study besides the interview questions. These issues touched on debates in primary research and how they impact reviews, the centrality of integration to MMRS reviews and the need for clarity on the process, and the evolving nature of the MMRS field and challenges associate with framework development. The first issue came up during his response on methodological background. He firmly stated that he was against traditional classification of research based on methodological divides stating, "I would be anti-orientation. I don't think there's any difference…I don't think there's any such thing as qualitative research." On a follow-up question regarding his view on current classifications of research he explained,

"…I would say still use the terms, because with the shorthand for things that people think they know what they mean when you start getting underneath the surface it's very clear that the categories don't matter…quantification we know what it is. Qualitative is more difficult because some people would say, you know… it's just Numbers otherwise it would be quantitative. But then others will say, no, that's not what qualitative

or quantitative research is all about. It's about subscribing to a particular worldview. Or a particular critical take or epistemology and ontology. And so it means so many different things, but it's actually not a meaningful description... Some people use quantitative as a sum of use and some people use numbers so yeah, I don't know..."

He later added to this argument when sharing his view on the use of the term 'mixed methods' for MMRS reviews where he prefers the term 'multicomponent' based on the methodological connotation traditionally associated with mixed methods research. On integration, he reinforced its integral role to MMRS reviews both for justifying the method and as a procedural component. Moreover, he indicated that integration is vital throughout the MMRS process and at different stages. For example, when deciding on the method given available evidence he explained, "…what I would add on the integration is…thinking about what the integration of the different types of evidence does over and above just having one of them…there's something about it, making it more than just the sum of the two parts." And during reporting and on the need to consider stakeholder needs and the study's results, he noted,

"…in terms of writing the report from mixed methods. It's probably that you want the integration to be in the finding and…it might well be that no matter how proud you are of the other parts of the report, you just need to de prioritize them…Because you know, they can harm the communication of the interesting bits if it's just too much."

Additionally, he acknowledged existing challenges with the process of integration and its perception across different individuals by questioning one of the proposed approaches. He was concerned about clarity on the process of integration, and the need

for more guidance on what to do, how and when, as well as the need for more practical examples to illustrate the procedure. Additionally, when discussing approaches to integration and about Bayesian methods he argued,

"…one of the things…if you're thinking about these…what part of the design is important for integration for us. It's not losing essential elements of either type or any of the types of evidence. We don't tend to quantitize qualitative research because it's sort of losing… like an essential element of what qualitative research is about. What we tend to do is to find the middle ground…the middle ground is probably around the concepts and the categories that are used. And then you can use those as a way of getting the different bodies of evidence to talk to one another..."

Finally, and in line with an earlier sentiment on the emergent nature of review research, he expressed his concern that the developed framework from the beginning, fails to address the fact that initial steps should explore the auditability of an MMRS study before advancing to other stages. Similarly, advancing the idea of a developing field, he shared his feelings about the cited EPPI-Center framework and his current work stating, "There are very few that have followed the same templates...The classic one you've got, they have trials and qualitative studies. There are far more other mixed methods reviews that we've done which haven't used that approach…And at the moment, we do quite a lot of QCA--qualitative comparative analysis."

The *third* interviewee argued for the need to engage in meaningful debates between the mixed methods and multi-methods communities. He alleged that despite sharing many promises and challenges, the two fields continue to distance their work

from each other. Specifically, mixed methods research and multi-method research are potentially vital for advancing evidence-based decision making. He found this distinction less useful to his work as a practitioner since he acknowledged gaining from both areas in improving his practice. Further citing the increased number of studies and applications across the two fields, he recognized the importance of and advocated for vigilant efforts targeting 'good' frameworks. Moreover, he acknowledged the need to view frameworks as flexible rather than rigid tools for review research. Precisely, when speaking to the developed framework he stated, "… I mean, it's always a case in practice that you will adapt this framework to your study later on…I always like it when it's more comprehensive and it's explicit on the different dimensions you have under scope of study and evidence search and so on..."

The *fourth* interviewee expounded on concerns he raised about the researcher rating of the two frameworks. He observed that the moment of integration and particularly how to organize evidence was not clear across current MMRS synthesis approaches. He also felt that many people apply the frameworks like a 'recipe,' thus it is more meaningful to rate application studies certain frameworks instead of the frameworks. He believes that this will ensure the outcomes of the rating process better inform the field on the usability of current frameworks. He stressed the agility in the frameworks over time to reinforce the need to evaluate application studies rather than proposed frameworks. Reiterating a sentiment by one of the interviewees regarding the EPPI-Center approach as an example, he stated, "… in some early work, they use a matrix approach to integrate the findings and now they seem to be using more QCA". He

further cautioned against numerically scoring certain processes of frameworks which he felt does not make sense since those processes are not set in 'brick and stone. Citing the realist review as an example he explained, "… it is anchored in the realist tradition, it defies procedural… they will say, we can't give you a recipe, because there is no recipe…" On the researcher developed framework, he advised revisiting a review study on realist synthesis for more insight. He also advocated for the need to apply the framework and learn from the process, by considering an established program or intervention with solid research behind it.

The *fifth* interviewee provided feedback on realist reviews and shared ideas she felt would advance the field for future research. With regards to realist reviews, she disagreed with classifying realist review under MMRS frameworks and felt that appraising it using the rubric in the study and alongside the EPPI-Center framework was not fitting. Despite agreeing that the realist review is one of the popular frameworks, she advised considering an alternative approach such as the JBI. On a different note, though she appreciated the current study, she thought as a new field, there were several issues to address regarding the practice of MMRS. These include addressing the process of integration, challenges in implementing systematic review processes for MMRS as a complex review application, and reporting. On reporting, she noted the tendency for people to first focus on understanding the process first, hence the need to first clarify related aspects. On a different note, through her statement, "…So for me, when you do a review, usually we will talk about synthesis. If primary research, we'll talk about analysis" she brought about the debate about terminology in review research. In an earlier

sentiment she had discussed this with regards to the use of the phrase ‘data analysis’ on the developed framework, although other participants used this term in a similar context without concern.

The *sixth* interviewee shared overall comments on MMRS reviews. First, she appreciated the role of systematic reviews and related advances given the added worth of understanding research from a broader perspective compared to primary studies. Despite this view, she cautioned against the failure to be inclusive. To this end, she argued for the need to deliberately reflect on the context and culture of the primary studies selected for the review which she believes strongly influences the results and findings. Secondly, she shared a concern regarding the subjective nature of reviews in which the reviewer works towards integrating individual studies in some way and how this affects the understandings and perspectives taken.

The *seventh* interviewee shared views on current perspectives about MMRS reviews, the developed framework, and the classification of the realist review as an MMRS framework. On the current JBI framework, she alleged that the current framework was more aligned with Sandelowski and Colleagues’ (2006) and Pluye and Hong’s (2014) approaches. Expounding on this, she shared that the JBI approach favored convergent approaches classifying them into the segregated and integrated approaches depending on the question. Despite this proposal, she noted anticipated challenges and insights from the application of these approaches to real life examples. For the developed framework, she appreciated the process for developing the framework given the existence of many approaches and thoughts with little guidance. Furthermore, she acknowledged

the challenges with straightening processes given the highly evolving nature of the field and its newness. Finally, on the realist review, despite using information from the approach to inform their work, her team did not classify the framework based on the literature review for their work. Their decision was based on the steps of the realist review which she felt didn't fit well with universal steps of a review as well as the definition of MMRS reviews.

***Overview of Findings for 'Other Issues**.'* Issues not directly sought though the interview questions proved meaningful to the study as they addressed important issues noted in the literature regarding review research and MMRS studies as well as emergent issues that are worth pursuing for the field. Some issues were more common across conversations with some of the participants than others. These issues comprised the classification of realist reviews as an MMRS frameworks, terminology, the use of frameworks, the developing nature of the MMRS field, and the impact of debates in primary research on review research.

On the classification, contrary to the literature at the point of this study, most participants were concerned about the positioning of realist reviews as an MMRS framework. The question on classification of realist reviews was not included in the interview questions but came up during conversations with one of the participants who strongly opposed the idea. Two other participants aired their concerns at different stages of the interview whereby one was clearly opposed to the classification and the other was not sure but unsettled about it. One participant was directly asked about the classification and was also not comfortable with citing realist reviews as MMRS frameworks. The

other three participants did not raise this concern and were not asked about it because the issue came up after their interviews. As a result, this concern raises a question for the field about the consideration of realist reviews as an MMRS framework.

A second and major concern was terminology. Participants raised concerns about language with respect to MMRS studies. Two participants spoke about their discomfort with the use of 'mixed methods' in MMRS reviews and provided alternatives that would eliminate traditional methodological undertones linked to the term. Another participant when discussing procedural characteristics noted her preference to refer to the process of data analysis for reviews as synthesis. While this was not an issue in the literature, it is an interesting finding to explore. Finally, another participant, without justifying their argument, felt that the use of the term 'integration' to allude to the process of allowing information from diverse evidence in the review study to speak to each other for the purpose of collectively informing the overall question was pointless. These perspectives indicate that terminology challenges inherent in primary research and traditional review studies permeate diverse dimensions despite ongoing developments.

Third, some participants voiced differing views on the use of existing frameworks, and the development of frameworks. Some participants felt that realist reviews did not sit well under the MMRS umbrella of frameworks because of their intended purpose, goal, and deviant processes such as exhaustive evidence search. Other participants were critical of current frameworks MMRS frameworks and their failure to consider key aspects that would bolster their usability in this context of reviews. The concerns raised included issues of clarity on causality, and processes failing to clearly

consider inclusion of evidence and diverse perspectives. Other participants reinforced the importance of understanding the use of frameworks as a starting point and a guide to the review process rather than a set process. In this context, while one reviewer spoke to his understanding that frameworks were to be adapted to given particular contexts and research questions, two other participants were concerned that this understanding is not always clear across current frameworks thus could be a point of abuse in resulting application studies. These concerns bring to light challenges with translating theory to practice for MMRS frameworks.

Fourth, several sentiments by participants highlighted the nature of a developing field. Specific statements evoked the need for clarity on MMRS processes such as integration and quality evaluation. Though integration is considered a central aspect for MMRS studies, transparency on the actual process and availability of techniques would make the procedure more understandable. Similarly, while participants appreciated the need for quality assessment, it was clear that challenges with evaluating research quality in review research persist across diverse evidence sources. As such, participants called for the need to be more specific and transparent about the process whereby developed frameworks could provide illustrations to best address involved mechanics. Another participant specifically spoke to the need for consistent language on the process of quality evaluation. On a different note, and in line with the previous discussion, two participants were dissatisfied with current frameworks calling for specific improvements for inclusiveness, while other pointed out ongoing developments regarding some frameworks such as the JBI and EPPI-Center. Moreover, the participants were generally concerned

about the attempt to rate current frameworks raising different concerns about the process and rubric used despite welcoming the idea. Some participants further highlighted the emergent nature of review research and challenges with misplaced implications for developed frameworks as indicative of rigid processes. These concerns and diversity in views due to the current developments, point to the need for rigorous efforts to address and clarify MMRS processes and associated concepts.

Finally, other issues brought up by participants pointed to debates carrying over from primary research and other review applications. Some of these issues overlap with those discussed earlier and include classification of primary research and implications for review research, terminology and language used for procedures and different review approaches, and challenges in effecting some technical aspects for given procedures such as quality evaluation. These concerns signify a need for vigilance in efforts geared towards addressing procedural aspects for advanced research and reviews applications such as MMRS studies.

Discussion of Expert Review Findings

The summaries for results and findings were evaluated for emerging themes. The themes developed out of participants' responses (Kuntz, 2010) and their descriptions of issues they perceived relevant to the MMRS field, frameworks, and studies. The main themes were also interrelated with some acting as subthemes to others.

Overall, four main themes and six subthemes were identified. Major themes; diversity, developing field, gap between research and practice, and ongoing debates/ developments, were identified by examining recurrent issues overall and across the five

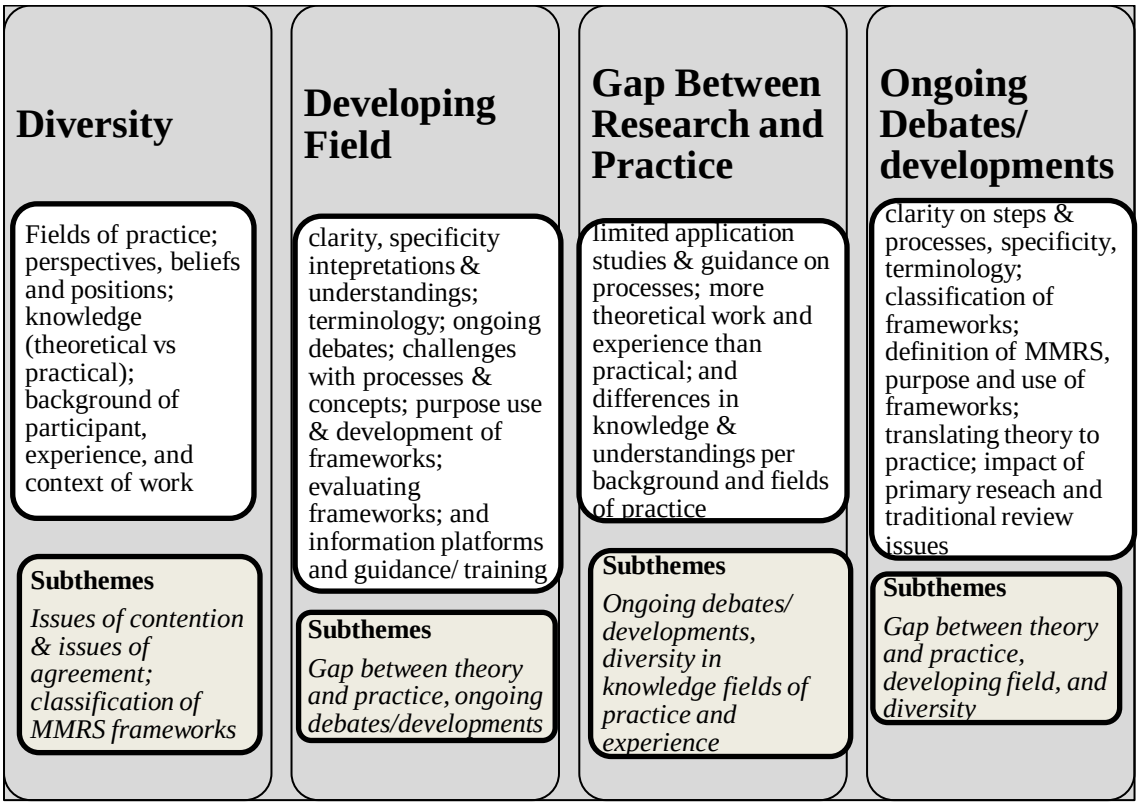
sections. Minor themes; Issues of contention and agreement, classification of MMRS frameworks, gap between theory and practice, ongoing debates/developments, diversity in knowledge fields of practice and experience, and diversity, were identified by examining matters that stood out across the five sections but were embedded within the major themes. The gap between theory and practice was a subtheme under two main themes; developing field and ongoing debates/ developments. Ongoing debates/ developments was a subtheme under two main themes; developing field and gap between research and practice. Diversity was a subtheme under, ongoing debates/developments, while developing field was a subtheme under ongoing debates/ developments. The other subthemes; Issues of contention and agreement and classification of MMRS frameworks, and diversity in knowledge, fields of practice and experience, fell under the main themes for diversity and gap between research and practice respectively. Figure 18 shows a simplified picture of the analysis process, illustrating a summary of the identified themes and subthemes along with key elements informing each theme. The themes and subthemes are discussed and linked to current literature, informing revisions of the CRS framework.

Diversity

The theme for diversity was advanced by the differences in participants' characteristics and how these impacted their responses to targeted MMRS issues. Participants' discussions were defined by their experiences, understandings, and beliefs about ideal review and MMRS practices. Diversity as a theme spoke to the varied opinions based on these discussions and in line with the various issues that informed

them. Diversity was dominant across various elements that were identified both overtly and covertly. These elements included fields of practice; perspectives, beliefs, and positions taken regarding methodological and general research practices; knowledge (theoretical versus practical); and background of participant, experience and context of work. These differences are important in understanding current debates in the MMRS field while shedding light on the development of MMRS frameworks. Moreover, they have both negative and positive implications for the field. Although these elements are discussed separately, they are in no way disjointed and complement each other in explaining diversity and how it impacts the MMRS field based on this study.

Figure 18
Summary of Themes and Subthemes with Notes on Supporting Findings



Background of Participant, Experience, and Context of Work. This element was overtly identified from examining the participant characteristics and the work they were engaged in. This theme played a key role in shaping participants' arguments for or against specific MMRS issues as is reinforced in subsequent discussions. Specifically, these elements were instrumental in directing the content and depth of issues addressed across participants' conversations. Examining these elements lead to the overt and covert identification of the other elements associated with the theme for diversity. This element overlaps and is intertwined with the other elements in many ways.

Fields of Practice. There was a clear distinction in views shared by participants engaged in practice-oriented works from those in theoretical or academic fields. Only one participant worked in a practical context and they had less theoretical knowledge about the MMRS field. This participant held different views and interpretations of various MMRS concepts, techniques, and processes relative to the others. All the other participants had some exposure to both theoretical and practical issues in the MMRS field, but their degree of experience varied. For example, participants with more years of experience in the field, in addition to considering certain MMRS frameworks superior to others, were interested in advancing practices that they strongly viewed as ideal for the field and to MMRS frameworks. Moreover, they were interested in results that reflected useful evidence to both policy and practice. These views align well with the purpose for MMRS reviews, to promote evidence-based results.

Participants with less experience in the field, despite having some understanding of and exposure to practical aspects of MMRS studies, were keener on methodological

nuances regarding MMRS and MMRS frameworks. For example, the two participants who were recent graduates extensively discussed ongoing debates on nuances regarding methodological practices and language, among others, that fit more within the theoretical guidelines to address challenges in the field. These issues indicate a developing field that exhibits ongoing debates for many foundational aspects, a welcome scenario for the MMRS field. On the contrary, the disparity in theoretical and practical knowledge raises questions in the context of fields of practice and is a concerning finding for this study.

Perspectives, Beliefs, and Positions Taken Regarding Methodological and General Research Practices. Building on diversity in the fields of practice, it was apparent that participants' perspectives regarding issues of significance to MMRS and MMRS frameworks differed to some degree. From the onset of interviews, it became clear that most participants, in airing their thoughts and views, were strongly influenced by their experiences, knowledge of the field, and backgrounds. Through the analyses it became clear that these factors further informed the positions taken regarding what participants considered as necessary methodological and conceptual issues for the MMRS field and research in general.

These aspects are important to understand in terms of what drives meaningful developments in MMRS. As a new and sophisticated review approach, the need for corroborating opinions and differing inputs to advance methodological, conceptual, and theoretical issues for MMRS is vital (Gough et al., 2017; Mertens, 2018). Diversity in this context adds to the richness of MMRS, thus promoting its applicability to narrow the gap between research and practice across various contexts. Furthermore, diversity in this

way advances interdisciplinary efforts to streamline best practices and to address emergent challenges in the field, allowing for the concurrent development of MMRS as a review approach and its respective methodological nuances. This element of diversity also speaks to the themes for a developing field and ongoing debates and developments.

Knowledge. Differences in participants' theoretical and practical knowledge was evident across their responses. This element became clear as the responses were examined. This element, though entangled with some of the others, is important to highlight as it speaks to other themes in the MMRS field. Primarily this element speaks to the challenges noted in translating research to practice. Despite this concern being highlighted in various research contexts, it is particularly imperative that the MMRS field considers this a crucial issue alongside methodological and conceptual advances. Moreover, the contexts of application for MMRS studies call for addressing research geared towards complexities of interventions to inform evidence-based decisions (Petticrew et al., 2019; Thomas, Kneale et al., 2019), thus it is essential that disparity in theory and practice be addressed.

The elements also inform the subthemes associated with the theme for diversity; issues of contention and agreement, and classification of MMRS frameworks. It is worth noting that this theme is foundational to the other three themes and plays a major role in shaping respective discussions.

Issues of Contention and Agreement. As a new and growing field, MMRS studies are capturing the interest of many researchers working across diverse fields and contexts (Gough et al., 2019). It is evident that efforts to streamline methodological

practices and to address current challenges utilize lessons and examples from different platforms (Heyvaert et al., 2016; Mertens, 2018). Additionally, diversity enriches the debates and developments that define the field. These advances emerge easily when involved researchers agree on many of the aspects of interest despite their diversity across various contexts.

On the other hand, diversity can result in debates that deviate from key developments in innovative research practices. These deviations driven by issues of contention can lead to concerns such as different interpretations of the purpose of frameworks and assigning of labels for practices without closer scrutiny of their necessity. Such disagreements can have negative consequences for the field that in many ways hinder further application of advanced research approaches.

Classification of MMRS Frameworks. Classification of MMRS frameworks emerged as a subtheme to diversity. The classification of MMRS frameworks, and specifically that for realist reviews was not considered an issue in the literature but emerged in discussion with one interviewee whose work primarily utilizes realist reviews. In their view, they disagreed with the classification of realist reviews under MMRS frameworks citing its nature, purpose, and goals as broader than those for MMRS studies. Three other participants addressed this matter. Specifically, participants' views on the classification of realist reviews as an MMRS framework differed in whether prompted or not. Two participants addressed this concern after being asked about it while one addressed it without direct questioning. One participant expressed discomfort with the classification of realist reviews as an MMRS framework, citing its purpose to develop

theory and related processes as not fitting with other frameworks. A second participant expressed discomfort without providing supporting arguments. The third participant, without being asked extensively discussed how theory, purpose, and process distinguish realist reviews from other MMRS frameworks. The other participants, though not asked, did not bring up the classification of realist reviews as MMRS frameworks as a concern.

This finding calls for a reexamination of the widespread reference to realist reviews as examples of MMRS frameworks in the literature (Heyvaert et al., 2016; Onwuegbuzie & Frels, 2016). The variability in responses indicates ongoing debates that signify a highly evolving field where researchers are continuously evaluating and testing their practices, ideas, and theory. Notably, literature on realist reviews appears to grow rapidly with focus on specific methodological features to advance relevance of the approach. Despite these advances, notable features and aspects such as search processes and the iterative nature of its procedural steps continue to align with those for MMRS reviews, with a key distinction lying in the purpose for realist reviews being to develop theory (Pawson, 2006). This realization necessitates a serious discussion between experts in both the realist review and MMRS field to come to an agreement about this classification. Moreover, it is important for experts in the MMRS field to review the classification of frameworks against the intended purpose, nature, and definition of MMRS studies for further clarity.

Developing Field

Participant discussions in many ways spoke to the evolving nature of the MMRS field given concerns shared about methodological and conceptual factors. Concerns about

terminology; understanding, interpreting, and going about proposed processes; challenges making sense of conceptual and procedural aspects; challenges with conceptualizing the purpose, use, and development of frameworks; agreement on the need for a rubric and process for evaluating MMRS frameworks; and the value and need for platforms to provide guidance for the implementation of MMRS frameworks evoked this theme. These elements speak to three aspects identified as procedural and conceptual clarity, the purpose and use of frameworks, and the evaluation of frameworks. These aspects are discussed below to further elaborate on this theme and its implications.

Procedural and Conceptual Clarity. This facet aligned with proposed MMRS frameworks and associated procedures as well as terminology used. Participants' repeated reference to challenges with making sense of the ideal implementation of procedures across different MMRS frameworks and the varied views about concepts and terminology reinforced this aspect for the developing field theme. Specificity and transparency on the actual methods encompassing the steps proposed for various frameworks was proposed to improve practicality of MMRS frameworks. Moreover, various sentiments indicated concerns about the MMRS label, and terminology used in both the literature and the current frameworks. It further emerged that the presence of resources such as websites with detailed procedural guidelines and training materials for proposed frameworks as well as online communities interested in working with MMRS studies would potentially benefit the field. This need for more comprehensive resources beyond developed frameworks is reinforced by challenges with fully capturing the methodological nuances for MMRS studies across current frameworks. These issues

highlight a field dominated by valuable developments driven by ongoing reflections, proposals, and thoughts regarding methodological and conceptual issues of relevance.

Purpose and Use of Frameworks. Participants, despite acknowledging the value and need for developing frameworks, raised concerns about purpose and use. Most of the participants worried about the implications for developing frameworks for complex research processes like MMRS. In line with this concern, participants cited misinterpretation of proposed steps resulting in misapplication in various contexts as a key concern. In many cases, it is possible that researchers view defined frameworks as rigid processes for guiding studies (Onwuegbuzi & Frels, 2016). These assumptions result in studies that are theoretically and practically indefensible by failing to meet the intended goals for certain research approaches. This concern is amplified for complex applications like MMRS whose methodological and procedural steps require deeper thought. Specifically, MMRS studies require that researchers think about the context, content, and purpose of the study throughout each step. And, at times steps are iterative, necessitating revisions to earlier processes and steps.

Moreover, it is imperative that the research questions are pre-requisite to procedural guidelines and should direct decisions on whether MMRS is necessary, followed by a decision about which framework to use. In this way, the approach should emerge based on the needs of the study rather than vice versa. Finally, and specific to the use of developed frameworks, clarity and specificity challenges driven by the lack of procedural transparency leave many conceptual suggestions open to diverse interpretations during application. This scenario necessitates discussion on better

presentation of the complex steps involved in MMRS studies. Frameworks are intended to clarify methodological aspects for research practices rather than complicate them. Thus, efforts to promote application of MMRS frameworks are essential to improve methodological practices for MMRS studies.

Evaluating Frameworks. The attempt to evaluate the two MMRS frameworks identified as most prevalent in the field yielded informative yet diverse opinions about the process and the tool employed. Concerns about the rubric targeted language, clarification and distinction of concepts of interest, and the nature and process of rating. Despite evidence that the assessment of developed frameworks is a critical factor towards advancing methodological practices across MMRS studies, concerns about going about the process were rampant across participants' discussions. In addition, availing information behind the decisions on the rating process would boost efforts to legitimize the tool by inter-rater reliability.

This theme advances the value of continued efforts towards procedural growth in the MMRS field while raising concerns about ways to accommodate and embrace changes. The diverse opinions held by participants on methodological issues call for more practical examples for proposed frameworks to allow for realistic visualization of the implications across different topics and various contexts. In this way, this theme overlaps with that for the gap between theory and practice.

Gap between Research and Practice

The gap in research and practice is a concern for research in general (Lochmiller & Hedges, 2017)). This study shows that this was also an alarming issue for the MMRS

field. The critical review indicated that the studies illustrating the application of current MMRS frameworks were limited in mumber. This finding implied that in some cases, researchers have to rely on hypothetical suggestions to apply proposed frameworks. This finding was reinforced by participant discussions in the expert review interviews. As discussed earlier, closer scrutiny of participants characteristics, showed evidence for more theoretical than experiential work. This finding coupled with evidence for more efforts towards theoretical than practical MMRS issues further supported this theme tying it to the theme for diversity hence the sub-theme for diversity in knowledge, fields of practice, and experience. Furthermore, the limited number of practical examples to signify current methodological proposals ascertain ongoing debates and developments as a sub-theme for this them.

Diversity in Knowledge, Fields of Practice, and Experience. Theoretical knowledge is essential for grounding research practices (Lochmiller & Hedges, 2017). Considering application of theoretical concepts across diverse fields of practice enriches methodological and conceptual research applications. Experiential knowledge further promotes understating of logistical aspects of methodological propositions. As such, differences across experts' contexts are useful for a developing field. In situations where these differences are unequal, implications could be dire for the field, meaning theoretical and practical knowledge fails to develop at the same rate. Results in this study indicate more growth in theoretical knowledge compared to practical knowledge. These observations elevate concerns about conceptualizing practical methodological features for MMRS studies, hence the need to advocate for more applied studies.

Ongoing Debates and Developments. Advances within and across research practices are richer if informed by diverse opinions, observations, and contexts. As such, this sub-theme ties into the sub-theme for diversity discussed above while reinforcing the need for new knowledge to inform the practice of MMRS, and raising new questions about narrowing down the research and practice gap.

As a developing field, practical knowledge is essential in challenging theoretical assumptions in any research endeavor. Notably, literature denotes that challenges from standard review approaches and primary research are a concern for sophisticated review approaches (Talbott et al., 2018). For example, despite the need and value for quality appraisal in review studies, debates are ongoing about appropriate factors to consider for these processes, tools to use across differing categories of evidence, and further dimensions that define developed tools (i.e., what should be assessed). As such, it is vital that methodological advances in MMRS studies are accompanied by insights from practical applications.

Ongoing Debates and Developments

Despite being immersed in other themes, it was important to highlight this theme separately as it speaks to the current state of the MMRS field. It was apparent that continuing debates are prevalent in the practice and development of MMRS and MMRS frameworks. These debates differ in context from those emergent with the development of MMRS to those carried over from simpler and traditional reviews as well as primary studies. In addition to elements tied to other themes--including procedural and conceptual issues, terminology concerns, translation of theoretical to practical knowledge,

classification of MMRS frameworks, and the purpose and use of MMRS frameworks--the definition of MMRS as a review approach and the impact of issues from primary research and traditional review approaches are additional elements that define this theme.

The definition of MMRS as a review approach came into question across discussions with three experts in this study. All three participants implied leniency towards renaming the approach as its label appeared to limit it to the definition associated with mixed methods primary studies, arguing that such a representation fails to fully account for the purpose of MMRS studies. This stance elicits an important but necessary debate regarding the practicality of the MMRS label. Suggested labels such as multi-component and multi-method review did not match any of the commonly used labels identified earlier in the literature as they all in some way included the 'mixed methods' aspect. Perhaps this definition could in some ways address the concern about the classification of realist reviews as an MMRS framework. Moreover, this argument is telling as two of the experts who brought it up have long been engaged in the review literature and particularly that for MMRS studies.

On the other hand, the impact of challenges from traditional review approaches and primary research was evident across discussions highlighting practical, conceptual, and terminology concerns. Literature has long identified challenges in primary research that translate to review research. Similarly, complex review applications such are MMRS are bound to be affected by such challenges. Given the complexity in considering diverse evidence sources, these challenges are amplified, calling for caution in advancing methodological propositions and developments. Specifically, review researchers need to

consider how these challenges are impacted by such complexity and consider ways to mitigate them without compromising the value of MMRS review among other complex review applications.

Comprehensive Research Synthesis: An Integrated MMRS Framework

The new framework was developed following the analysis of the expert review results and in line with related literature. Revisions were implemented by considering meaningful findings while staying true to ongoing discussions in the field. As noted earlier and with regard to the discussions associated with the expert review, the revised CRS framework presents a fluid, adaptable, and flexible tool for MMRS studies. This is relevant given ongoing developments and discussions in the field about methods and methodology. The current debates imply that the CRS is subject to future revision and modification. Also, despite emergent concerns about the classification of realist reviews among MMRS frameworks, the views shared are considered for revisions of the CRS framework. This opens the classification question for future inquiry in the field. Discussions in the final Chapter elaborate on the classification issue and the decision to consider applicable suggestions for revisions to the CRS framework. Revisions to the CRS framework are addresses next.

Revisions to the CRS Framework

Revisions were considered for each step and implemented depending on the strength of the argument and current MMRS literature. It is worth noting that despite this study's focus on methodological concerns for MMRS frameworks, the revisions for the CRS framework per the expert review process were primarily structural. Notably,

structural and procedural factors have implications for methodological issues and are therefore important for the development of the framework.

Overall, the framework was restructured to include an extra column, 'important things to consider,' to better illustrate the implementation of the proposed processes, what to keep in mind, and examples of strategies for executing the stated processes. For example the PICO framework (Higgins & Green, 2008) can be considered for some of the steps involved in defining the *scope of the study*. This restructuring provides an improved version of the MMRS framework. Moreover, the language was revised so it was more direct and statements that explained or offered suggestions on implementing certain processes were moved to the 'important things to consider' column. Examples of certain processes that appear confusing such as synthesis, integration, and tools for appraisal of different study types are provided to improve clarity and to provide solid illustrations for executing the steps. The number of steps stayed the same despite some re-orientation and rewording for clarity. These changes were intended to promote the application of the CRS framework and to address the concern about complexity and lack of clarity among current frameworks. In addition to the general changes, amendments were considered for individual steps to address concerns about language, terminology, and re-orientation of processes. These modifications are discussed next.

Step 1: Scope of the Study. This step consisted of eight processes after revision, compared to seven in the original version (Table 6). These procedures are: define topic of interest, identify problem and research question(s), define construct of interest, define purpose of the study, identify study's and researcher's philosophical assumptions,

conduct a scoping search, develop a protocol, and evaluate review team expertise and available resources. Changes included adding the process 'define construct of interest' from step three; using more specific language for the fourth, sixth and seventh bullets; switching bullets six (evaluate review team expertise and resources) and seven (conduct scoping search); moving the comment about IRB approval under bullet six to the advice column and leaving 'develop a protocol'; and rewording the scoping search proposition so it is conducted regardless of the review researcher's familiarity with the topic.

The bullet for identifying underlying philosophical assumptions for the researcher and the study was not removed as suggested by some of the interviewees. This is because, from the expert review discussions, it was clear that while researchers might choose not to report or discuss philosophical assumptions in their review reports, these underlying assumptions play a critical role in directing important methodological and conceptual decisions. As such, it is neccessary that these assumptions are identified and justified depending on the target audience for the final report. Futhermore, given the need for transparency in review studies and the complexity of MMRS reviews, information on the philosophical assumptions is important to enlightening review study users. For example, researchers who might want to implement a similar review study or utilize a given framework are able to make informed methodological and conceptual decisions when sufficiently informed about the assumptions that guided significant choices for current review studies. In this study, participants' discussions and views of various concepts were influenced by theoretical positions such as realism and transformative perspectives, further reinforcing the need for transparency on this issue.

Step 2: Evidence Search. The number of procedures for this step dropped to four from five in the original version. The four steps comprise define search strategy/ strategies, identify sampling strategy (E.g., purposive, exhaustive), identify information management strategy and/ or software (E.g., EPPI-Reviewer), and conduct the literature search. For this step, the first bullet was moved to the last position for clarity and the second step in the initial version was excluded since it is incorporated in the first step. A respective note was added to the advice column to emphasize the point that it might be necessary to revisit the scoping review for this stage. Additional changes include the addition of examples for the sampling strategy and information management software to offer more clarity and specificity for the respective processes. Finally, 'literature search' was revised to 'conduct the literature search' to better communicate the procedure.

Suggestions to not use 'sampling' were not taken since sampling is referenced in review literature in relation to the selection process for evidence. This point is noted for further discussion in the field. Additionally, suggestions to merge the first and second steps were not considered because despite classic reviews, these processes are more involving for complex reviews. Keeping the two steps (scope of the study and evidence search) separate reinforces the importance and weight they each carry for MMRS reviews. Specifically, combining the steps and attempting to make them comprehensive and more informative would make the step too long while attempts to condense them for aesthetic purposes would mean unclear communication of the processes involved for the specified procedures.

Step 3: Evidence Retrieval. This step had numerous revisions. The bullet on 'define construct of interest' was moved to the first step, while those for 'consider context for primary studies and related evidence' and 'clearly documents study selection process' were reworded for clarity and moved to the advice column. Four processes are defined for this step in the revised version: define inclusion/ exclusion criteria and consult with stakeholders/ review team, screening---review titles, abstracts, and full articles progressively selecting appropriate sources, sorting---sort evidence by type, conduct backward/forward searches as applicable. These processes are specific to the evidence retrieval stage with screening and sorting included given the consideration for diverse evidence. In addition to screening, sorting of evidence is necessary to enlighten subsequent stages for quality appraisal, and data extraction and synthesis. The first bullet includes additional information to consider the views of stakeholders or the review team depending on the study type (i.e. for research or policy work). Finally, backward and forward searches are important to ensure additional retrieval of valuable sources that might not be accessible via general searches. Consultation with stakeholders or hand searches for comprehensive retrieval of studies are also encouraged in the advice column.

Step 4: Quality Appraisal. Despite retaining the same number of bullets as the initial version, the processes for this step were all revised. The steps: identify appraisal tools (e.g., the MMAT for mixed methods studies); appraise selected studies and identify additional exclusion criteria if necessary were proposed. PartIcularly, the language was revised for precision, while two processes (consider the diverse evidence types and

sources and consider issues of validity/ legitimacy) were moved to the advice column and replaced by two others to better depict the quality appraisal process.

The new steps: ‘appraise selected studies’ and ‘identify additional exclusion criteria if necessary’, were proposed. They speak directly to the steps involved in executing the quality assessment process. Sometimes the quality appraisal process might necessitate modifications to the earlier established inclusion/exclusion criteria depending on the purpose of the review and the targeted evidence. These changes might result in further exclusion of studies; thus, it is vital to consider additional information from the evaluation of quality for this purpose. Lastly, for the appraisal tools, an example is provided to illustrate the existence of different appraisal tools for different evidence types. The review researcher is further advised to utilize available tools for the diverse evidence across included studies or develop them for specificity on what the process entails. Despite ongoing debates about quality evaluation (Carroll & Booth, 2015; Cook et al., 2017; Crowe & Sheppard, 2011; Neequaye, 2019), the researcher should rely on the literature for comprehensive insights on selected tools. Expertise on utilizing the tools for the various evidence types or appropriate consultations are crucial.

Step 5: Data Extraction and Synthesis. Initially termed ‘data analysis and synthesis,’ this step was renamed for consistency and clarity. Based on a sentiment by one of the reviewers, the term data analysis is generally synonymous with primary research while synthesis is more appropriate for secondary research. Most importantly, despite this revision, other reviewers were not concerned about the phrase ‘data analysis’ in the context of MMRS reviews. Data extraction is an intensive process for complex

reviews. As such, data extraction was included with the synthesis step hence the revisions yielding two steps.

Like step 3, this step revisions increased the number of processes from six to four. These steps consist of four data extraction and two synthesis steps. The data extraction steps were identify data extraction tools, identify type of information/ data to extract, extract data and code (E.g., use conceptual coding (Miles et al., 2014)) and organize coded information. The synthesis steps were identify synthesis techniques (e.g., thematic analysis) and synthesize the evidence. Thematic synthesis is provided as an example of a synthesis for clarity.

Step 6: Integration/Mixing. The integration step was kept intact despite suggestions by some of the experts to include it with synthesis. The literature (Creamer, 2018; Creswell, & Plano Clark, 2011; Heyvaert et al., 2016) supported by the findings for this study indicate that integration is integral to MMR and its applications (Fetters & Freshwater, 2015). As such, integration significantly distinguishes MMRS reviews as application of MMR (Heyvaert et al., 2016), given the process for pooling evidence from varied types and sources to inform a mutual research purpose. It is therefore vital that integration stands out among the other procedures involved in executing MMRS reviews.

Modifications to this step included reducing the number of proceses from three to two namely: identify techniques for integration (e.g., matrix approach, qualitative comparative analysis (QCA) and justify integration techniques. Futhermore, examples of integration techniques are provided in the advice column for clarity on the process.

Step 7: Writing the Report, Presentation & Interpretation of Results. The final step was revised to make it more comprehensive and inclusive. This step accommodates the complexity involved in disseminating results and findings for MMRS as a complex review approach. Consideration for the diverse purposes that influence the processes, decisions and contexts for executing this step are factored into the procedures and advise provided. Two procedures define this step: revisit intended purpose of the study and develop appropriate means for reporting results and findings with the intended audience. This step is largely variable subject to the review's purpose. The users' needs essentially determine the final product for the review. It is worth emphasizing the need to adapt this step to varied review studies and their respective contexts. Basically, this step links the review process to the results impacting its worth to the users. Table 9 shows the revised CRS framework with discussions for respective steps and processe. Figure 19 shows the framework, demonstrating its iterative nature.

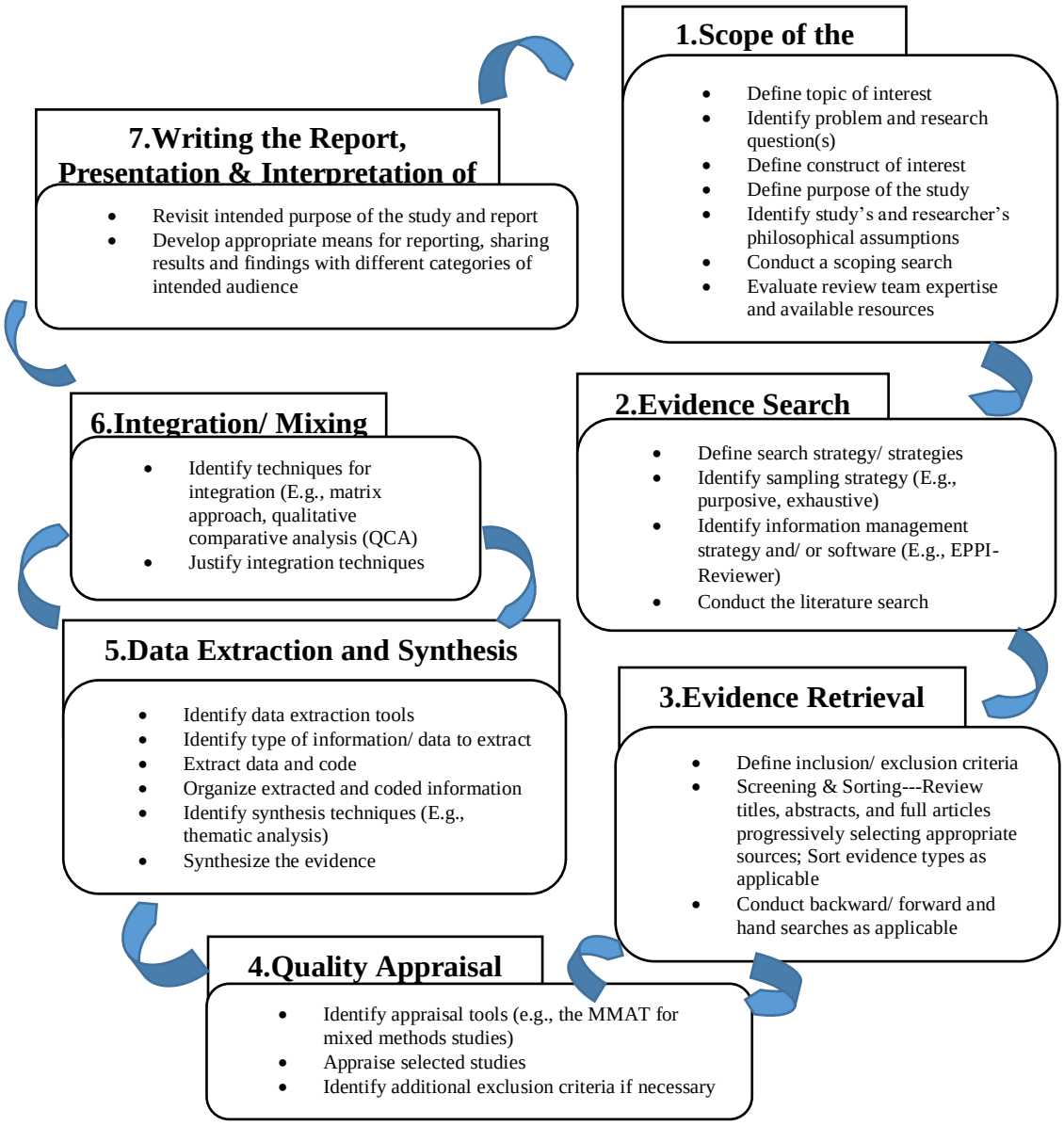
Table 9

The Revised Researcher-Developed Comprehensive Research Synthesis (CRS) Framework after Expert Review

The Revised Comprehensive Research Synthesis (CRS) Framework	
Steps for the study	**Important things to consider (Useful tips)**
Step 1: Scope of Study • Define topic of interest • Identify problem and research question(s) • Define construct of interest • Define purpose of the study • Identify study's and researcher's philosophical assumptions • Conduct a scoping search • Evaluate review team expertise and available resources • Develop a protocol	- Seek IRB approval **OR** consider ethical issues e.g., transparency in decisions made and steps taken - The scoping search provides an updated understanding of the nature and scope of the literature in a given field/ topic - Consult with stakeholders and/ or review team for clarity - Consider a frameworks to guide some of these processes e.g., the Population, Intervention, Context, and Outcome (PICO) framework
Step 2: Evidence Search • Define search strategy/ strategies • Identify sampling strategy (E.g., purposive, exhaustive) • Identify information management strategy and/ or software (E.g., EPPI-Reviewer) • Conduct the literature search	**Note:** These processes are iterative and might be revisited. - Conduct an additional scoping search if necessary - Consult with information specialist/ librarian for search process and strategies -Consider diversity in evidence types and sources - Determine whether MMRS is appropriate---reflecton step 1 and the evidence selected.
Step 3: Evidence Retrieval • Define inclusion/ exclusion criteria • Screening & Sorting---Review titles, abstracts, and full articles progressively selecting appropriate sources; Sort evidence types as applicable • Conduct backward/ forward and hand searches as applicable	- Reflect on the evidence types and decide on the best strategy/ strategies - Revisit the definition of the construct to define the eligibility criteria - Consider eligibility criteria for primary studies - Document the selection process - Consider stakeholders'/ review team's perspectives. For example, clarify inclusion/ exclusion criteria and use resources beyond academic platforms.
Step 4: Quality Appraisal • Identify appraisal tools (e.g., the MMAT for mixed methods studies) • Appraise selected studies • Identify additional exclusion criteria if necessary	- Consider issues across evidence types (E.g., use defined tools for various evidence types or develop them) - Process, and purpose can vary depending on framework and the intended goal of the study (e.g., theory development for realist reviews)
Step 5: Data Extraction and Synthesis • Identify data extraction tools • Identify type of information/ data to extract • Extract data and code • Organize extracted and coded information • Identify synthesis techniques (E.g., thematic analysis) • Synthesize the evidence	- Reflect on design, evidence diversity, purpose of study, & knowledge of review team. - Select appropriate extraction, coding (e.g., conceptual coding (Miles et al., 2014) & synthesis strategies)
Step 6: Integration/ Mixing • Identify techniques for integration (E.g., matrix approach, qualitative comparative analysis (QCA) • Justify integration techniques	- Reflect on selected design, evidence, research problem & questions - Document and justify decisions, processes, & steps
Step 7: Writing the Report, Presentation & Interpretation of results • Revisit intended purpose of the study and report • Develop appropriate means for reporting, sharing results and findings with different categories of intended audience	- Reflect on theoretical underpinnings, researcher reflexivity and personal beliefs on process - Other factors (e.g., consultations with stakeholders, intended audience and initiate discussions if needed) - Report on conflicts of interest and funding; limitations, and strengths; and recommendations for the field and future research

Figure 19

The CRS Framework: The Double Arrows show the Iterative Phases in Most Cases.



Useful Tips/ Things to consider

Step 1: IRB/ ethical issues, stakeholder/ review team consultations & frameworks (e.g., PICO)
Step 2: Additional scoping search, consultation with information expert/ librarian, reflect on step 1 to quality MMRS process
Step3: Document selection process, consult interested parties, quality MMRS process and design, and revisit construct definition
Step 4: Reflect on process and purpose of review, evidence types and respective tools (can develop or use existing tools)
Step 5: Reflect on design, evidence types, purpose of study, knowledge of review team, and select appropriate coding, data extraction and synthesis procedures
Step 6: Reflect on MMRS design, selected evidence, research problem and question, and document and justify decisions and steps
Step 7: Reflect on theoretical underpinnings, researcher and reflexivity, conflicts of interest and funding, intended audience and presenting the report, limitations, strengths and recommendations

Methodological Reflections

This Chapter dwelt on the implementation of the expert review process, the findings, and results. The Chapter laid the foundation for the expert review by discussing the content for the developed CRS framework, before embarking on the expert review process. The expert review's primary purpose was to inform revisions and modifications of the initially developed CRS framework. Seven experts from four countries and three continents were selected for this stage. The experts' level of experience in the field, areas of interest and expertise, as well as backgrounds based on disciplinary orientation and fields of practice were diverse. An attempt to select a purposive sample of experts based on levels of experience and expertise in the MMRS field proved futile following email recruitment resulting in only four willing participants out of a possible forty. Three more participants were selected through convenience sampling after recommendations from participants interviewed earlier in the expert review process. This subsequent recruitment efforts made it possible to reach the targeted number of five to seven participants.

The interviews were conducted via Zoom. Despite initial plans to conduct the interviews over a shorter time period, accommodations were made to align with the participants' availability. Interview sessions lasted between thirty minutes and one hour despite formally setting a time limit of 30 to 45 minutes. The interviews were conducted for approximately six weeks and audio recorded in real time. The transcripts were qualitatively analyzed as case studies and cross case analysis used to identify commonalities across participants' responses. The responses were organized into five sections aligning with the purposes for the interview questions identified as; general

characteristics, issues pertinent to MMRS and MMRS frameworks, the two prevalent frameworks (researcher ratings, and weaknesses and strengths), the researcher developed framework, and other issues. Summary tables and notes with supplemental materials shared by the participants informed further analyses and evaluation of the results and findings, allowing for the identification of emergent themes and sub-themes. Elements from the results supporting the identified themes and subthemes are presented in the same table for transparency (See Table 8).

The findings, themes, and subthemes were discussed and linked to related literature. This process provided insights for the research questions, the current study, and the MMRS field. It also enlightened modifications to the developed framework. Four main themes; diversity, developing field, gap between research and practice, and ongoing debates/ developments, were identified. Six subthemes; Issues of contention and agreement, classification of MMRS frameworks, gap between theory and practice, ongoing debates/developments, diversity in knowledge fields of practice and experience, and diversity were acknowledged. To conclude this Chapter, the revised Comprehensive Research Synthesis (CRS) framework is presented and discussed.

Key information from the expert review findings leading to revisions to the CRS were discussed and linked to the literature. The content for the revised CRS framework was revised to clarify the steps and procedures presented. Major changes to the framework involved restructuring hence two columns; one with the steps and the other with additional information including corresponding examples, advice, and illustrations for techniques to implement the various steps. Minor changes involved revisions to

terminology and re-orienting some of the processes tobetter align with specified steps on the framework. Overall discussions and implications for this study and the MMRS field from the expert review and the critical review covered in Chapter Three are discussed in the next Chapter.

CHAPTER 5

METHODOLOGICAL REFLECTIONS AND IMPLICATIONS FOR THE FIELD

The overall purpose for this dissertation as a methodological study was to improve the application of mixed methods research synthesis (MMRS) studies while encouraging rigorous debate about best practices. The following questions directed the study towards that end:

1. What conceptual frameworks are present in MMRS literature, and what are their strengths and weaknesses in relation to methodological concerns?
2. How does the evidence from the first question, paired with related debates and the views of experts in the field, inform the development of a new MMRS framework?

The current chapter considers these questions in the context of the study's results before discussing the overall implications of the dissertation for the field. To this end, the first part of the Chapter reflects on the existing literature on MMRS frameworks, singling out the findings for the first part of the study involving the critical review. Specifically, methodological implications for current MMRS frameworks, their strengths and weaknesses, and how they impact the application of MMRS studies are covered in this section.

The subsequent section addresses the second question, reflecting on the developed framework and implications for the field. This section elaborates on how the first

research question informs the need for development of a new framework, further deliberating on the opinions of selected experts in the field and how they contribute to the methodological debate.

To conclude this Chapter and the dissertation, the last section, informed by the first two, discusses future work regarding the new framework. This section discusses inferences relating to the comprehensive research synthesis (CRS) framework, considering what it offers, important contemplations for its application, implications for competing frameworks, and additional pursuits targeting 'best practices' for MMRS studies.

Section 1: Critical Review and the Initial CRS Framework

Frameworks are essential for effecting and directing research in various contexts (Creswell, 2015a; Creswell & Plano Clark, 2011; Tashakkori & Teddlie, 2010). With the recognition of review studies as a distinct branch of research (Gough et al., 2012), MMRS as an emerging and complex review approach is on track given efforts to advance, define, and review methodological practices. The literature shows that the use of many frameworks is founded on diverse principles relating to the practice of MMRS, but oriented to review research and mixed methods research (MMR) (Heyvaert et al., 2016; Lemire, 2017). Despite this, it is evident that only a few MMRS frameworks are used in practice (Noyes et al., 2019). Around 17 key MMRS frameworks (See Figure 6) were identified as commonly used. Literature review insights directed this study and the critical review respectively.

The literature identifies several issues as imperative to MMRS frameworks and MMRS reviews. These factors included the topic, purpose, research question and the context of the study (Gough et al., 2019; Pawson, 2006). Other issues, though seemingly vital for the practice of MMRS studies, were not explicitly discussed in the literature in the context of existing frameworks. This implies that users of the frameworks require some training or background information to understand the implications, necessity, and inclusion of certain aspects in their review process (Gough & Richardson, 2018; Gough & Thomas, 2016). For example, the theoretical assumptions grounding a given study appear to largely impact the process and decisions for MMRS studies (Mertens, 2018; Onwuegbuzi & Frels, 2016). Despite this realization, a majority of the current MMRS frameworks do not openly disclose that this is an important part of MMRS reviews. In such cases, users of the review end up implementing review frameworks without full knowledge and/or disclosure of underlying assumptions and how they influence their review process. Besides, important decisions in MMRS studies impact methodological issues and are thus relevant in the development of MMRS frameworks. These factors include procedures for data analysis, synthesis, integration, and the selection of studies (Gough et al., 2019; Noyes et al., 2019). These issues were important for shaping the foundation for the critical review.

The critical review focused on a closer exploration of current MMRS frameworks. The critical review was complemented by a scoping review. The approach to employ the scoping review within the context of a critical review better situated this study given the complexity of the MMRS field and frameworks. Literature highlights the benefit of using

simpler reviews to enhance other review types for comprehensive findings (Grant & Booth, 2009). In this case, the scoping review highlighted patterns of use (Squires et al., 2017) for current MMRS studies, setting the stage for the concluding critical review stages. The initial steps for the scoping review discussed in Chapter 3 overlapped with many of those for the critical review. The overlapping steps (See Figure 2) were revisited with the emergence of new information to avoid redundancy before embarking on the concluding critical review.

Application studies from the scoping review varied across diverse characteristics including the labels for MMRS studies, the current types of MMRS frameworks, and the authors of the studies. It was also evident that MMRS application studies were primarily carried out in western countries and within the medical field. These findings align with the MMRS and review literature in general where a majority of the research and discussions of practical and methodological issues are linked to the medical field (Gough et al., 2012) and to researchers in western countries. The scoping review indicated that the Center for Reviews Dissemination (CRD) and the Joanna Briggs Institute (JBI) approaches were the most applied MMRS frameworks. The EPPI-Center review was fourth while the realist review ranked sixth in popularity based on the scoping review. This was contrary to the literature which pointed to the realist and EPPI-Center review approaches as the most popular. This finding, though specific to this study, raises concern about the classification and application of realist reviews in the context of MMRS studies and is worth further exploration. These findings directed subsequent review steps. The final review steps; the critical review and appraisal of studies, and the synthesis and

critical analysis of findings, delved deeper into the state of current MMRS frameworks to answer the first research question.

Strengths and Weaknesses of Current MMRS Frameworks

Subsequent steps for the critical review focused on identifying key MMRS frameworks in the field based on selected methodological studies from the scoping review. Issues of relevance to the MMRS field and the strengths and weaknesses for the selected set of methodological studies were then noted accordingly conforming to the research questions and the purposes for this study. Important findings were examined after narrowing down and reviewing methodological MMRS studies from the scoping review. Concerns for MMRS studies and related frameworks were primarily focused on methodological factors. Despite this, it is apparent that methodological factors are not disparate from structural and procedural issues (Noyes et al., 2019). This is especially so because of the complexity associated with MMRS studies. The strengths and weaknesses of the frameworks were recognized based on the final set of methodological studies and informed the initial development of the Comprehensive Research Synthesis (CRS) framework.

Issues important in the practice of MMRS studies directed the evaluation of current frameworks for strengths and weaknesses. The weaknesses and strengths were related to the comprehension, interpretation, and use of current MMRS frameworks. Identified weaknesses and strengths varied from those that are general across current frameworks to those that are specific to individual frameworks. A major concern across developed frameworks was the lack of procedural clarity on implementing proposed

frameworks. Insufficient guidance, particularly on procedures unique to MMRS studies such as integration and synthesis, were of greater concern. This observation implies that the legitimacy for many application studies utilizing current MMRS frameworks is jeopardized. Moreover, questions arise on the usability of current MMRS studies in light of this concern, raising doubt about achieving the intended purpose for informing evidence-based practice. It is therefore critical to address this problem in order to justify MMRS as a useful addition to the existant plethora of reviews.

Strengths of the MMRS frameworks were identified. These strengths were retained and/or modified for the development of the CRS framework. Weaknesses were factors deemed unneccessary, lacking, or unclear. These factors were excluded, revised, or added to the new framework. Identified weaknesses and strengths are grouped under three key topics; integration, adaptability, and design. Additional considerations focused on challenging aspects of modifying basic review processes to better address the complexity for MMRS studies. Identified strengths and weaknesses speak generally to current frameworks while some speak to individual frameworks. What is considered a strength in one framework could be a weakness in another. Because of this, issues singled out as weaknesses and strengths are discussed with specific examples and elaborations provided for each case. Comprehensive discussions are provided in Chapter 3.

Integration. MMRS studies are grounded on the concept of mixed methods research (MMR). Integration is identified as an integral process for MMR and thus MMRS studies (Heyvaert at al., 2016; Lemire, 2017; Gough et al., 2012). The literature, supported by the critical review findings, highlights the failure of MMRS frameworks to

address the process of integration as it relates to quantitative and qualitative findings within a given study. Singling out integration as an important procedural aspect of MMRS studies and providing examples of applicable and verified processes enhances practicability of many MMRS frameworks. The realist review approach, for example, though identified as one of the most popular MMRS frameworks, neither mentions nor addresses integration. Other frameworks such as the Center for Review Dissemination (CRD), and the mixed methods research synthesis frameworks touch on integration but do not reinforce its importance to the MMRS process. Additionally, many frameworks require users to have an extensive understanding of the MMRS literature before implementing the framework. This expectation does not consider the developing nature of the field and its complexity, which would disadvantage novice review researchers, discouraging the application of many MMRS frameworks.

Also, the logistics for implementing integration are not directly provided, leaving the interpretation for the process open to users based on their knowledge and background. This leaves room for misinterpretation, misapplication, and improper application of current frameworks, resulting in substandard and questionable MMRS reviews. The EPPI-Center and the JBI frameworks are noted as exemplary with regard to addressing integration. In addition to mentioning integration, these two frameworks provide specific examples for executing the process. The EPPI-Center review offers the matrix method and the qualitative comparative analysis (QCA) method for later applications as possible integration processes (Thomas et al., 2019) while the JBI approach proposes the Bayesian method (Pearson et al., 2005; Pearson, 2010; Pearson et al., 2015).

Adaptability. A second concern focused on the flexibility of current frameworks, content, context, and research questions. As a complex process, MMRS requires basic logical processes to direct its implementation (Booth et al., 2019). It is agreed that too much structure would limit the efficacy of MMRS frameworks. Therefore, frameworks should guide the review process while leaving opportunities for adjustments depending on the phenomenon in question (Jordan et al., 2019; Noyes et al., 2019). Current frameworks are criticized for appearing prescriptive when in a real sense this is impractible. Many MMRS processes emerge as new details materialize and require revisiting to ensure comprehensiveness (Mertens, 2018; Onwuegbuzi & Frels, 2016). Systematic processes guide basic procedures but cannot be strictly assessed as inflexible given the nature and complexity of MMRS studies. For example, the EPPI-Center framework, though hailed for being simple, easy to understand and apply, is susceptible to misinterpretation if there is limited comprehensiveness of respective steps. This is especially true of the initial framework (Thomas et al., 2004) since recent revisions (Gough et al., 2019) attempt to address this shortcoming. On the other hand, too much flexibility complicates the interpretation of important steps, especially for novice review researchers. For example, the realist review framework is criticized for leaving too much room for interpreting steps, making it too complex to implement and to gauge existing studies that apply it (Barnett-Page & Thomas, 2009; Grimshaw, 2010; Shepperd et al., 2009). A balance between structure and flexibility is thus necessary for better outcomes.

Design. A third concern addressed research design. The overall approach relates to the sequence for synthesizing selected evidence for the study. For example, the review

researcher decides on the overall review design among contingent, segregated, or integrated designs (Sandelowski et al., 2006). Like any research study, to justify important decisions in an MMRS review, the key procedures should be defensible. Justification equally applies to decisions on overall design as well as the evidence strands since these processes complement each other (Gough et al., 2019; Jordan et al., 2019). Most of the current frameworks fail to articulate the necessity to support choices relating to design and many times reinforce certain designs more than others. This concern brings up the need for emphasizing transparency in relation to addressing methodological issues in design for current frameworks.

While the weaknesses addressed above primarily speak to methodological aspects, structural characteristics are noted as relevant for the successful implementation of MMRS studies. Three issues were identified in relation to this concern. The first issue relates to the ability for MMRS frameworks to take into account the underlying theory driving the research questions. As noted earlier, the complexity for MMRS studies is mainly due to the utilization of diverse evidence to answer complex research questions. Methodological and procedural decisions are influenced by the philosophical and theoretical assumptions that ground the synthesis of the respective evidence (Onwuegbuzi & Frels, 2016). Though these underlying assumptions are not necessarily methodological, their role in the review process is worth articulating to ensure transparency. The purpose of the review and the intended users determine whether these assumptions are spelled out in the final product or included in supplementary materials.

Despite the role of the theoretical background in shaping the MMRS review process, many of the current frameworks do not include this aspect in their major steps. The realist review is the only framework that includes the theoretical and philosophical assumptions as critical aspects for the review process (Pawson et al., 2005; Wong et al., 2013). Other frameworks such as the comprehensive literature review (CLR) framework by Onwuegbuzie and Frels (2016) acknowledge the role of theory in shaping the review process but do not include this as a characteristic of the presented framework. To reinforce the importance of underlying theory and philosophical assumptions to MMRS reviews it is necessary to include this as part of proposed frameworks.

A second concern relates to the adaptability of the frameworks but is not directly associated with methods. The content, intent, and type of both the evidence and research question for MMRS studies (Booth et al., 2019; Noyes et al., 2019) vary from one study to another. For example, a review intended for policy and one for purely understanding the literature might consider different characteristics when selecting evidence for the review. These differences impact the processes and decisions made during the review. While some current MMRS frameworks attempt to address contextual features so they can be kept in mind when answering the research questions, the majority do not. Moreover, the definition of 'context' is vague among current systematic review tools (Booth et al.) while issues relating to use that are central for adapting the frameworks are not clearly articulated. Though not among the frameworks selected for the critical review, Mertens (2018) proposed a framework that emulates the transformative view. In this

framework, Mertens emphasizes the importance of the context of the review and that of the evidence reviewed in directing the study.

Finally, other issues relating to MMRS studies including structure and terminology were considered for the new framework. Structural issues such as steps that are well laid out and show meaningful progression were noted as important for effectively implementing MMRS reviews. While most of the current MMRS frameworks arguably present their steps well, the realist review is once again lauded as the best in this regard (Taylor, 2018; Wong et al., 2013). The concern for terminology reflects on the plethora of options available in the MMRS and review literature fields in general (Cooper, 2015). Terminology is thus identified as a critical factor in the successful implementation of any framework. In this study, the variable labels used to reference MMRS studies complicated the search process. This was especially challenging since potential studies for the review were considered across diverse disciplines, implying differing database setting and rules. Soliciting guidance and advice from subject specific librarians during searching ensured a comprehensive and more directed process.

The issues discussed above in addition to the literature review findings were foundational for the development and drafting of the initial CRS framework. The framework is summarized below.

The initial CRS Framework

The draft framework was developed following the critical review findings. First, methodological issues such as integration, synthesis, searching, and evidence selection were addressed. For example, integration is included as a separate and distinct process to

highlight its significance for MMRS studies. Missing steps such as consideration for the phenomena of interest, definition of the construct of interest, and context of the study and selected evidence were included. Other steps such as quality evaluation and searching and retrieving of studies were expanded to outline key processes that characterize them for clarity and comprehensiveness. Second, contextual issues including the role of the users of the review, the expertise of the review team, and the purpose for the study were included. Finally, structural issues including terminology, common language, length, and comprehensiveness were instrumental in defining the various steps. This information directed the expert review process and informed the initial CRS framework (Table 6). Detailed discussions regarding the draft framework are provided in the first section of the previous Chapter.

The realist and EPPI-Center review were identified as the most used frameworks in the field following the critical review and informed by the literature. These frameworks were then evaluated per the researcher developed "Mixed-Methods Research synthesis (MMRS) frameworks' rubric," leading to the identification of the realist review framework as the better of the two frameworks with regard to quality for sampling, design and integrity, and structure and clarity. Additional feedback on the developed tool and the evaluation of the two most prevalent frameworks was also sought through the expert review.

Section 2: The Expert Review and the New MMRS Framework

The main goal for the current study was to address methodological concerns in the application of MMRS studies. Despite apprehensions on the prescriptive implications

of methodological processes in mixed methods research and related processes, it is important to note that the complexity of advanced applications calls for general guidelines for consistency in best practices. This realization supported the need for the development of the new framework in this study. An expert review guided revisions to the CRS framework. Seven reviewers provided feedback on their background, experience and work in the MMRS field; issues pertinent to MMRS and MMRS frameworks, the two prevalent frameworks (researcher ratings and weaknesses and strengths); and the initial CRS framework. The expert review validated most of the observations in the literature and the critical review findings, as expected. New information emerged regarding the classification of MMRS frameworks and terminology use.

The Expert Review

The reviewer's feedback addressed key issues on the CRS framework and MMRS frameworks broadly. Overall, reviewers' sentiments concurred with observations in the literature and majority of the findings for the critical review. Key issues in the reviewers' discussions were directed towards methodological, procedural, and practical issues in the creation and use of MMRS frameworks. Moreover, the experts agreed with the indentifcation of the realist and EPPI-Center frameworks as the most used as noted in the literature yet contrary to the results for the review of selected application studies. Other issues emerged in relation to the literature and are discussed.

Methodological elements examined matters of importance to the main research question and were fundamental to the focus for this study. First, the need for MMRS frameworks to highlight underlying theory was crucial. The reviewers recognized this as

a shortcoming among current frameworks, with the exception of the realist review. Second, reviewers pointed out the applied purpose of the research and resulting methodological implications. This was crucial in apprising processes requiring the solicitation of input from the users and funders of the review. This consideration would ensure that resulting reports are useful to the intended audience. The understanding that MMRS studies are necessary for evidence-based purposes situates them as important tools for producing results that are actionable. Third, there is a need for adaptable methodological features that are applicable to different research questions. As complex review approaches, MMRS studies address multifaceted review questions. The context and phenomena of both the primary research reviewed and the MMRS review study are important (Mertens, 2018). It is worth noting variations in the contexts, purposes and phenomena of interest might necessitate procedural differences that might yield differing outcomes for MMRS studies addressing similar questions. Thus, it is important that frameworks articulate this characteristic clearly to avoid misrepresentation and misuse.

A key practical issue relates to the clarity, specificity, and comprehensiveness of a given MMRS framework. While clarity speaks to the face value of the framework and easy understanding, specificity calls for the consideration to include examples for executing processes such as integration. Comprehensiveness on the other hand calls for the inclusion of sufficient details for each step of the framework.

Review literature is plagued by a terminology challenge (Paré et al., 2015). Use of diverse terminology to reference the same practice is a concern for review research that can result in misinterpretation or misapplication of processes. Mixed methods research

scholars continue to debate the definition and use of important concepts such as integration (Creamer, 2018; Fetters & Freshwater, 2015; Olofson & Garnett, 2018). Since MMRS reviews are informed by both review research and mixed methods research, it is important that frameworks provide illustrations when using terminology that is unclear in the field or not common.

Other issues were considered of relevance to MMRS studies and frameworks but were not directly associated with advancing the methodological debate. These issues addressed the classification of MMRS studies, the application of MMRS frameworks, and the language used in MMRS frameworks.

The classification of MMRS frameworks and particularly that for the realist review approach unexpectedly came under scrutiny. Classification of MMRS frameworks did not appear to be a concern in the literature with regard to the realist review at the time of this study. Some reviewers argued that the classification of the realist review framework as an MMRS framework was inappropriate and should be reconsidered. This finding perhaps speaks to the limited number of MMRS application studies utilizing the realist review framework as witnessed in the early stages of the critical review. While several resources for understanding and using realist reviews exist, realist reviews have largely targeted qualitative and evaluation research practiced in the health and medical field. Broader applications and discussions across other disciplines and among MMRS experts would inform this debate.

Application studies in research affirm or disconfirm the theoretical reasoning behind innovations. Reviewers voiced concerns about the need for practical applications

of current MMRS frameworks to inform arguments about methodological debates and advances.

Language use introduces an interesting perspective about current frameworks. Language impacts the interpretations that accompany current MMRS frameworks. Some of the reviewers' questioned the usage of some terminology such as data analysis, synthesis, and integration in the context of review research and in this case MMRS reviews. For example, one reviewer was concerned about the phrase 'data analysis' in MMRS reviews. Despite this concern, the term data analysis is extensively used in review research (Cooper, 2010; 2015). Moreover, this phrase is used in MMR studies when referencing integration and synthesis processes (Creswell & Plano Clark, 2011, 2017). This concern necessitates careful consideration of the lingo used with regard to various steps along with the implications for the review and for the framework. Additionally, identifying the specific terms that might lead to certain misunderstandings is important.

The expert review complemented by the findings of the critical review and relevant concerns in the literature informed revisions to the CRS framework. These are summarized next.

The Revised CRS Framework

The comprehensive research synthesis (CRS) framework provides a flexible and all-inclusive approach for carrying out MMRS studies. The framework at this point of its development has several attractive features. First, the development process considered current literature as well as the opinions of experts in the field. The revised CRS

framework was primarily informed by expert review feedback. Several issues were addressed based on what reviewers said. Additions to the framework included consideration for conceptual issues, terminology, and procedural aspects.

Conceptual issues focused on foundational ideas such as 'quality evaluation.' Terminology examined included use of important labels for various processes such as integration and synthesis. Procedural aspects looked at suggestions to revisit the role of specific guidelines to ensure flexibility. For example, some reviewers suggested the inclusion of the option to keep or bypass the use of theory underlying the research question, depending on the intended purpose and audience for the review. Additionally, reviewers argued for the importance of including examples for specific fields with respect to certain steps. This was especially important for steps that are evolving with regard to debates in the field such as integration (Creamer, 2018), synthesis (Lemire, 2017), and quality evaluation (Booth, 2017; Talbott et al., 2018). Providing examples and including additional information or advice to guide the implementation of such processes was viewed as important. In response to this concern, the framework presented in Table 6 was split into two columns with one presenting the comprehensive steps and the other useful tips, guidelines, and advice on carrying out the respective steps (See Table 9).

Another concern voiced by the reviewers that informed revisions to the CRS framework was based on concerns about the review process. Examples of issues addressed included the need for a team of experts, with consideration for diversity in skills required to engage methodological demands given the diversity in evidence sources. Current efforts to improve the understanding and practice of MMRS studies

highlight the importance of expertise for various procedures (Jordan et al., 2019; Noyes et al., 2019).The recognition that the MMRS process is non-linear further necessitated the inclusion of additional notes and commentary to better guide users. A diagram (See Figure 19) further illustrates key iterative processes in addition to the summary. Key iterative processes are indicated by feeback loops. Additional information for respective processes reinforced the need for transparency in the MMRS review process.

The framework is also focused on clarity, comprehensiveness, and flexibility when implementing procedural steps for MMRS studies. Through proposing detailed steps with clear and distinct procedures that are defined by specific methodological guidelines, the CRS framework offers a promising approach for implementing MMRS studies. Figure 19 shows the steps in a different light presenting an alternative means for users to conceptualize the framework processes. This is particularly useful to capture the iterative nature for many of the steps and MMRS reviews in general.

Finally, despite focusing on the two most used frameworks to highlight the strengths and weaknesses of MMRS frameworks, an effort was made to consider other issues in the literature about general shortcomings and strengths of MMRS frameworks. These issues were considered when developing the CRS framework and were reinforced by the sentiments of the selected expert reviewers. Comprehensive discussions about specific revisions to the framework and the expert review were covered in the Chapter 4.

Besides its robustness, it is worth acknowledging that the CRS framework like any scientific tool is not without its shortcomings. Two major limitations define the development of this framework. First, the MMRS field is still in its infancy with ongoing

debates about methods and methodologies, and conceptual and practical issues. Despite the efforts to streamline practices, there are foundational disagreements. This means that the CRS framework, despite its flexibility, is likely to require future revision to adequately meet the needs of MMRS studies. Moreover, the fact that there are ongoing debates and discussions about foundational concepts such as integration and synthesis (Noyes et al., 2019) calls into question the legitimacy of the MMRS approach in general. These concerns translate to any applicable measures to advance the respective MMRS methods and methodology. It is therefore necessary that rigorous discussions focus on contextualizing the various conceptual challenges (translated from primary and traditional review research) and the resulting consequences for MMRS studies.

Second, despite its attractive characteristics, the CRS framework is at this point theoretical. Application studies would tease out the framework's strengths and weaknesses to better gauge its viability. Separately evaluating methodological components such as the synthesis of qualitative and quantitative evidence paired with associated concerns would enlighten overall efforts to address methodological challenges. Recommended as important next steps for future research efforts are studies that focus on application and on methodological issues.

In conclusion, this study informed the development of an improved and comprehensive MMRS framework and sheds light on the MMRS field and MMRS frameworks. Guidelines stipulated by the CRS framework are general to MMRS studies regardless of the field of application. To use the CRS, one has to first, through the first three steps, establish that the purpose of the study is best addressed by an MMRS study.

If otherwise, it is advisable that one stops and considers alternative review approaches for achieving the desired goal for the review. If it is established that an MMRS study is appropriate, the review team should reflect on their expertise and various skills and knowledge before proceeding. Outsourcing is recommended in case of inadequate skills or lack of any necessary expertise. Notably, the application of the CRS raises expectations for research expertise of the review team requiring careful execution of each step while reflecting on the purpose of the review. Additionally, the complexity associated with the CRS steps coupled with their iterative nature calls for appropriate utilization of respective information management, retrieval, and extraction software.

While larger corporations such as the JBI and EPPI-Center have developed software for handling and retrieving information, access issues might hamper other researchers from utilizing them. Review researchers can consider available software like Zotero, which is freely accessible, for managing, retrieving, and extracting information. Other software like Refworks, which is accessible through various institutions is also useful for managing and retrieving information. Other software exists, including R programs. Review researchers are advised to carefully explore and select necessary software based on expertise, training, and the goal for the search and evidence retrieval processes in the context of the purpose of the review. It is worth noting that information on software is still unfolding and users of the CRS framework should be open to exploring and settling on the most suitable resources based on their circumstances.

Highlighted in the next section are recommendations for further research.

Section 3: Final thoughts---Implications and New Directions

This study brings forth important findings for MMRS frameworks, MMRS studies, and review research in general. First, this study's methods exemplified an application for complex approaches to review studies. In particular, the critical review was supplemented by a scoping review. This approach was pragmatic and allowed a simpler review approach, in this case the scoping review, to reinforce another, the critical review, for better outcomes (Grant & Booth, 2009). Also, the expert review added a new dimension to issues under debate in the MMRS field presenting an example of using primary research to bolster review findings in the context of current issues (O'Mara-Eves & Thomas, 2016). For example, in this study, through the expert review, it became apparent that the classification of realist reviews as MMRS frameworks was a concerning issue. Some of the reviewers were certain that the classification of the realist review as an MMRS framework was reasonable, others were not sure but understood why the classification could be questioned, while others were certain that the classification was inaccurate. This information was not apparent in the literature even after the critical review. This methodological strategy therefore has implications for the review field in general. Explorations with similar methodologies for complex reviews like this are worth attempting to further discussions in the field.

The study shed light on concerns in the MMRS field. Ongoing challenges and debates center on conceptual and practical issues. Conceptual issues, starting with the definition of MMRS reviews, given the foundational impact of mixed methods research, is critical. The terminology dilemma in the literature speaks to this concern with different

researchers attempting to best capture the idea of a ‘complex approach collating diverse evidence sources to answer a given research question.’ This concern was further reflected in the expert review discussions where a couple of veteran researchers in the field strongly voiced their discomfort with the MMRS label and especially the conceptual foundation of mixed methods for the approach. They went on to suggest alternative labels for the approach, citing better representation for the process and its intended goal. This concern raises questions about the foundational concept for MMRS reviews

Additional conceptual concerns touched on distinguishing methodological features for MMRS studies such as underlying typologies and integration and synthesis techniques. Ongoing works and arguments about typologies guiding MMRS reviews, as well as techniques for integration and synthesis, and the implications for understanding evidence (Noyes et al., 2019), exemplify an evolving field. Typologies with regard to synthesis of diverse evidence play a critical role in directing the review process. For example, a review examining the same issue could yield very different results if evidence is synthesized with qualitative evidence informing the quantitative evidence strand or vice versa. A decision on a suitable typology for an MMRS review is an important step. The purpose of the review should direct the typology, in addition to the broader decision to engage in an MMRS study at all.

Foundational processes including integration and synthesis are critical for the MMRS process. First, it is agreed that MMRS studies are founded on the concept of mixed methods research. In this context, integration is central to the methodological process for MMRS reviews and thus relevant when defining guiding frameworks.

Debates on the techniques for integration and its implications for understanding evidence are ongoing (Burch & Heinrich, 2016; Creamer, 2018; Olofson, & Garnett, 2018). Some researchers, as evidenced by one of the participants' responses, dismiss the label—Integration—arguing for the need to focus on what the process entails rather than labeling it. Second, like integration, techniques for synthesis processes of diverse evidence and guidance on their usage are still evolving. Syntheses of qualitative evidence are the most controversial and lack clarity on the information most relevant for review studies (Major & Savin-Baden, 2010; Melendez-Torres et al., 2017). This concern impacts MMRS studies as applications of MMR. These issues call for further debate on specific aspects defining MMRS reviews.

Given the value of research frameworks in facilitating the research process, it is important to examine practical issues that impact their efficacy in addition to conceptual issues. It is imperative that the methodological process including both conceptual and logistical issues is carefully considered when using a given framework. Several characteristics were noted as instrumental for well defined MMRS frameworks. Given the complexity of MMRS studies, MMRS frameworks should be adaptable, transparent and should require a team of experts (Gough et al., 2019).

First, frameworks should be adaptable to the context of the study and evidence included (Booth et al., 2019), the purpose and the research question of interest (Claes et al., 2017; Thomas, Kneale et al., 2019). Second, to ensure ttransparency, MMRS frameworks should be comprehensive, well articulated in regard to the method and methodology, and consider the non-linear process associated with MMRS reviews by

clearly explaining iterative steps. Finally, MMRS frameworks should reinforce the importance of including a team of experts (Noyes et al., 2019). In this case, the diversity in knowledge and skills should be clear to potential users of the framework to legitimize resulting reviews (Petticrew et al., 2019). For example, librarians or information scientists should be included in the review team or consulted extensively for comprehensive evidence search processes (Gough et al.). The role of librarians or information scientists is underrated in the review process despite its critical role in shaping the direction of review studies. In this study, librarians were instrumental in the evidence search, management, and retrieval process considering challenges with diverse terminology for MMRS and the newness of the field. This experience reinforced the importance of experts with information handling knowledge for review studies. Methodological and content experts are also important. This need for diverse expertise for potential MMRS review researchers raises the expectations in their training and knowledge which is especially important when applying the CRS framework.

Second, logistical and procedural factors are crucial for enforcing methodological processes and practicality of MMRS frameworks. Futhermore, the lack of concensus or perhaps guidance on best practices when adopting basic review processes such as defining the research question, searching, and quality appraisal, are still developing. For example, terminology regarding the quality appraisal process is evolving. Specifically, the terms reliability, validity, and trustworthiness are widely misused across studies (Guba, 1990; Guba & Lincoln, 1994; Lincoln et al., 2011). The credibility of the quality evaluation process remains in question for qualitiative, quantitative, and mixed methods

studies (Claes et al., 2017; Cook et al., 2017; Grimes et al., 2018). Additionally, in mixed methods, the quality of integration impacts the value of the resulting review. These issues, prevalent in traditional review studies, impact ongoing contemporary review developments. It is necessary that review researchers remain vigilant in keeping up with developments, and evaluating how these issues impact MMRS reviews.

In line with the conceptual, methods, and methodological developments, MMRS stands out as an application that bridges the gap between research and practice. As such, it is essential that researchers collaborate with practitioners in effecting developments in the MMRS field, especially since MMRS is founded on the concepts of mixed methods and review research practices. In this study, during the expert review, it was clear that most of the participants who emphasized the importance of considering stakeholder views in the MMRS review process were currently enegaged with or had engaged with policy and practice work. In this regard, this observation has implications for graduate programs in research methods when considering applications such as the MMRS.

Given the recognition of review research as its own field of research, it is essential that research methods programs offer students sufficient training in review methods along with traditional methods. Such a foundation will equip more scholars with the much needed knowledge and skills for engaging in complex review applications such as the MMRS. Consequently, for students to successfully apply the CRS framework they will need sufficient theoretical training as mentioned above, hence promoting further discussions in methodological and practical issues for the MMRS field. Finally, such training will expose more scholars to the much needed collaborations between

researchers and practitioners that is essential to comprehensively address contemporary research and evaluation questions to inform policy and practice.

In conclusion, this study highlights important findings in the MMRS field with a focus on MMRS frameworks. Results were primarily focused on methods and closely related issues. It is agreed that MMRS is a developing field with great potential for addressing complex research questions. Like any new field, controversies and promises are endemic, calling for rigorous discussions and application of proposed frameworks to comprehensively inform ongoing research endeavours and methodological and theoretical developments. While ongoing discussions about best practices in MMR and MMRS in individual fields (e.g., Erkkilä, J. (2016; Neequaye, 2019; Crawford & Tan, 2019) are important, collaborations across fields of research and practice as well as diverse disciplines will further enrich the growth of the field. While the CRS framework offers a promising tool for research, it is necessary to utilize it with a pragmatic perspective and with caution given current debates in the field.

To add to the development of the CRS framework, this study brings to light important issues that require further discussions on methods, methodology, and conceptual and practical aspects of MMRS studies. As evidenced in this study, it is necessary to continue debates beyond the development of the CRS framework. The attempt to evaluate the effectiveness of the two most prevalent frameworks revealed that developing an effective tool requires intensive processes, consultations, and considerations that are beyond the scope of this study. Moreover, following the expert review feedback, it emerged that it may be more effective to evaluate application studies

utilizing various frameworks rather than evaluating conceptual framework development studies. Such investigations will better inform judgements on the utility of current MMRS frameworks. It is agreed that the practice of MMRS might not adhere to a specific framework. This might necessitate defining basic features of MMRS frameworks and allowing for frameworks to be developed across differing disciplines. Moreover, the purposes for conducting MMRS studies are essential in directing key methodological characteristics (Noyes et al., 2019). As part of this study, the development of a tool to evaluate MMRS frameworks, which was used to evaluate the two most prevalent MMRS frameworks, was explored. Since the main focus of this study was to develop the CRS framework, efforts to improve the tool were not pursued following the experts' feedback. Therefore, investigations towards effecting this purpose are recommended as areas for future research.

This study, in addition to developing the CRS framework, as discussed above, highlights important issues along with controversies surrounding the MMRS review process. Many of these issues, discussed above, are foundational to the MMRS review process. For example concerns about language and terminology, though not actively parsued in this study, are important for the MMRS field. Setting standards for basic MMRS processes and practices is important to clarify some of these concerns. Standards are an important part for informing practice in any field (Montrosse-Moorhead, & Griffith, 2017). Future research is thus needed to provide clarity on these issues in the field. For example, application studies utilizing different MMRS designs and informed by the CRS framework are suggested. Furthermore, explorations targeting the viability for

the CRS framework and across disciplines are recommended to provide understanding for appropriate modifications in diverse contexts of application. Specific focus on aspects that have traditionally not been given emphasis in review research and MMRS reviews such as definition of the construct and philosophical foundation is encouraged to understand how they impact the review process and outcomes through practical examples. In addition, encouraging new and upcoming researchers to participate in the methods and methodological developments such as through dissertation work (E.g., Joubert, 2017; Lemire, 2017) would propel the MMRS field forward. Finally, complexity in research is argued to manifest via an "interventions'perspective, a systems' perspective or both" (Noyes et al., 2019). Explorations demonstrating how the CRS accommodates research questions given this understanding would further strengthen its foundation. For example, there is a need for future research to explore the development of an extended manual for using the CRS.

Chapter Summary

This dissertation resulted in the creation of the comprehensivce research synthesis (CRS) framework. The CRS was informed by current MMRS frameworks and complemented by the views of experts in the field. The MMRS offers a multipurpose tool for MMRS studies and provides guidance on basic steps and procedures. The utility of the CRS depends on ongoing concerns and debates in the MMRS field. Modifications of the CRS are anticipated in this regard. Elaboration and clarification of issues of concern in the field is recommended to better inform the application of the CRS. As a theoretical tool in it scurrent state, application studies utilizing the CRS are encouraged to motivate

debate on its utility. This study therefore lays the ground for crucial debates about the MMRS process and provides an approach to address current methodological concerns. Methodological concerns are centered on the purpose, process and practice of MMRS studies. For example, it became apparent through the expert review process that the classification of MMRS frameworks is crucial to understand and address methodological issues in the field. This concern, specifically directed towards realist reviews in the context of MMRS research, is worth examining and clarifying. Other concerns including the labels used to identify MMRS studies and their implications for the process as well as issues about the purpose of the MMRS review and its significance in shaping the review are also worth examining closely. Clearly, contentious and emergent issues in the MMRS are crucial for future developments of the CRS framework while advancing the field.

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APPENDIX A: SUMMARRIES AND TOOLS FOR STAGES 1 AND 2 OF THE STUDY

Table 1

A Summary of the Initial Inclusion and Exclusion Criteria

Inclusion	Exclusion
• Methodological MMRS studies • Application / illustrative MMRS studies • Peer-reviewed and Gray literature providing insight on the MMRS process • Any time period • Written in OR translated to English • Any discipline, field, and research area	• Other review studies • Qualitative, quantitative, or mixed methods specific reviews OR design focused rei research e.g., experimental studies • Primary studies • Secondary (reviews of reviews) review studies (E.g., Umbrella reviews)

Table 2

Summary of the Revised Inclusion and Exclusion Criteria for the Initial Review

Inclusion	Exclusion
• Methodological MMRS studies specifically using one of the synonyms for MMRS in their title of abstract • Other review studies applying MMRS processes • Integrative reviews that apply an MMRS framework • Commentaries, editorials, and other grey literature that mentions and addresses MMRS methodological issues • Conference abstracts with seemingly sufficient details on MMRS processes	• Methodological studies not using MMRS or its synonyms in the title or abstracts • Review studies using the term "systematic review" broadly ○ Review studies complemented by primary studies or vice versa • Integrative reviews (inconsistencies in usage and application. Also resulted in significantly many results when included in search) • Commentaries, editorials, and other grey literature that mentions BUT do not address MMRS methodological issues • Duplicates (Exact and close in '*Refworks'*)

	• Proposals (Follow-up searches done to identify the associated completed studies) • Conference abstracts with limited details on MMRS processes

Table 3

A Summary of the Search String Combinations for Initial Systematic Searches Across Different Databases

Search String	**Google Scholar Results**	**Web of Science Results**	**ProQuest Central**
"mixed methods research synthesis" OR "mixed methods systematic review" OR "systematic mixed studies review" OR "mixed methods synthesis" OR "integrative reviews" OR "mixed methods mixed research synthesis study"	7450 (2610)	219 (132)	1386 (551)
("mixed methods research synthesis" OR "mixed methods systematic review" OR "systematic mixed studies review" OR "mixed methods synthesis" OR "integrative reviews" OR "mixed methods, mixed research synthesis study") AND ("mixed methods research protocol" OR "conceptual framework")	7450 (2610)	3 (3)	244 (87)
("mixed methods research synthesis" OR "mixed methods systematic review" OR "systematic mixed studies review" OR "mixed methods synthesis" OR "mixed research synthesis stud*" OR “integrative reviews”) AND ("mixed methods research protocol" OR "conceptual framework" OR framework)	7450 (2460)	50 (27)	885 (372)
("mixed methods research synthesis" OR "mixed methods systematic review" OR "systematic mixed studies review" OR "mixed methods synthesis" OR "integrative reviews" OR "mixed research synthesis stud*") AND ("mixed methods research protocol" OR "conceptual framework" OR framework) AND ("knowledge synthesis" OR "literature review"	7450 (2460)	36 (6)	590 (237)

OR "evidence synthesis" OR "research utilization")			
("mixed methods research synthesis" OR "mixed methods systematic review" OR "systematic mixed studies review" OR "mixed methods synthesis" OR “integrative review*” OR "mixed research synthesis stud*") AND ("mixed methods research protocol" OR "conceptual framework" OR framework) AND ("knowledge synthesis" OR "literature review" OR "evidence synthesis" OR "research utilization") AND (method OR methodology OR "research methodology")	7450 (2460)	10 (6)	588 (236)
("mixed methods research synthesis" OR "mixed methods systematic review" OR "systematic mixed studies review" OR "mixed methods synthesis" OR "integrative review*" OR "mixed research synthesis stud*") AND ("mixed methods research protocol" OR "conceptual framework" OR framework) AND ("knowledge synthesis" OR "literature review" OR "evidence synthesis" OR "research utilization") AND (method OR methodology OR "research methodology" OR qualitative OR "Qualitative research" OR Quantitative OR "Quantitative research" OR "mixed methodology" OR "quantitative and qualitative research")	7450	11	588
("mixed methods research synthesis" OR "mixed methods systematic review" OR "systematic mixed studies review" OR "mixed methods synthesis" OR "mixed research synthesis stud*") AND ("mixed methods research protocol" OR "conceptual framework" OR framework) AND ("knowledge synthesis" OR "literature review" OR "evidence synthesis" OR "research utilization") AND ("qualitative meta synthesis" OR "qualitative synthesis" OR "qualitative meta-analysis" OR "quantitative synthesis" OR "quantitative research synthesis" OR "meta analysis" OR metaanalysis OR "meta-synthesis" OR "methodologically inclusive" OR "mixed research synthesis" OR	7450	11	360 (174)

"mixed methods review" OR "quantitative and qualitative synthesis" OR "meta-study" OR "meta-narrative") AND (method OR methodology OR "research methodology" OR “mixed methodology” OR "quantitative and qualitative research")			
(("mixed methods research synthesis" OR "mixed methods systematic review" OR "systematic mixed studies review" OR "mixed methods synthesis" OR "mixed research synthesis stud*") AND ("conceptual framework" OR protocol))	440	12	335
(("mixed methods research synthesis" OR "mixed methods systematic review" OR "systematic mixed studies review" OR "mixed methods synthesis" OR "mixed research synthesis study") AND (framework))	1570	29	321
(("mixed methods research synthesis" OR "mixed methods systematic review" OR "systematic mixed studies review" OR "mixed methods synthesis" OR "mixed methods, mixed research synthesis study" OR "systematic mixed studies review") AND (framework OR protocol))	1920	34	389

Table 4

Summary of Systematic Search Strategies for Methodological Studies across Different Databases and Indicating the Total Number of Returned Results Along with those Retained after Screening the Titles.

Database	**Search String**	**Results**	**Retained studies after screening titles**
Web of Science (Web of Science Core Collection, Biological Abstracts, KCI-Korean Journal Database, MEDLINE ®, Russian Science Citation Index, SciELO Citation Index)	("mixed methods research synthesis" OR "mixed methods systematic review" OR "systematic mixed studies review" OR "mixed methods synthesis" OR "mixed research synthesis") AND	39	4

	(“conceptual framework” OR framework)		
	("mixed methods research synthesis" OR "mixed methods systematic review" OR "systematic mixed studies review" OR "mixed methods synthesis" OR "mixed research synthesis") AND (methodology OR “research methodology”)	23	5
Google scholar	("mixed methods research synthesis" OR "mixed methods systematic review" OR "systematic mixed studies review" OR "mixed methods synthesis" OR "mixed research synthesis") AND (“conceptual framework” OR framework)	300 (1930 identified but only first 30 pages screened)	120
ERIC (ProQuest)	(mixed methods research synthesis OR mixed methods systematic review OR systematic mixed studies review OR mixed methods synthesis OR mixed research synthesis) AND ("conceptual framework" OR framework)	32	3
ProQuest (Central)	("mixed methods research synthesis" OR "mixed methods systematic review" OR "systematic mixed studies review" OR "mixed methods synthesis" OR "mixed research synthesis") AND (“conceptual framework” OR framework)	445	26
	("mixed methods research synthesis" OR "mixed	385	11

	methods systematic review" OR "systematic mixed studies review" OR "mixed methods synthesis" OR "mixed research synthesis") AND (methodology OR “research methodology”)		
PsycINFO (EBSCOhost)	(mixed methods research synthesis OR mixed methods systematic review OR systematic mixed studies review OR mixed methods synthesis OR mixed research synthesis) AND ("conceptual framework" OR framework)	22	5
PubMed (Central)	("mixed methods"[All Fields] AND "research synthesis"[All Fields]) AND ("review"[Publication Type] OR "review literature as topic"[MeSH Terms] OR "systematic review"[All Fields]) AND (“conceptual framework” OR framework)	179	26
MEDLINE (EBSCOhost)	(mixed methods research synthesis OR mixed methods systematic review OR systematic mixed studies review OR mixed methods synthesis OR mixed research synthesis) AND ("conceptual framework" OR framework)	46	2
MEDline (Ovid)	("mixed methods research synthesis" or "mixed methods systematic review" or "systematic mixed studies review" or	176	10

	"mixed methods synthesis" or "mixed research synthesis").mp. [mp=title, abstract, original title, name of substance word, subject heading word, floating sub-heading word, keyword heading word, protocol supplementary concept word, rare disease supplementary concept word, unique identifier, synonyms]		
Embase	'mixed methods research synthesis' OR 'mixed methods systematic review' OR 'systematic mixed studies review' OR 'mixed research synthesis'	158	9
CINAHL(EBSCOhost)	("mixed methods research synthesis" OR "mixed methods systematic review" OR "systematic mixed studies review" OR "mixed methods synthesis" OR "mixed research synthesis") AND (“conceptual framework” OR framework)	50	1
Totals		1855	222
After removing duplicates (Exact and Close)			178
Hand Searches Journal of mixed methods research The Journal of Research Synthesis and Multi-Method Studies Educational Review The Journal of Research Synthesis International journal of multiple research approaches.			

Backward and forward searches			

Table 5

Summary of Refined Search Strategies for Different Study Sources with Returned Results.

Database	***Refined Search Strategy***	***Results***	
		Returned	**Considered for Review**
Web of Science	"mixed methods research synthesis" OR "mixed methods systematic review" OR "systematic mixed studies review" OR "mixed methods synthesis" OR "mixed research synthesis study"	194	194
Google Scholar	"mixed methods research synthesis" OR "mixed methods systematic review" OR "systematic mixed studies review" OR "mixed methods synthesis" OR "mixed research synthesis study"	3070	300 (First 30 pages)
CINAHL (EBSCOhost)	("mixed method*" OR "mixed stud*") AND ("research synthes*" OR "systematic review*")	560	560
PubMed (Central)	("mixed methods"[All Fields] AND "research synthesis"[All Fields]) AND ("review"[Publication Type] OR "review literature as topic"[MeSH Terms] OR "systematic review"[All Fields])	241	241
PubMed (MEDline)	("mixed methods"[All Fields] AND "research synthesis"[All Fields]) AND ("review"[Publication Type] OR "review literature as topic"[MeSH Terms] OR "systematic review"[All Fields])	9	9
Eric (PROQUEST)	("mixed methods research synthesis" OR "mixed methods systematic review" OR "systematic mixed studies review" OR "mixed methods synthesis" OR "mixed research synthesis ") AND (protocol OR framework) AND (methodology OR "research methodology")	377	377

	• *Source type: Limited to articles where full text is available*		
EMBASE	'mixed methods research synthesis' OR 'mixed methods systematic review' OR 'systematic mixed studies review' OR 'mixed research synthesis'	147	147
PROQUEST (Central)	("mixed methods research synthesis" OR "mixed methods systematic review" OR "systematic mixed studies review" OR "mixed methods synthesis" OR "mixed research synthesis ") AND (protocol OR framework) AND (methodology OR "research methodology") • *Source type: Limited to articles where full text is available*	290	290
PsycINFO *(EBSCOhost)*	("mixed methods research synthesis" OR "mixed methods systematic review" OR "systematic mixed studies review" OR "mixed methods synthesis" OR "mixed research synthesis ")	61	61

Table 6

A Summary of the General Characteristics for the Included Studies from the Review of Methodological Studies before the Comprehensive Review

Framework	(Author/s, Year)	Reference Type	Citations	Author's Country	First Author Discipline
n/a	Hannes, K. (2015)	Book chapter	4	UK	Social science
Mixed methods research synthesis (MMRS)	Heyvaert, M., Hannes, K., & Onghena, P. (2016)	Book	36	UK	social science
Meta-modelling	Lemire, S. T. (2017)	Dissertation/Thesis	1	USA	Social science
A meta-framework for conducting mixed research synthesis	Onwuegbuzie, A. J., Collins, K. M., Leech, N. L., Dellinger, A. B., & Jiao, Q. G. (2010)	Book Chapter	49	USA	Social science
n/a	Sandelowski, M., Voils, C. I., & Barroso, J. (2006)	Journal Article	232	USA	Health science
EPPI - Centre framework	Thomas, J., Harden, A., Oakley, A., Oliver, S., Sutcliffe, K., Rees,	Journal Article	445	UK	Social science

	R., ... & Kavanagh, J. (2004)				
EPPI - Centre Framework	Oliver, S., Harden, A., Rees, R., Shepherd, J., Brunton, G., Garcia, J., & Oakley, A. (2005)	Journal Article	185	UK	Social science
Integrative review	Whittemore, R., & Knafl, K. (2005)	Journal Article	3911	USA	Health science
Meta-needs assessment	Gaber, J. (2000)	Journal Article	26	USA	Physical science
Realist review	Pawson, R., Greenhalgh, T., Harvey, G., & Walshe, K. (2005)	Journal Article	1631	UK	Social science
The mixed methodology based ILRP framework	Combs, J. P., Bustamante, R. M., & Onwuegbuzie, A. J. (2010)	Book chapter	18	USA	Social science
Comprehensive Literature Review (CLR)	Onwuegbuzie, A. J., & Frels, R. (2016)	Book	18	USA	Social science
Question Eligibility Source Identification Selection Appraisal Extraction Synthesis (QESISAES)	Pluye, P., Hong, Q.N., & Vedel, I. (2016)	wiki page	4	Canada	Health science
The Joanna Briggs Institute model of mixed-methods synthesis.	Pearson, A., White, H., Bath-Hextall, F., Apostolo, J., Salmond, S., & Kirpatrick, P. (2015)	Manual	12	Australia	Health science

*** n/a: illustrates publications that did not outright provide a name for the identified framework

Mixed Methods Research Synthesis (MMRS) Studies Critical Review Protocol

This form targeted general study information to allow for easy tracking of retrieved studies and for record keeping purposes.

Characteristics of interest for study tracking and chatting

- Title of the study
- Research study identification (full citation)
- Research study citation characteristics

- Study citation: Author(s) (author(s)'s names – Last name, initials)
- Year of Publication
- Country of Publication
- Publisher (Journal, Agency, Conference)
- Publication source (E.g., website)
- Type of publication (Journal article, Conference paper etc.)
- Retrieval date
- Reference type (book chapter, methodological, commentary etc.)

Mixed Methods Research Synthesis Studies Critical Review: Coding Form

This form targeted information relevant to the research questions thus informing further refining of the inclusion/ exclusion criteria.

Characteristics of interest for study coding

- Study citation (author/s, publication year)
- Discipline of leading author (background/ area of specialization)
- Disciplinary orientation of journal/publisher
- Study quality (per the study evaluation rubric)
- Framework employed/ discussed
- Theoretical foundations for the MMRS framework
- Logical steps/ citation of the MMRS framework
- Outcome and study objective: What is the intended purpose of the study (propose a distinct MMRS framework, address issues pertaining to a specific MMRS framework, etc.)
- Factors to consider when applying the framework
- Practical examples of MMRS framework use
- Richness: Description of the addressed MMRS framework
- Deviations/ modifications/ adaptations of the MMRS framework if applicable
- Additional articles: References found in the article that may lead to new frameworks or that address methodological issues on the same framework
- Theoretical foundation tied to framework and study (if application study/ methodological) – *Used in initial coding before subsequent coding for studies methodological and application studies*
- Brief notes – *Issues useful to understanding procedural steps regarding framework addressed in study*

Mixed Methods Research Synthesis Studies Critical Review: Quality Evaluation Rubric for Retrieved Studies

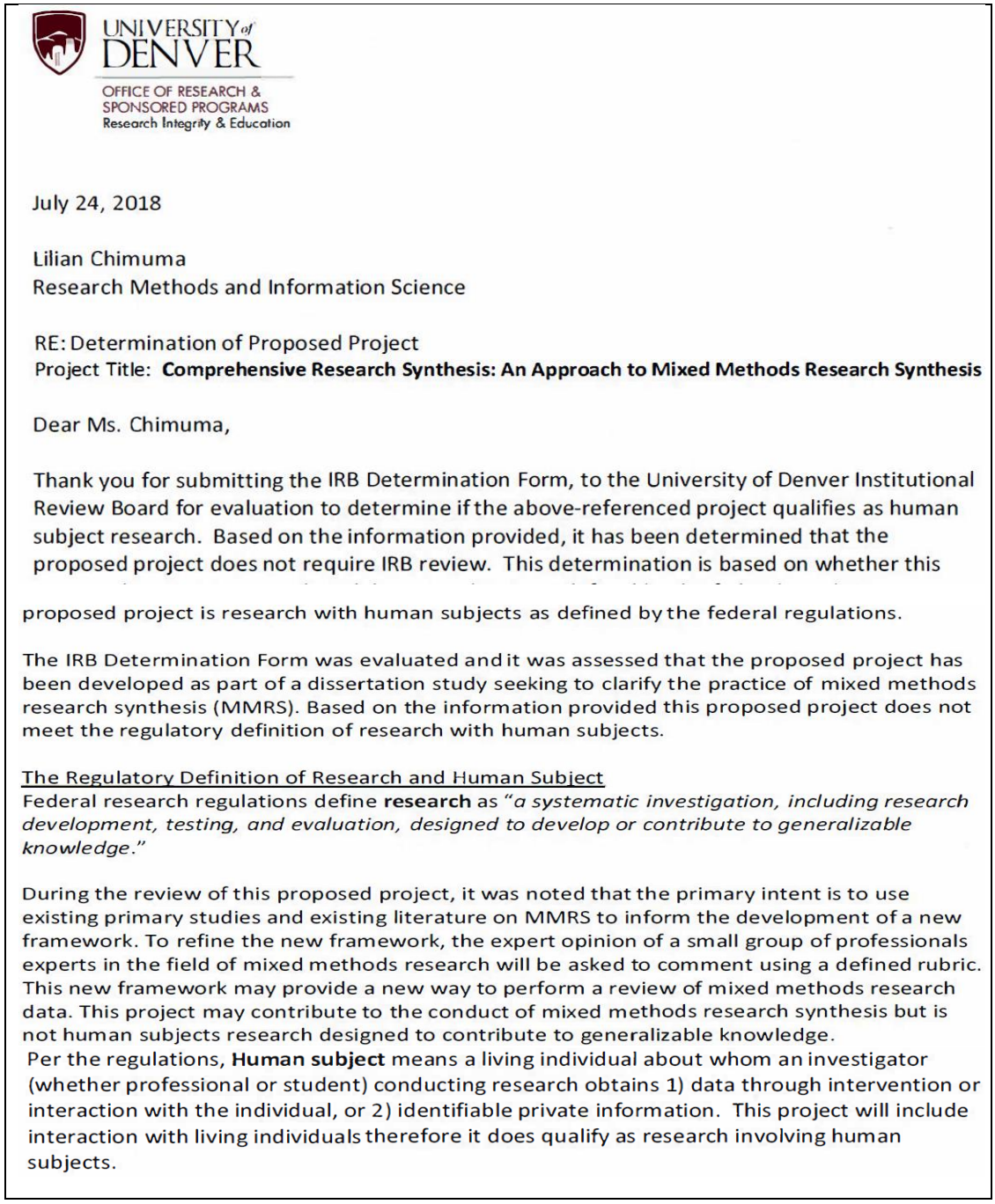
This form targeted the quality of the publications included for the final comprehensive critical review. The publications were evaluated based on their theoretical grounding and the methodological clarity of the publication hence the identified framework. Additionally, notes from references reviewed in relation to identified frameworks informed the evaluation process. The questions are scored assigned a score of 1 if the response to the questions asked 'yes'. Otherwise, the assigned score is 0 if the response is 'no'. The total score provided an overall picture of the quality of the publication. This score was considered together with the critical review exclusion criteria to inform the final set of included studies.

Characteristics of interest for retrieved study quality evaluation

- Methodological clarity
    - Clearly identifies framework employed
    - Adequately applies identified framework
    - Adheres to general review processes
    - Outlines relevant theoretical foundation(s)
    - Justifies study appropriately per theoretical stance
    - Procedural steps clearly outlined
    - Legitimates decisions made and steps taken
- Theoretical grounding
    - Offers ground breaking arguments
    - Work is largely acknowledged by other researchers (through citations, discussion etc.)
    - Addresses key methodological concerns
    - Adds to existing framework or proposes alternative approach or discusses existing framework highlighting insightful views about its application

APPENDIX B: TOOLS FOR THE EXPERT REVIEW

IRB Exemption Letter



UNIVERSITY of DENVER
OFFICE OF RESEARCH & SPONSORED PROGRAMS
Research Integrity & Education

July 24, 2018

Lilian Chimuma
Research Methods and Information Science

RE: Determination of Proposed Project
Project Title: **Comprehensive Research Synthesis: An Approach to Mixed Methods Research Synthesis**

Dear Ms. Chimuma,

Thank you for submitting the IRB Determination Form, to the University of Denver Institutional Review Board for evaluation to determine if the above-referenced project qualifies as human subject research. Based on the information provided, it has been determined that the proposed project does not require IRB review. This determination is based on whether this proposed project is research with human subjects as defined by the federal regulations.

The IRB Determination Form was evaluated and it was assessed that the proposed project has been developed as part of a dissertation study seeking to clarify the practice of mixed methods research synthesis (MMRS). Based on the information provided this proposed project does not meet the regulatory definition of research with human subjects.

The Regulatory Definition of Research and Human Subject
Federal research regulations define **research** as *"a systematic investigation, including research development, testing, and evaluation, designed to develop or contribute to generalizable knowledge."*

During the review of this proposed project, it was noted that the primary intent is to use existing primary studies and existing literature on MMRS to inform the development of a new framework. To refine the new framework, the expert opinion of a small group of professionals experts in the field of mixed methods research will be asked to comment using a defined rubric. This new framework may provide a new way to perform a review of mixed methods research data. This project may contribute to the conduct of mixed methods research synthesis but is not human subjects research designed to contribute to generalizable knowledge.
Per the regulations, **Human subject** means a living individual about whom an investigator (whether professional or student) conducting research obtains 1) data through intervention or interaction with the individual, or 2) identifiable private information. This project will include interaction with living individuals therefore it does qualify as research involving human subjects.

However, in order for a project to require IRB review, the proposed research must qualify und **both** definitions of being research and involving human subjects. This research project does NOT fulfill the regulatory definition of research but does involve human subjects per the feder regulation definition.

My evaluation, based only on the information provided, determined that the proposed projec does not require IRB review.

If you have questions regarding this determination or believe that this proposed project does qualify as human subject research, please feel free to contact me directly at 303-871-4037 or via e-mail at: Camilla.Lind@du.edu.

Sincerely,

Cami Lind, CIP
IRB Research Compliance Administrator
Office of Research and Sponsored Programs
University of Denver

IRB Exemption Email and Note on Revisions

Please note that University of Denver (DU) IRB has taken the following action on IRBNet:

Project Title: [1410368-1] Comprehensive Research Synthesis: An Approach to Mixed Methods Research Syntheses

Principal Investigator: Lilian Chimuma
Submission Type: Revision
Date Submitted: March 12, 2019

Action: EXEMPT
Effective Date: March 25, 2019
Review Type: Exempt Review
Should you have any questions you may contact Cami Lind at camilla.lind@du.edu.

Thank you,
The IRBNet Support Team

www.irbnet.org

Expert Review Interview Protocol with Instructions and Additional Details

Thank you for helping me by providing your expert opinion to aid in the development of a framework to guide the practice and application of mixed methods research synthesis (MMRS) studies. I developed the framework as part of my dissertation study.

Background

As a new and emerging application for both MMR and research synthesis, MMRS promises to better address complex contemporary research and evaluation questions. The importance of addressing method and methodological concerns concurrently are well documented in the literature. Researchers seeking to address these concerns have proposed several frameworks, but controversies are prevalent. My study addressed procedural nuances of completing an MMRS study by proposing a new framework. Your input in refining the developed framework will help to inform the practice of MMRS studies while boosting their applicability.

Instructions

You are kindly requested to participate in an interview to provide your opinion on an assessment that I conduced of two MMRS frameworks identified through a review of the literature as the two most prevalent in the MMRS field. I conducted the assessment using a rubric developed for this purpose. Based on a review of related current literature and my findings of this assessment, I developed a third framework as an alternative within the field. I also would like to get your feedback on my proposed framework.

You are provided with the following set of materials in preparation for the phone interview:

- A follow-up email describing the process and highlighting the logistics for the interview session,
- The interview protocol to guide our discussion on your opinions about the application and use of the three MMRS frameworks (two prevalent frameworks in the field, and the framework I developed),
- A summary of my ratings for the two prevalent frameworks as stated in the follow-up email. These summaries provide the scores for the two prevalent frameworks and are complemented with brief comments,
- Copies of the three frameworks: Framework 1 (Realist review), Framework 2 (EPPI-Center), and Framework 3 (Framework I developed from this study),and
- A copy of the rubric I used to rate the frameworks for more insight about the rating process.

Audio recording

I will audio record the interview session to facilitate note taking and to ensure accuracy of your comments and feedback. If you do not want to be audio recorded, please let me know, and I will only take notes during the interview.

You have the option to select an alternative mode of communication for the interview session (e.g., Skype) per your preference. No video recordings will be carried out during the interview session.

Logistics for the Interview Session

I will be contacting you at the scheduled time for the interview. I anticipate that the interview session will last between 30 and 45 minutes.

The interview questions address critical issues and concerns about MMRS frameworks. However, emergent issues will be considered for discussion and discussed only if time permits.

I will really appreciate additional comments or feedback about my study and related issues through future communications after our interview.

The University of Denver, where I am obtaining my degree, requires me to include the following statements (Risks, Benefits, and Consent) regarding informed consent, even though my study is exempted from the traditional, long form of informed consent.

Risks

There are no known physical or mental risks associated with your participation in this study. If you experience any discomfort while providing your responses you may stop at any time or reach out with questions to the researcher (lilian.chimuma@du.edu), or her dissertation advisor (Kathy.green@du.edu), or the DU IRB (irbadmin@du.edu).

Benefits

Your participation in this study is voluntary and there is no associated monetary or material compensation.

The main benefit of your contributions to this study is that it will enlighten the development of a new MMRS framework. The new framework is intended to better inform the application and practice of MMRS studies through:

- Informing the collection and generation of high-quality evidence to inform research, policy, and evaluation questions.
- Promoting better MMRS practices as an application of both mixed methods and research synthesis studies by reinforcing transparency and clarity.
- Strengthening the credibility of MMRS studies while emphasizing ethical practices.

- Encouraging dialogue and deliberation on best practices associated with the application of MMRS studies as an emerging method.

Consent

You are receiving these materials following your positive response to an introductory email sent to you by the researcher. Your positive response to the referenced email indicated your willingness to participate in the study.

This means you voluntarily agree to provide your opinion to aid in refining the developed framework. If you prefer not to continue, if you prefer not to participate in the study, please let me know and I will not contact you for the interview.

Please take all the time you need to read through this document and decide whether you would like to continue with participation in this research study.

If you decide to participate, your completion of the research procedures will indicate your consent. Please keep this form for your records.

Please direct any questions, or concerns to the researcher, Lilian Chimuma (Phone number: 513-282-8340, Email: lilian.chimuma@du.edu), her advisor, Dr. Kathy E. Green (Phone number: 303-871-2490, Email: Kathy.Green@du.edu), or the DU IRB office (Phone number: 303-871-2121, Email: irbadmin@du.edu)

Expert Review Draft Interview Protocol

Opening Questions

1. How many years have you been working/ did you work in this field?
   _____

2. On a scale of 0 to 4, with '0' being no experience and '4' being high experience, how would you rate your experience with the following concepts on theoretical and empirical contexts:

   High experience (4) ___ Moderate experience (3) ___ Average experience (2) ___ Minimum experience (1) ___ No experience (0) ___

Concept	Theoretical	Empirical
a. Qualitative Synthesis		
b. Quantitative synthesis		
c. Mixed methods research synthesis		

3. What methodological orientation/s do you primarily ascribe to (quantitative, qualitative, mixed methods)?
   _____

Questions general to MMRS

4. From your point of view, what are the steps for designing a Mixed Methods Research Synthesis (MMRS) study?

5. In mixed methods, the type of design is very important for integration. How would you address design in the context of MMRS?

Questions general to MMRS frameworks

6. What mixed methods research synthesis frameworks are you most familiar with?

7. From your perspective, what critical issues need to be considered when conducting an MMRS study for the:
   a. Qualitative synthesis component?

   b. Quantitative synthesis component?

   c. Mixed methods synthesis component?

Questions specific to the two provided frameworks

8. Have you used in your research the Realist review framework and/or the EPPI-Center framework that I provided to you with the materials?

9. In your view, what are the strengths and weaknesses of these frameworks?

Questions on Researcher ratings for the two frameworks

10. I provided you with a summary of my ratings for realist review and EPPI-Center frameworks. I would like to get some feedback about my ratings. Do you agree or disagree with the scores, and why?

Questions on Researcher developed framework

11. As I mentioned, I tried to address what I saw as gaps or weaknesses of those two frameworks by developing a third framework. In your view, what would you say are the strengths and weaknesses of the framework I developed?

12. What would you add to this framework? What would you remove from this framework? What would be one or two things I could change in this framework to improve it?

Closing questions

13. I would appreciate any additional thoughts about MMRS frameworks, and the framework I developed.

14. Are there any additional thoughts you would like to share about the study in general?

Initial Email to Expert reviewers:

Dear Dr…,

My name is Lilian Chimuma, a doctoral candidate at the University of Denver in the Research Methods and Statistics Program. My dissertation, on mixed methods research synthesis (MMRS) is to develop a framework addressing and guiding the methodological process. I am working under the guidance of my dissertation committee, Drs. Antonio Olmos, Kathy E. Green, and Duan Zhang.

I am seeking your expert opinion on the MMRS framework developed as part of my dissertation study, compared to two established frameworks. You name arose as an expert given your involvement in major methodological debates and developments in the field of mixed methods research synthesis (MMRS). I have also followed your work through conference proceedings and publications within and beyond the academy. Your participation would lie in providing feedback about my MMRS framework through a phone interview.

I will send out more details regarding your participation in my study accompanied with applicable tools in one week (week of April 1, 2019). I hope to set a possible time for the phone interview within two weeks (the week of April 8, 2019). Because I highly value your input, if you would like to schedule the phone interview at a different time, please let me know. Based on a pilot study, the interview should last about 30 to 45 minutes. I will be sending out related materials to guide our interview session shortly after I hear from you about your willingness and availability to participate.

If you are willing to participate please reply to this email with a contact phone number.

Thank you in advance for your time and participation in helping me complete my dissertation.

I look forward to hearing from you soon.

Sincerely,

Lilian L. Chimuma, Ph.D. Candidate,
Research Methods and Statistics Program, Morgridge College of Education,
University of Denver,
513-282-8340
Lilian.Chimuma@du.edu

Email to Expert reviewers:

Dear Dr…,

Thank you for your willingness to participate in a phone/ web interview for my dissertation study on mixed methods research synthesis (MMRS). Your expertise will go a long way to inform not only the development of my framework, but to highlight key issues in the field.

To aid in the scheduled interview, I am providing you in advance with the respective logistics and related study materials for your preparation.

The interview will seek your expert feedback and opinion on three MMRS frameworks. Frameworks 1 and 2 represents the realist review and EPPI-Center frameworks respectively identified as the most prevalent in the field. Framework 3 represents the framework I developed as part of this study. I have rated the three frameworks based on a rubric I created for quality, design and structure. I will be seeking your feedback regarding my evaluation process and related issues, pertaining to methodological aspects of MMRS frameworks. The following tools and items are attached to provide you with reference materials for the scheduled interview:

1. Copies of the three frameworks,

2. An interview protocol to guide our discussion,

3. A summary of the results for my ratings and scores for the three frameworks,

4. A copy of the rubric I used to rate frameworks 1 and 2

I anticipate that the interview will last between 30 and 45 minutes. During the interview, I suggest that we use the draft interview protocol to guide our discussion. The questions and your responses will address key issues relating to the two frameworks and my rating of their quality, structure, and clarity. The overall goal of our discussion will be focused on the developed framework and how to improve it so that it comprehensively covers aspects most relevant to MMRS studies.

I would really appreciate any follow-up thoughts on our discussion and related concerns via email or another phone/ web conversation as you please. I will audio record our discussion for reference purposes and to accurate details.
Note that I am able to use other forms of online communications such as Zoom, or Google Hangout. If any of these platforms are used, NO VIDEOS will be recorded. If you have not, please let me know if you prefer any of these options in place of a phone call.

Thank you once again for your time and participation in helping me complete my dissertation.

I look forward to our interview.
Sincerely,

Lilian L. Chimuma, Ph.D. Candidate,
Research Methods and Statistics Program, Morgridge College of Education,

University of Denver,
513-282-8340
Lilian.Chimuma@du.edu

Rubric for Rating the Frameworks with Descriptions

Descriptions

The two frameworks identified as mostly used and prevalent in the field were rated per a developed "Mixed Methods Research synthesis (*MMRS) frameworks' rubric"*. The rubric was based on issues identified as critical to MMRS frameworks from the first stage of the study. Appropriate measure development steps were taken before its usage. The rubric addressed three key factors relating to the framework and MMRS studies: quality, structure, and clarity. Definitions for these factors were presented on the rubric to provide additional context as defined below.

First, the researcher addressed the quality of the overall frameworks, as well as the qualitative, quantitative, and mixed methods components. Quality in this sense referred to how well the framework addressed issues related to methods, and methodological and logistical stipulations. Quality was further divided into three categories by considering the design of the framework, the sampling process, and the integrity with which it observes the respective methods and methodological requisites of the respective fields.

Next, the structure of the two frameworks was examined. The structure targeted the procedural nuances of the framework, hence the ease with which an individual can make sense of the logistical processes. The structure measured six aspects, namely: the overall framework, the leading/ dominant component/ strand, the minor component, the transition between strands, the mixing and integration of strands, and the conclusion/ ending of the framework.

Finally, the clarity of the two frameworks was evaluated. Clarity targeted the general presentation, appearance, and flow of information in the framework. Specifically, by examining whether the framework was clear, the researcher provided evidence about how easy it was for users to understand and follow the content in the framework. To achieve this goal, five characteristics were considered, namely: the overall framework, the language used in the framework, the procedures employed, the steps taken in the framework, and the general outline of the framework.

The researcher further provided additional feedback on their general understanding of the frameworks after rating them per the rubric as a written summary. This information enriched the data collected and enlightened the researcher and the experts on the preceding interview process.

Scoring Guide

The scores on the rubric ranged from 1 (the characteristic is poorly addressed) to 4 (the characteristic is adequately addressed). Intermediate scores between each score captured any uncertainty in the scoring process. These scores include 1.5, 2.5, and 3.5.

Rubric for Opinion on MMRS Frameworks								
	1 point	**1.5 PTS**	**2 points**	**2.5 PTS**	**3 points**	**3.5 PTS**	**4 points**	**Total Score**
QUALITY (Design)								
Overall	The quality of the overall design is not addressed. Supportive arguments and evidence are not provided.	Mid-level	The quality of the overall design is somewhat addressed. Supportive arguments and evidence are vague.	Mid-level	The quality of the overall design is adequately addressed. Supportive arguments and evidence are broad in some areas.	Mid-level	The quality of the overall design is thoroughly addressed. Supportive arguments and evidence are provided in detail.	
Qualitative Component	The quality of the design for the qualitative component is not addressed. Supportive arguments and evidence are not provided.	Mid-level	The quality of the design for the qualitative component is somewhat addressed. Supportive arguments and evidence are vague.	Mid-level	The quality of the design for the qualitative component is adequately addressed. Supportive arguments and evidence are broad in some areas.	Mid-level	The quality of the design for the qualitative component is thoroughly addressed. Supportive arguments and evidence are provided in detail.	
Quantitative Component	The quality of the design for the quantitative component is not addressed. Supportive arguments and evidence are not provided.	Mid-level	The quality of the design doe the quantitative component is somewhat addressed. Supportive arguments and evidence are vague.	Mid-level	The quality of the design for the quantitative component is adequately addressed. Supportive arguments and evidence are broad in some areas.	Mid-level	The quality of the design for the quantitative component is thoroughly addressed. Supportive arguments and evidence are provided in detail.	
Mixed Methods Component	The quality of the design doe the mixed methods component is not addressed. Supportive arguments and evidence are not provided.	Mid-level	The quality of the design for the mixed methods component is somewhat addressed. Supportive arguments and evidence are vague.	Mid-level	The quality of the design for the mixed methods component is adequately addressed. Supportive arguments and evidence are broad in some areas.	Mid-level	The quality of the design for the mixed methods component is thoroughly addressed. Supportive arguments and evidence are provided in detail.	

Rubric for Opinion on MMRS Frameworks								
	1 point	**1.5 PTS**	**2 points**	**2.5 PTS**	**3 points**	**3.5 PTS**	**4 points**	**Total Score**
QUALITY (Sampling)								
Overall	The overall quality and process of sampling is unclear. Supportive arguments and evidence are not provided.	Mid-level	The overall quality and process of sampling is somewhat clear. Supportive arguments and evidence are vague.	Mid-level	The overall quality and process of sampling is mostly clear. Supportive arguments and evidence are vague.	Mid-level	The overall quality and process of sampling is very clear. Supportive arguments and evidence are provided in detail.	
Qualitative Component	The qualitative component quality and process of sampling is unclear. Supportive arguments and evidence are not provided.	Mid-level	The qualitative component quality and process of sampling is unclear. Supportive arguments and evidence are vague.	Mid-level	The qualitative component quality and process of sampling is clearly outlined. Supportive arguments and evidence are vague.	Mid-level	The qualitative component quality and process of sampling is clearly outlined. Supportive arguments and evidence are provided in detail.	
Quantitative Component	The quantitative component quality and process for sampling is unclear. Supportive arguments and evidence are not provided.	Mid-level	The quantitative component quality and process of sampling is unclear. Supportive arguments and evidence are vague.	Mid-level	The quantitative component quality and process of sampling is clearly outlined. Supportive arguments and evidence are vague.	Mid-level	The quantitative component quality and process of sampling is clearly outlined. Supportive arguments and evidence are provided in detail.	
Mixed Methods Component	The mixed methods component quality and process for sampling is unclear. Supportive arguments and evidence are not provided.	Mid-level	The mixed methods component quality and process of sampling is unclear. Supportive arguments and evidence are vague.	Mid-level	The mixed methods component quality and process of sampling is clearly outlined. Supportive arguments and evidence are vague.	Mid-level	The mixed methods component quality and process of sampling is clearly outlined. Supportive arguments and evidence are provided in detail.	

Rubric for Opinion on MMRS Frameworks								
	1 point	**1.5 PTS**	**2 points**	**2.5 PTS**	**3 points**	**3.5 PTS**	**4 points**	**Total Score**
QUALITY (Integrity)								
Overall	The process for achieving integrity overall is unclear. Supportive arguments and evidence are not provided.	Mid-level	The process for achieving integrity overall is somewhat clear. Supportive arguments and evidence are vague.	Mid-level	The process for achieving integrity overall is mostly clear. Supportive arguments and evidence are vague.	Mid-level	The process for achieving integrity overall is very clear. Supportive arguments and evidence are provided in detail.	
Qualitative Component	The process for achieving integrity for the qualitative component is unclear. Supportive arguments and evidence are not provided.	Mid-level	The process for achieving integrity for the qualitative component is unclear. Supportive arguments and evidence are vague.	Mid-level	The process for achieving integrity for the qualitative component is clearly outlined. Supportive arguments and evidence are vague.	Mid-level	The process for achieving integrity for the qualitative component is clearly outlined. Supportive arguments and evidence are provided in detail.	
Quantitative Component	The process for achieving integrity for the quantitative component is unclear. Supportive arguments and evidence are not provided.	Mid-level	The process for achieving integrity for the quantitative component is unclear. Supportive arguments and evidence are vague.	Mid-level	The process for achieving integrity for the quantitative component is clearly outlined. Supportive arguments and evidence are vague.	Mid-level	The process for achieving integrity for the quantitative component is clearly outlined. Supportive arguments and evidence are provided in detail.	
Mixed Methods Component	The process for achieving integrity for the mixed methods component is unclear. Supportive arguments and evidence are not provided.	Mid-level	The process for achieving integrity for the mixed methods component is unclear. Supportive arguments and evidence are vague.	Mid-level	The process for achieving integrity for the mixed methods component is clearly outlined. Supportive arguments and evidence are vague.	Mid-level	The process for achieving integrity for the mixed methods component is clearly outlined. Supportive arguments and evidence are provided in detail.	

Rubric for Opinion on MMRS Frameworks								
	1 point	**1.5 PTS**	**2 points**	**2.5 PTS**	**3 points**	**3.5 PTS**	**4 points**	**Total Score**
STRUCTURE								
Overall	No guidance on managing and fitting together diverse evidence considering: the complexity of the research question, and the diversity in evidence and data collection and analysis approaches is offered overall.	Mid-level	Some guidance on managing and fitting together diverse evidence considering: the complexity of the research question, and the diversity in evidence and data collection and analysis approaches is offered overall.	Mid-level	Sufficient guidance on managing diverse evidence considering: the complexity of the research question, and the diversity in evidence and data collection and analysis approaches is offered overall.	Mid-level	Extensive guidance on managing and fitting together diverse evidence considering: the complexity of the research question, and the diversity in evidence and data collection and analysis approaches is offered overall.	
Leading Component	The process for addressing and outlining the leading component is neither acknowledged nor explained.	Mid-level	The process for addressing and outlining the leading component is partially acknowledged but not explained.	Mid-level	The process for addressing and outlining the leading component is acknowledged but only somewhat explained.	Mid-level	The process for addressing and outlining the leading component is fully acknowledged and fully explained.	
Transition	Transition at key points of sampling, data collection, and analysis, given diverse sources of evidence is neither addressed nor outlined.	Mid-level	Transition at key points of sampling, data collection, and analysis, given diverse sources of evidence is somewhat addressed but not outlined.	Mid-level	Transition at key points of sampling, data collection, and analysis, given diverse sources of evidence is addressed and somewhat outlined.	Mid-level	Transition at key points of sampling, data collection, and analysis, given diverse sources of evidence is extensively addressed and fully outlined.	
Integration	Integration is neither acknowledged nor outlined.	Mid-level	Integration is acknowledged but not outlined.	Mid-level	Integration is acknowledged and somewhat outlined.	Mid-level	Integration is acknowledged and extensively outlined.	
Organization	Organization is unsatisfactory and the ending is unclear.	Mid-level	Organization is somewhat satisfactory with an unclear ending.	Mid-level	Organization is satisfactory, but the ending is only somewhat clear.	Mid-level	Organization is satisfactory with a clear ending.	

Rubric for Opinion on MMRS Frameworks								
	1 point	**1.5 PTS**	**2 points**	**2.5 PTS**	**3 points**	**3.5 PTS**	**4 points**	**Total Score**
CLARITY								
Overall	Information presentation is unclear and is complex.	Mid-level	Information presentation is somewhat unclear and somewhat complex.	Mid-level	Information presentation is clear but is somewhat complex.	Mid-level	Information presentation is very clear, and straightforward.	
Language	Terminology and language used is unfamiliar to researchers across disciplinary and methodological divides.	Mid-level	Terminology and language used is more familiar to researchers from certain disciplines than others, and more familiar to researchers who identify with a given method.	Mid-level	Terminology and language used is familiar to researchers across disciplinary divides but more familiar to researchers who identify with a given method.	Mid-level	Terminology and language used is familiar to researchers across disciplinary and methodological divides.	
Logic and flow	The sentence structure is complex and challenging to follow.		The sentence structure is somewhat complex and challenging to follow.		The sentence structure is clear but somewhat challenging to follow.		The sentence structure is clear and easy to follow.	
Procedure	Procedures are unclear and poorly communicated.	Mid-level	Procedures are somewhat unclear and somewhat poorly communicated.	Mid-level	Procedures are clearly outlined but somewhat poorly communicated.	Mid-level	Procedures are clearly outlined, and communicated.	
Steps	Steps are unclear and complex.	Mid-level	Steps are somewhat unclear and somewhat complex.	Mid-level	Steps are clearly outlined, but somewhat complex.	Mid-level	Steps are clearly outlined, and easy to follow.	
Outline	The outline is unclear and reserved.	Mid-level	The outline is somewhat unclear and somewhat reserved.	Mid-level	The outline is clear but somewhat reserved.	Mid-level	The outline is clear and communicative.	
Development	The development of the framework fails to address key issues about mixed methods research synthesis studies	Mid-level	The development of the framework scarcely addresses key issues about mixed methods research synthesis studies.	Mid-level	The development of the framework moderately addresses key issues about mixed methods research synthesis studies.	Mid-level	The development of the framework comprehensively addresses key issues about mixed methods research synthesis studies.	

Please provide any additional feedback on the rated frameworks in the space below:

Table 2

A Summary of the Researcher Rating Scores for the three Frameworks (EPPI, Realist, and New framework)

Summary of ratings and scores for the two most prevalent frameworks (1 & 2)		
	Framework 1	Framework 2
QUALITY (Design)		
Overall	3.5	3.5
Qualitative Component	2.5	3.5
Quantitative Component	2.5	3.5
Mixed Methods Component	2.5	2.5
Total Scores	11/16 (0.688; 68.75)	**13/16 (0.813; 81.25)**
QUALITY (Sampling)		
Overall	4	3
Qualitative Component	2.5	3
Quantitative Component	2.5	3
Mixed Methods Component	2.5	2.5
Total Scores	11.5/16 (0.719; 71.88)	**11.5/16 (0.719; 71.88)**
QUALITY (Integrity)		
Overall	2	3.5
Qualitative Component	1.5	3
Quantitative Component	1.5	3
Mixed Methods Component	1.5	2.5
Total Scores	6.5/16 (0.406; 40.63)	**12/16 (0.75; 75.00)**
STRUCTURE		
Overall	3.5	4
Leading Component	4	4
Transition	2.5	4
Integration	1	3
Organization	4	4
Total Scores	15/ 20 (0.75; 75.00)	**19 (0.95; 95.00)**
CLARITY		
Overall	3.5	4
Language	4	3.5
Logic and Flow	3.5	4
Procedure	4	3
Steps	3.5	3.5
Outline	3.5	3.5
Development	1	2
Total scores	23/ 28 (0.821; 82.14)	23.5/28 (0.839, 83.83)

General notes on the frameworks:

The frameworks do not emphasize one type of evidence (i.e., qualitative or quantitative) thus for the 'leading component' aspect when evaluating the structure, both frameworks received full scores of 4. This interpretation could differ per reviewer during application.

The frameworks were rated based on how I felt the presented information in the framework spoke to me. I did not consider additional information provided in prints accompanying the frameworks.

No user guidelines are provided for these frameworks. A user has to read accompanying prints to apply frameworks with fidelity. This is the case for all reviewed frameworks except the JBI approach which is provided with a manual. The manual is expansive to read for a reader looking to understand and quickly apply the framework.

Notes on Framework 1:

- This framework appears to be mostly used in the literature
- The framework gives equal priority to both qualitative and quantitative methods and seeks to reinforce the value for learning from diverse evidence but fails to directly address methodological issues associated with using these multiple sources of evidence to inform
- Adaptable to various contexts and topics but flexible. Heavily embodies an explanatory perspective.
- It is assumed that the various steps that comprise the framework reflect on the overall quality of the framework.

Notes on Framework 2:

- This framework focuses on the integration of qualitative and controlled trials. Therefore, there is no mention of the mixed methods component except in the integration or mixing of evidence.
- No specific reference to integration. The framework reflects equal power to qualitative and quantitative studies though this is subject to reviewer's interpretation during application
- This framework appears simplistic and easy to use by users, but the 'in-between' issues relating to the actual application of the framework can be challenging for a user with less background knowledge on MMRS

APPENDIX C: REVIEWED APPLICATION AND METHODOLOGICAL STUDIES

Table 1

A Summary of Extracted Details from Application Studies

First Author/ Year	Rationale	Notes	Strengths/weaknesses	Methods of the Review
Larsson, G. (2016)	The design was chosen to gain broader knowledge as a result of including studies investigating hassles and uplifts among first responder professionals from different angles.	A systematic mixed studies review (Polit & Beck, 2012) with an integrated design (Sandelowski, Voils & Barroso, 2006). The literature review was also based on the principles established by the Cochrane Collaboration (Higgins & Green, 2011) and the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) guidelines (Moher, Liberati, Tetzlaff, Altman & The PRISMA group, 2009).	Given the scope of the review questions, and the complete lack of studies using the gold standard randomized control trials design, the methodological guidelines mentioned above were tailored to the integrated design. Our review was also methodologically inspired by the reviews of Kennedy, Brooks-Young, Gray et al. (2014) and Sansdalen, Hov, Hoye, Rystedt and Wilde-Larsson (2015). Finally, we would like to address a couple of methodological considerations. We performed literature searches in several data bases to minimize the risk of overlooking fruitful studies. Despite our efforts, it is possible that we did not find all the relevant studies to include in a review. Most of the included studies were based on retrospective crosssectional studies and the findings should be viewed in this context. However, we have reported our methods in detail and consistent patterns emerged to illustrate the role of daily hassles for professional first responders. The validity and reliability were strengthened by a team of researchers working closely together and discussing each step in the synthesis of findings to maximize rigor in all stages.	1. Aim for the review was identified 2. Criteria for including studies were identified 3. Literature was identified according to an explicit search strategy 4. Studies were selected according to inclusion criteria 5. Data extraction was undertaken by all authors 6. A hierarchical system of codes, categories and superior categories was generated from data in an ongoing and iterative thematic analysis 7. The superior categories were related to each other in the form of a theoretical model

Sandlund, M. (2017)	The key feature of this review was to get a wide scope of the literature with breadth and depth. Previous reviews have often rated the quality of studies so the present review, which updates previous reviews but whose aim is to consider the gender perspectives, did not entail the appraisal and exclusion of articles based on the quality of research methodology	Pluye P, Hong. Combining the power of stories and the power of numbers: mixed methods research and mixed studies reviews. Annu Rev Public Health. 2014;35:29–45. Since studies of all designs were included, the standard systematic review steps for mixed studies reviews with a convergent qualitative design was used to synthesize the results.	A number of methodological features could influence the result of this review. A strength is the broad literature search in a number of electronic databases, done systematically with the consultation of a librarian. However, despite the efforts to identify all eligible publications, we cannot exclude the possibility that some were missed. The lack of generally used keywords for participant's views and preferences and the diverse research methodologies used in the studies aiming for made it difficult to develop a comprehensive search strategy. In order to compensate for this difficulty, the reference lists of all included articles and previous resembling reviews were searched for additional publications, which resulted in a few more studies to include. No ranking of quality of the included studies was performed.	n/a
Teskereci, G. (2018)	This is a mixed-methods systematic review, which involves a combined analysis and synthesis of data from both quantitative and qualitative research in order to provide a better understanding of individuals' experiences, values and perceptions (Heyvaert et al. 2013; Saini & Shlonsky 2012).	All the studies included in this systematic review aimed to identify the problems experienced by caregivers. The quantitative data in this review showed that family caregivers of women with gynaecological cancer have physical, psychosocial, economic, sexual and spiritual care needs and the qualitative data added clarity to these needs. This review also demonstrated the insufficiency of the research on supporting caregivers and solving their problems and the need for action studies to be conducted in this area.	There are several strengths and limitations of this review. First, data search was conducted by English key words. Therefore, some studies might have been missed. Also, the care gains obtained by caregivers seem to have remained unveiled because of the small number of the qualitative studies included in this systematic review. Future research needs to further explore the concepts related to positive outcomes of caregiving. Although a study appraisal was conducted using a well-developed instrument, no metaanalysis or meta-synthesis was conducted due to the inefficiency of definitions, study designs and outcomes.	1. Research Question: What are the life experiences of caregivers to women with gynecological cancer? 2. Quantatitative research: a. Application of inclusion criteria b. Quality assessment (n = 11) c. Data extraction d. Quantitative synthesis (n = 10 quantitative, n = 1 mix study) 3. Qualitative research: a. Application of inclusion criteria b. Quality assessment (n = 5) c. Data extraction d. Qualitative synthesis (n = 5

				qualitative, n = 1 mix study) 4. Synthesis of quantitative and qualitative studies

Charles, J. M. (2016)	One approach employed within this review was realist synthesis, to provide a theory driven approach to discover what works, for whom, how and under what circumstances for repeat teenage pregnancy. The realist synthesis aimed to identify the mechanisms or programme theories by which the authors postulate the intervention works or explain why the intervention did not work.	The standard for reporting in the evidence base was mixed. However, most studies were considered to be of good quality. Using the principles of relevance and rigor, the included evidence confirmed middle range theories, helped to refine our thinking and made a credible contribution to theory development. The review found limited UK evidence; we used UK grey literature and stakeholder consultation to inform the realist review to enhance applicability of results to UK public health agencies. There is a need for recognition of wider cultural perceptions of motherhood in adolescence. For some cultures, pregnancy in adolescence is viewed as the social norm and the role of mother is considered a desirable one. In other cultures, there is stigma around pregnancy in adolescent and judgement of young mothers. In the realist synthesis, we theorise it is how an adolescent internalises these external factors and influences with their own thinking to derive at their own perceptions of motherhood, pregnancy, sex and relationships, to trigger mechanisms such as motivation and control. There are also issues of access and funding for health care services that offer contraception and family planning advice in different contexts. The realist synthesis highlights the mechanism of tailoring by policy makers and service providers to reduce barriers and increase facilitators to access of services and uptake of interventions.	Strengths: We applied realist principles as part of a wider mixedmethods review, which included a varied range of literature from RCTs to qualitative studies and grey literature giving our analysis a rich source of evidence. Unlike previous studies realist methods were applied whilst undertaking the wider review. Therefore, rather than being directed firstly by the systematic review findings and then exploring the literature using the realist approach, realist methodologies drove the process from the start. We also involved stakeholders throughout the process and discussed theory development and our interpretation of the evidence base, which further strengthen the review, and has been previously utilised by others. Limitations: Though RCTs are considered by most to be the gold standard of evidence, they are usually disseminated with limited description or explanation as to why an intervention worked. Therefore, it was left to the reviewers' interpretation of the evidence to determine whether a theory was explicit or implicit. The interpretation of evidence, though a key component of realist principles, has implications for the replications of findings from the review, as others may have interpreted the evidence differently. To minimise this limitation as much as possible, we involved stakeholders from public health, primary care, sexual health, obstetrics, midwifery and adolescent mothers throughout the review.	Searchstrategy, Inclusion/exclusion, quality appraisal, Involving stakeholders, theory development, data extraction, data synthesis, results, conceptualizing the issues of pregnancy in adolescence

Fritz, N. E. (2017)	n/a	Did not provide specific steps for the study	While the review may highlight the need for high quality RCTs of exercise interventions, it is important to consider recent recommendations for intervention studies in rare diseases when planning definitive evaluations. In small sample studies, random subject assignment may not always balance out subject characteristics due to the inherent heterogeneity. An alternative is to broaden subject inclusion criteria at the risk of increasing within-group variability and in this respect, it may then be useful to consider alternative approaches such as cross-over or within subject repeated measures designs. Multicenter collaborations, although imposing logistical and regulatory challenges, are critical to achieving sufficient study power and alongside this the use of either less stringent levels or one-sided tests particularly when there are clear a-priori directional hypotheses could also be considered. The prospective evaluation of well considered covariate factors may also improve precision and increase statistical power. However, additional consensus would be needed to inform meaningful evaluation of outcomes in this respect. Adaptive designs, which allow modification of design elements including reestimation of sample size or modification of the randomization ratio based on accumulating data may also improve overall efficiency	n/a

Hoang, V. L. (2018)	n/a	it was not possible to conduct a meta-analysis due to the heterogeneity of study populations and instruments used. Thus, the synthesis followed a narrative method where similar findings of the included studies were grouped into textual descriptions. In addition, the qualitative studies included in this review did not provide sufficient social and cultural contextual information which limits transferability of the findings to other settings. Second, over half of the studies originated from highincome countries (e.g. USA, Canada, Jordan, or Singapore). Therefore, it is difficult to generalise the results of these studies to other countries which have different socioeconomic	The review findings address some of the limitations of previous reviews by including all studies regardless of design or research paradigm, and also location (hospital/home) and type of dialysis (HD and PD). However, this review has certain limitations. First, most of the included studies were descriptive (there was only one intervention study) and the results between studies were inconsistent. While all of the quantitative studies used wellvalidated measurements, the finding from cross-sectional studies precludes establishing any causal relationships between variables. In addition, the qualitative studies included in this review did not provide sufficient social and cultural contextual information which limits transferability of the findings to other settings. Second, over half of the studies originated from highincome countries (e.g. USA, Canada, Jordan, or Singapore). Therefore, it is difficult to generalise the results of these studies to other countries which have different socioeconomic and cultural characteristics. Lastly, due to the limitation of time and resources, only English language papers were reviewed. Thus, studies of informal caregivers published in other languages were excluded from this review.	n/a

Tsimicalis, A., (2016)	We anticipated this approach would permit an integrated and differentiated understanding and insight of the psychosocial experiences of individuals with OI.	Heyvaert, Maes, and Ongena (2013) framework referenced for the steps/ methods. This mixed-methods systematic review consisted of systematically reviewing, appraising, and synthesizing the qualitative, quantitative, and mixed-methods research. A mixed-methods approach was used to integrate research findings generated from different research methodologies into a single systematic review. Our protocol was not published beforehand and entailed the following steps: Search strategy and selection criteria, Quality assessment, Data extraction, translation, and synthesis,	This review presented with several strengths and limitations. This review was conducted in collaboration with scientists and clinicians, and included a clinician scientist with OI as well. An exhaustive and rigorous approach was utilized to identify all potential published studies. Setting no language restriction, our multi-lingual research team included research conducted in America and Europe. Our mixed-methods approach permitted the inclusion of quantitative, qualitative, and mixed-methods research synthesized in one review, which permitted an integrated insight of the psychosocial experiences of individuals with OI. Our review was limited by the availability of accessible published studies. The majority of the quantitative studies were conducted in the Netherlands within a short period of time (1997–2007). Therefore, there is likely to be an overlap between participants within the different studies. Although the authors did not report this potential overlap, we were limited in our capacity to link and/or combine these studies. Only a few studies with varying quality of methodologies met our inclusion criteria, limiting the data available for synthesis. Of those studies included in this review, we were unable to detect differences in the contribution of weaker versus methodologically stronger studies. Instead this review benefitted from studies using a qualitative design, which provided richer descriptions and more nuances than studies adopting a quantitative design. Finally, despite incorporating a wide range of study aims, methodologies, and sample characteristics in our review, we were unable to detect differences in subgroups (e.g. by age or OI type). Contrasting findings contributed to this limitation.	Search strategy and selection criteria, Quality assessment, Data extraction, translation, and synthesis,

Klassen, K. M. (2018)	This present review deliberately adopts a mixed methods approach in order to expand our understanding of how young adults want to use social media to learn about nutrition in addition to synthesizing the results from experimental research about nutrition outcomes, and understand how and why interventions worked, or did not work.	Our previous systematic review of evaluation practices for social media interventions also described the benefits of using study designs other than RCTs to improve the evaluation of interventions taking place in social media beyond narrow and tightly controlled trials [29]. Further, it recommended evaluating the reach and engagement of an intervention, as well as effectiveness, and the use of mixed-methods evaluation when possible [29].	Limitations of this review include that it was difficult to measure the additive benefits of the social media component in complex interventions, as it was only one component of multi-component complex interventions, that could be a small or large component of the intervention, and as social media was used differently between the studies. As previously argued by Vandelanotte [28] and Lim [29], randomised trials, even if they are of complex interventions, may not be the best measures of effectiveness for social media interventions and no ecological studies nor health promotion campaigns were found. It was also difficult to compare engagement metrics between studies as the metrics reported varied, highlighting a gap in tools available to researchers. Many of the qualitative and engagement studies were hypothetical rather than real world or lived experience, or content analyses of actual social media posts, which limits our understanding of how individuals actually use social media. The generalizability of this review should reflect the populations and settings of included studies were from the USA with mainly overweight participants recruited from universities.	n/a
Stephen, N. (2013)	n/a	Prior to the systematic review, a protocol outlining inclusion/ exclusion criteria and the methods of analysis was developed according to the review method proposed by Petticrew and colleagues.14 The review method—question development, literature search, study screening, data collection and analysis, quality appraisal and synthesis—allows for statistical or narrative synthesis of included studies. As the review guidelines are general, other sources (e.g., for quality appraisal and synthesis)1,16 were incorporated into the method when necessary. The review was conducted in accordance with PRISMA guidelines.15 The components of the review question using the PICO framework are:14	A limitation of this review is the range of countries from which data were obtained. The included studies were produced by countries with a wide range of health care systems, from nationalized to private, however only studies published in English were included and those all originated in Western countries. As a result, cultural variables were not explored in this review and were rarely addressed in the included studies. A second limitation of this review is that the scoring system used for the quality appraisal did not provide specific guidelines for what constituted a poor or excellent review. Therefore, the quality of included papers relative to other papers in the review is known, but not quality compared to literature in general.	The review method—question development, literature search, study screening, data collection and analysis, quality appraisal and synthesis—allows for statistical or narrative synthesis of included studies.

Skirton, H. (2013)	n/a	This review was conducted in a systematic way with every effort to obtain and analyse all the available relevant evidence on this topic. However, it is possible that some evidence, particularly in the grey literature, was not identified.	It should be noted that there is a dearth of literature relating to the use of NIPT in diverse cultural settings, so the evidence pertainsmainly to those living in Western societies. In addition, there were only two studies in which the views of those who had actually experienced NIPT were reported, and this needs to be addressed.	n/a

Farrance, C. (2016)	This review sought to gain a deeper understanding of the promising role which CBGEP may play in older people's sustained adherence to a PA lifestyle. It has done this by carrying out three syntheses. The first synthesis was carried out using qualitative studies to understand the views of older people regarding their adherence to CBGEP. This is important because to date reviews in relation to determinants of physical activity have largely been quantitative (Bauman et al., 2012). Meanwhile no qualitative reviews have been identified which focus specifically on why older people attending CBGEP show sustained adherence. The second synthesis sought to update the work of van der Bij et al. (2002) in identifying the long-termadherence rates of community dwelling, free living older people to CBGEP. The third synthesis sought to go deeper in understanding adherence by identifying the degree to which the interventions described in the quantitative studies overtly considered the factors highlight from the qualitative review.	The framework for this review followed the Evidence for Policy and Practice Information and Co-ordinating Centre (EPPI-Centre)method of integrating qualitative research with trials in systematic reviews (Thomas et al., 2004). Datawas synthesised in threeways (Fig. 1). Firstly, the qualitative data underwent thematic synthesis. The findings sections of each qualitative study were copied verbatim and imported into QSR International's NVivo 10 qualitative data analysis software (QSR International, 2012). The guidelines for thematic analysis of textual data in primary research studieswere then followedwith open, descriptive and analytical coding (Thomas et al., 2004).	A meta-analysis of the quantitative data was not possible due to heterogeneity in intervention type and outcomes. Over the last two decades several review articles have been published addressing factors and interventions associated with physical activity in older people (Allender et al., 2006; Baert et al., 2011; Franco et al., 2015; King et al., 1998; Martin and Sinden, 2001; Rhodes et al., 1999; van Stralen et al., 2009). Systematic reviews which focus on adherence have been limited to home exercise programmes (Simek et al., 2012) or have included short term interventions (≤6months) including home exercise programmes (Picorelli et al., 2014). Therefore, none of the above reviews have focused specifically on the role CBGEP play in sustained adherence to exercise programmes in older people. Limitations of this study include the fact that the synthesis is based on a small number of studies (i.e. five quantitative, three qualitative and two mixed-methods). This is reflective of the limited literature available on longer-term adherence rates to CBGEP. The restricted information regarding study design, sampling, setting,methods, and findings is also noted. Of particular consideration is the fact that in order to execute the third synthesis a conservatively critical method was employed to assess whether the quantitative studies had evidence of the qualitative themes. It is recognised that just because the theme was not reported explicitly does not necessarilymean itwas not considered in the study design. This is noted as a weakness in this review and means that conclusions must be interpreted with caution. Furthermore, the philosophical underpinnings of the different qualitative data analysis methods may have impacted on the individual study findings. However, it is not possible to say how this may have affected this current study. Studies also varied by research goal with only three studies having adherence as their primary outcome (Cyarto et al., 2006, Jancey et al., 2007, Tak et al., 2012). Again, this highlights the lack of longer term studies focusing on adherence to CBGEP. Reviewed studies were limited to those published in English and grey literaturewas not included. Advice following personal contact with one of the study authors to manually search the previous six volumes of relevant journals should with hindsight have been expanded to include all volumes from 1995 on. This may have led to the exclusion of some relevant studies. In addition, a further limitation is noted in the discrepancywith the age criteria for participants in the quantitative and qualitative studies. Ideally, the authors should have also lowered the age range for the	1. Research Questions; 2. Synthesis 1: Qualitative studies - Quality assessment, data extraction, thematic synthesis; 3. Synthesis 2: Quantitative studies - Quality assessment, data extraction, narrative synthesis; 4. Synthesis 3: Qualittaive and quantitative synthesis (Thomas et al., 2004)

			quantitative studies to 60 years to ensure consistency. This is recognised as a limitation; however in actuality the mean ages were similar across both types of studies.	

Guillaumie, L. (2016)	n/a	This mixed-methods systematic review is based on the framework described by Thomas and Harden (Thomas et al. 2004, Harden & Thomas 2005). It consists in a review of controlled and uncontrolled clinical trials designed to assess the effect of mindfulness-based interventions on nurses. It is followed by a synthesis of qualitative studies that explore nurses' views and perceptions of these interventions during or after their participation in them. The final analysis integrates both quantitative and qualitative findings to explore to what extent benefits or challenges experienced by nurses have been measured and confirmed by quantitative studies. A four-step process was followed to integrate quantitative and qualitative research in accordance with the framework described by Thomas and Harden (Thomas et al. 2004, Harden & Thomas 2005).	Data from qualitative and quantitative studies were combined using an established methodology to increase the richness and robustness of the synthesis. Providing standardized mean differences and mean differences, for controlled and uncontrolled studies, respectively, appeared to be a useful way to produce a description of patterns. The main limitation comes from the small number of RCTs, which prevented us from doing meta-analysis on several variables or exploring variables moderating the effects of interventions. Moreover, most studies included were conducted in the United States. Future research could analyse the effects of mindfulness training in various countries to shed more light on possible differences related to culture or region.	A four-step process was followed to integrate quantitative and qualitative research in accordance with the framework described by Thomas and Harden (Thomas et al. 2004, Harden & Thomas 2005).
Sznitman, S. R. (2016)	n/a	We followed the recommended guidelines of the PRISMA-P statement for transparent reporting of systematic reviews (Moher et al., 2015). The Crowe Critical Appraisal Tool (CCAT), designed to critique a variety of research methodologies and found to be a valid and reliable quality assessment tool (Crowe & Sheppard, 2011; Crowe et al., 2012)	The literature review has a number of strengths, such as its inclusion of both quantitative and qualitative studies, its multi-database search strategy, and its dual-author data extraction. Despite these strengths, limitations include the possibility that relevant studies may have been missed because of the exclusion of gray and non-English literature or because of publication bias.	n/a

Arrowsmith, V. (2016)	n/a	Thomas and Harden (2008) approach for thematic synthesiswere adopted. One reviewer conducted the search. The quality of the included studies also influences thisreview (Supplementary File Table S1). In addition, thedesign and methods of included studies impacted on thisreview. For example, case studies may not be generalizable(Bowling 1997) and surveys with larger samples might havebeen more likely to more closely reflect the populationsstudied (Field 2009). However, the systematic review pro-cess and synthesis, adopted herein, is less likely than singlestudies to draw incorrect or misleading conclusions (Harden& Thomas 2005).	This review adopted a systematic approach, including a focused question and search, application of inclusion and exclusion criteria and quality assurance processes. However, one reviewer conducted the search and it is possible that some relevant studies were not identified. No studies from developing nations were found. In addition, the decision to exclude cross-sectional studies, of which there are many, could provide additional evidence and snapshots of work role transitions, if not the entire transition process. The quality of the included studies also influences this review (Supplementary File Table S1). In addition, the design and methods of included studies impacted on this review. For example, case studies may not be generalizable (Bowling 1997) and surveys with larger samples might have been more likely to more closely reflect the populations studied (Field 2009). However, the systematic review process and synthesis, adopted herein, is less likely than single studies to draw incorrect or misleading conclusions (Harden & Thomas 2005). In addition, no studies which met the inclusion criteria for this review were found for nurses moving from clinical to management or to academic roles. This prevents the exploration of the widest scope of role change for experienced nurses.	1. Review Question: What are nurses' perceptions and experiences of work role transitions? 2. Synthesis 1: Qualitative Analysis - a. Application of inclusion criteria b. Quality assessment c. Data extraction d. Qualitative thematic synthesis (Thomas and Harden, 2008) 3. Synthesis 2: Quantitative analysis - a. Application of inclusion criteria b. Quality assessment c. Data extraction d. Qualitative thematic synthesis (Thomas and Hraden, 2008) 4. Synthesis 3: quantitative and qualitative synthesis (Harden and Thomas, 2005)

McCutcheon, K. (2015)	The evidence reported on in this systematic review provides a critical evaluation of the current evidence base to support the nurse educator's pedagogical decision on the best and most effective teaching methodology and appropriate technology resources for the instruction of clinical skills.	The included papers from the systematic search were analysed using a narrative synthesis approach. Similar to data synthesis used in previous literature reviews (Bloomfield et al. 2008, Rowe et al. 2012), predetermined themes of method/research design; study aims; sample population; outcome measure and results were used to abstract data (Table 1).	This systematic review has followed a robust protocol with a replicable search strategy based on JBI guidance (JBI 2013). However, although the systems of data extraction and quality appraisal have been rigorously followed, some limitations must be acknowledged. Four studies were excluded due to language restrictions of non English papers. Pilot studies or feasibility studies were excluded when they reported on intervention optimization and were not appropriately powered to test effect. The exclusion of these papers may have biased this review. The quality appraisal stage of the review, although clearly presented in terms of risk, did not exclude any papers. If a minimum threshold had been applied to this review, several studies would have been excluded. It was considered important to include all studies irrespective of quality appraisal risk, to enable a more comprehensive picture of relevant research pertaining to the aim of this review. However, it is acknowledged that the lack of a minimum threshold may hold some limitations for the findings of the review	n/a
Kolehmainen, N. (2010)	n/a	For search strategy and inclusion of relevant papers, established procedures for systematic reviewS were followed. Due to the heterogeneous nature of the literature a framework for mixed-methods systematic reviews developed by Popay et al. was applied to quality appraisal, data extraction, analysis and synthesis. Further details for each step provided below.	n/a	quality appraisal, data extraction, analysis and synthesis

Hoare, K. J. (2016)	Our thesis is that guidelines are country specific and many IMGs may be unaware of the problem of ARF in Māori and Pacifika people in NZ. There are no bridging programmes available for IMGs coming to work in primary care here. IMGs may be unaware that access to primary health care, and thus treatment of sore throats, is limited for many Māori and Pacifika people and that this may contribute to the failure of ARF reduction over the past three decades. The persistence of high rates of ARF in NZ is now receiving attention from policy makers. It is timely to explore the preparation for IMGs coming to work in NZ, particularly for IMGs working in general and rural practice.	We conducted a mixed methods review using a contingent methodology.10 Contingent methodologies were described by Sandelowski et al. as being one of three frameworks to conduct a mixed methods review.11 The other two ways areContingent methodologies were described by Sandelowski et al. as being one of three frameworks to conduct a mixed methods review. The other two ways are segregated and integrated mixed method systematic reviews. Sandelowski M, Voils CI, Barroso J. Defining and Designing Mixed Research Synthesis Studies. Res Schools. 2006;13(2):29. contingent methodology involves two or more systematic reviews that are conducted sequentially and based on the results of the initial synthesis (see Figure 1). They can use data from qualitative, quantitative or mixed methods studies. In our review the initial data collected pertained to the number of international sore throat guidelines and their key points. The subsequent review focused on a content analysis of studies referring to IMGs working in primary health care in NZ.	The strength of this review is that it followed the AGREE and RAMESES statements which are both recognised as quality consensus tools providing transparency in data appraisal. Transparency helps readers decide for themselves if reviewer judgements made are reasonable, both for the topic and from a methodological perspective. Additionally, findings from the current research, notably that NZ is heavily reliant on IMGs and that guidelines for sore throat management are country specific, are plausible. A limitation is that the themes developed from data were constructed by KH, EW and BA and other researchers may have developed alternative themes.	Initial search (Any guideline), Research Question 1, Study Selection and Data analysis, Quantitative or Qualitative or Mixed methods synthesis, Research Question 2, Study selection and data analysis, AND Quantitative or Qualitative or Mixed methods synthesis

Cunningham, J. (2015)	n/a	No methodological issues discussed	Only papers published in the English language were reviewed, which could lead to publication bias. However, it is likely that significant research studies for an international audience would be published in English language journals. The number of papers (nine) also could be seen as a limitation, but this does reflect the paucity of research in this area. The demographic make-up of the participants in the different studies was largely unclear. Apart from one study (Alsulaiman etal., 2010, from Saudi Arabia) all were conducted in western countries, but little was reported about the ethnicity, age or educational level of participants. It should be noted that the papers studied and this review focused on the process of PGD, which may explain why many of the findings appear negative, because many of the couples involved found it a difficult process. There view does not take into account the likely joy and potential relief of having an unaffected child. Although reviews may be subject to bias, we tried to limit this by involving more than one research era teach stage in the process and by using a validated quality assessment tool.	n/a
Heyvaert, M. (2015)	n/a	Part two. In the second article (Heyvaert et al. 2014), we focus on experiences with RIs for CB among people with intellectual disabilities. It is our intent that both papers are considered together. A mixed methods research synthesis involving statistical meta-analysis and qualitative meta-synthesis techniques	n/a	n/a
Heyvaert, M. (2014)	n/a	Part one. This first article reports on the meta-analysis of 59 single-case experiments (SCEs) on effectiveness of Ris for CB among people with intellectual disabilities.	n/a	n/a

Puzzolo , E. (2016)	n/a	Part pf a larger study and review	In addition to this being the first such systematic review on adoption of clean fuel, the methods and findings confer number of strengths. First, an extensive search strategy was employed in an attempt to comprehensively capture all relevant published and some of the unpublished evidence available at the time of the search. Second, the mixed-methods approach including the systematic integration of evidence from quantitative, qualitative and case studies using standardised methods for study identification, data extraction and quality appraisal, adopted because different research disciplines tend to be more or less suited to the assessment of different domains. For example, qualitative studies are useful in elucidating values and preferences, whereas case studies provide useful in-depth insights into policy and programme mechanisms (Puzzolo etal.,2013). Integration of different research methods is therefore important to maximise the understanding around uptake of clean cooking fuels and technologies (Stanistreet et al.,2015). Third, the consistency of findings across a wide range of countries and settings and across distinct types of evidence, including from user and stakeholder perspectives assessed qualitatively through to quantitative outcome measurements on uptake drawn from quantitative datasets and case studies. Fourth, the quality of the included studies was assessed using standardised methods tailored to the different study designs, allowing for sensitivity analysis to be carried out investigating the influence of quality on the synthesized evidence. Following the exclusion of the 'weak' studies, some the evidence in support of particular factors was lost for LPG, solar cooking and alcohol fuels, but there was no substantive change in the level of evidence supporting each domain. There are also a number of limitations inherent within this body of evidence. First, there are relatively few published studies for some of the clean fuels, in particular for solar cooking and alcohol fuels, and few qualitative studies overall, with none being identified on LPG and alcohol fuels. Second, although there view incorporates both peer-review and grey literature, it is limited to the experience that is recorded in such published sources while much more knowledge resides in the experience of governments and the commercial sector. Indeed, objective accounts of such experience are typically sparse and only partially recorded in published studies. For example, issues around taxation, enforcement of regulation, supply and distribution networks were reported only to a limited extent, but an effort was made to highlight the importance of such	n/a

			these issues based on the available evidence. Third, the majority of studies were cross-sectional, relating to initial adoption and short-term use of clean fuels, making it difficult to draw conclusions on the most successful mix of factors determining longer-term sustained use. Finally, the type of evidence identified in this review restricted opportunities for causal inference, and hence most findings from the individual studies should be interpreted as associations. It is principally through the integration of evidence from different study designs (e.g. qualitative, quantitative and case studies) and from heterogeneous contexts and settings that conclusions can be drawn about probable causal relationships between enabling/inhabiting factors and adoption and sustained/exclusive use of clean fuel options. Factors that are consistently shown to be enabling (when present/satisfactory) and limiting(when absent/un-satisfactory) across study types, countries and settings are likely to be playing apart in causal linkages(although lack of consistency does not necessarily imply no such role).Qualitative findings, which offer a different take on these associations and often give explanations as to why users felt a factor either enabled or hindered adoption and use, help to strengthen conclusions about causation when considered together with other evidence.	

Lloyd, M. (2018)	n/a	This review was designed as a mixed-methods systematic review and meta-analysis. The framework by Thomas, Ciliska, Dobbins and Micucci (2004), designed for synthesizing quantitative and qualitative evidence, was used to comprehensively integrate evidence on case fatality, effects, feasibility, and acceptability. The following sections describe the study eligibility criteria for this review.	In terms of the evidence included in this review, there was a paucity of high-quality quantitative—and particularly qualitative—evidence, as discussed above. These limitations impact on the conclusions that can be drawn in this review, and recommendations for strengthening the evidence base will be discussed below. In terms of review methodology, a systematic and comprehensive literature search was conducted. However, despite best efforts, other relevant studies may have been overlooked. Reporting of ambulatory status was generally poor, and although authors were contacted where required, data were not always available, and therefore, some studies had to be excluded. Studies in languages other than English also had to be excluded, due to resource limitations. Taken together, these limitations mean that not all potentially relevant literature could be included in this review.	n/a
Thompson, J. (2017)	n/a	The papers described in 'Tables 1 and 2', which met our inclusion criteria and passed our screening processes, were subjected to analysis and synthesis as separate groups of quantitative and qualitative papers. The separate syntheses were then combined in a final synthesis, drawing conclusions from all findings. This was based on the mixed-method systematic review approach described by Harden and Thomas (2005) and supported by the Evidence for Policy and Practice Information and Coordinating Centre framework for conducting reviews (EPPI-Centre, 2010). Results from the quantitative studies were divided into three categories: decision making, outcome and satisfaction.	There remains a degree of heterogeneity in the literature which has been highlighted in previous reviews (Desmeules et al., 2012; McPherson et al., 2006), so it was not possible to complete a metaanalysis of the included papers.	n/a

Husebø, A. M. L. (2018)	n/a	The design of the mixed-method systematic review was conducted as outlined in Gough, Thomas, and Oliver (2012). Our review comprised three subreviews: one on quantitative research, one on qualitative research and one combining the two. All three subreviews addressed the same review questions and were combined and contrasted in a final synthesis.	A review that integrates studies with different research methods represents a challenge to the synthesis and interpretation of findings and calls for a clear strategy (Gough et al., 2012). A methodological strength of this review is the combining of qualitative, quantitative and mixed-methods research into a final synthesis, providing rich and detailed information on student learning in nursing homes (Pace et al., 2012). To enhance the rigour of our review, a sampling plan including searches in multiple databases and reference lists, and the use of strategic search terms and well-defined selection criteria were used. Study selection involved several researchers, ensuring that the review data materials were eligible for inclusion. A more specific and comprehensive literature search could have been conducted by consulting a librarian (Whittemore, 2007). In addition, a more extensive inclusion of synonymous search terms, such as clinical practice, could have broadened the result. However, after discussions among the research team members and consulting the literature, the applied search terms were considered valid. To achieve an even broader perspective of nursing homes as learning arenas for undergraduate nursing students, documents such as systematic reviews, reports and white papers could have been included in the review. Furthermore, none of the included studies were performed in Asian, African or South American countries, possibly because of cultural issues related to care for the aged. Although our findings might be less relevant for informing nursing practice studies within the realm of care for older people in these regions, the results could have relevance for student learning in other clinical settings. To establish the methodological rigour of the selected studies, we applied a unique and innovative tool that has been proven valid for quality assessment of quantitative, qualitative and mixed-methods studies (Pace et al., 2012; Souto et al., 2015). The quality assessment involved all the co-authors working in teams, thereby ensuring a thorough methodological assessment. During the appraisal process, the researchers' areas of expertise were matched with the methodology of the included studies (Pluye, Gagnon, Griffiths, & Johnson-Lafleur, 2009). Furthermore, several of the co-authors had previous experience with review methodology. Although the quality appraisal revealed moderately high methodological quality across studies, some limitations were identified. Few of the studies using qualitative methods reported interactions between researchers and participants. A researcher's influence could present a	Broad research questions: what influences the student's learning processes during clinical practice studies in nursing homes, and what nursing competencies do they achieve?; Subsynthesis of quantitative research; subsynthesis of qualitative research; subsynthesis of quantitative and qualitative research; Mixed synthesis: Themes (Gough et al., 2012)

			possible bias, especially when using qualitative interviews as a data collection method (Doody & Noonan, 2013); therefore, clarifying possible bias in research reporting is important. A great variation in design features among the included studies making this review vulnerable to maintaining reliability or transparency in its conclusions. This needs to be recognised as a limitation (Gough et al., 2012). All the quantitative descriptive studies fell short in terms of sample representativeness, most likely due to small sample sizes. Lack of representativeness can result in a false conclusion about the target population and can be avoided by sample size estimations and application of a suitable sampling strategy (Mart ınez- Mesa, Gonz alez-Chica, Duquia, Bonamigo, & Bastos, 2016). The main reasons for low-quality scores in studies that combined methods were equal to those found in studies of qualitative or quantitative designs (e.g., researchers' influence and sample representativeness). In addition, only the study by Salamonson et al. (2015) had given appropriate consideration to limitations associated with integrating quantitative and qualitative methods (i.e., MMAT item K), probably due to a priori defined research design within the mixed-methods paradigm. Nevertheless, despite ambiguous findings and limitations, we believe that this synthesis provides important insight into the research context.	

Kennedy, F. (2012)	n/a	Although systematic reviews have traditionally relied on evidence from quantitative studies the benefits of including qualitative research evidence is increasingly recognized (Centre for Reviews and Dissemination. 2008). The inclusion of qualitative studies which reflect the experiences of the target groups of the intervention is likely to enhance the review (Thomas et al. 2004), especially because it was anticipated there would be limited evidence derived from trials relating to the impact of nurse consultant roles. Furthermore, it was recognized that the nature of nurse consultants' work is often complex and multi-faceted, which may be more suitably explored by qualitative methods. This review therefore integrated evidence from qualitative and quantitative research and was informed by Oliver et al's. (2005) proposed framework.	Firstly, some retrieved articles explored nurse-led services. Although some of these were written by nurse consultants, it was unclear who was involved in the service and it was considered inappropriate to include studies based on speculation about the nurse consultant's involvement. Hence, some nurse consultant-led service evaluations may have been overlooked. Equally, services that nurse consultants set up and passed to other nurses to deliver may not have been identified if they were not explicitly affiliated to a nurse consultant. A study by Manley (2000) was also excluded because it was conducted in the mid 1990s, prior to the introduction of nurse consultants by the DH and it was uncertain whether the criteria for defining the role would be comparable. Secondly, the quality assessment highlighted several issues. Several studies would have been excluded if a minimum threshold for quality had been imposed, but in the current review it was considered valuable to illustrate comprehensively the extent to which the impact of nurse consultants has been explored to date. This also met the objective of the review to refine the proposed framework of impact. However, this inclusivity has implications for the findings of this review. Studies described as research, audit or service evaluation were included. The last two often lacked rigour in terms of study design and reporting in the papers was often inadequate. However, inadequate reporting was a feature of all papers, including research studies. This inevitably influenced the ability to appraise the studies. The included studies were also presented in a variety of formats. Given that the nurse consultant role is a relatively new development, grey literature was an important source (7 of the 15 qualitative studies were only available as a study report or dissertation), but comparing these studies with the peer-reviewed published articles involves a potential bias, particularly in assessing quality since reports are often longer and may include more methodological detail. During this review the appropriateness of assessing quality based on published information only and the problems that this gives rise to were highlighted. It could be argued that quality is inadequate if insufficient methodological detail is provided in the published account. This is justified on the basis that poor reporting probably reflects lack of methodological rigour (Juni et al. 2001). However, studies may have legitimate constraints on the detail they report (e.g. journal word limits). This is also a consequence of including grey literature, because any absent or inadequate description of methods may	n/a

			have been addressed during peer-review. The approach taken in this review was considered the most appropriate given the importance of including grey literature, but the possibility of bias is recognized.	

Mathieson, A. (2018)	As the topic area of this review is context-sensitive, a design that provides a practical understanding of the phenomenon is required. The approach taken was therefore a systematic mixedstudies review and convergent qualitative synthesis (Pluye and Hong, 2014). To maximize transparency, where appropriate, we have reported our review in line with the PRISMA statement (Moher et al., 2009).	Since the included studies were heterogeneous regarding design and outcome, we used an interpretive rather an aggregate approach to synthesize the evidence, namely Critical Interpretive Synthesis (CIS) (Dixon-Woods et al., 2006). This approach was adopted to explore the factors shaping implementation within community nursing, and aimed to produce an empirically grounded framework, which can be used in practice (Dixon-Woods et al., 2006). Previous reviews that have used CIS have revealed the appropriateness of this approach for answering questions concerning the influence of context on effectiveness (Flemming, 2010a; 2010b); in this instance, the impact of context on the success or not of implementation, and effectiveness of certain strategies and facilitators.	There are a number of limitations to this review, mainly relating to scope. Only English Language papers were reviewed and the quality of the papers varied. The included papers come from a wide range of countries with differing healthcare systems. However, by adopting a Critical Interpretive Synthesis approach we have attempted to be critical and clarify effective implementation strategies in a diverse and confused field. Due to inconsistency in reporting, labelling and defining these strategies have relied upon our interpretations and those of the authors' of the included studies. In particular, the post hoc implementation strategies offered in the included studies are attempts by the authors to explain what did or did not work. There may be alternative explanations, and more appropriate names. More testing is therefore required.	The standard systematic review steps were taken, whereby the reviewer (A.M.) identified, selected, appraised and synthesized qualitative, quantitative and mixed-methods studies; with all papers reviewed independently by the three authors. Authors discussed disagreements and a consensus was met. For pragmatic reasons, a time limit for the literature was imposed. To ensure all relevant literature within this time limit was captured, a number of databases were searched from different fields.

Kang, E. (2018)	n/a	A systematic mixed studies review guided by Pluye and Hong's framework (Pluye and Hong, 2014) was undertaken to describe, critically appraise and synthesise the types of discharge education delivered to general surgical patients. This method allow qualitative, quantitative and/or mixed methods studies to be included and synthesised to obtain a holistic understanding of a given problem (Pluye and Hong, 2014). To ensure the process for this review is rigorous, the seven stages of conducting a mixed studies review outlined by the mixed studies review guidelines were utilised (Pluye and Hong, 2014). Based on a priori criteria, this review has been registered with PROSPERO (CRD42018086946). We used the Preferred Reporting Items for Systematic Reviews and Meta-Analysis (PRISMA) statement (Moher et al., 2009) to report review findings.	We acknowledge several limitations to this mixed studies review. This review was informed a priori by defined inclusion and exclusion criteria, with searches conducted in scholarly databases. While every effort has been undertaken to conduct a comprehensive search, it is possible that some studies might have been missed. For example, we have added the Boolean operator NOT "day surgery" or "ambulatory surgery" as we wanted to exclude these types of procedures and this could have narrowed the search and caused some potential studies to be missed. Second, of the quantitative studies included, there were few empirical studies of individualised discharge education interventions. Some of the studies were exploratory and relied primarily on self-report. These studies were selected based on the aims of identifying the types of discharge education delivered to general surgery patients and included studies were intended to provide a holistic view of education provided. Lastly, a sensitivity analysis was not performed due to the limited number of studies identified from this review and a qualitative analysis was used to synthesis the data. Notwithstanding, a clear and transparent description of the review process was conducted and discussed.	To ensure the process for this review is rigorous, the seven stages of conducting a mixed studies review outlined by the mixed studies review guidelines were utilised (Pluye and Hong, 2014). Stage 1: formulate a review question; Stage 2: define eligibility criteria; Stage 3: apply an extensive search strategy; Stage 4 and 5: identify potential relevant studies and select relevant studies; Stage 6: appraise the quality of included studies; Stage 7: thematic synthesis

Olson, J. K. (2018)	The realist approach to literature review described by Pawson, Greenhalgh, Harvey, and Walsheet (2005) was used. Such an approach to knowledge synthesis considers the theoretical underpinnings and empirical evidence to analyze interventions (in this instance, simulation experiences), the context in which the interventions occur, the mechanisms by which the interventions work, and the outcomes they produce (Pawson et al., 2005; Pawson & Tiley, 2004).	The purpose of this paper is to review research literature on the use of simulation in pre licensure nursing education and identify directions for nursing education and future research. The research question that guided this systematic review was: What is the best evidence available upon which to base decisions regarding the use of simulation experiences with pre licensure nursing students? The research question is relevant and important because nurse educators should use research-based evidence when making decisions about the use of simulation in nursing education. Such evidence can inform best practices for the use of simulation in nursing education and guide decision-making in terms of the cost-effectiveness of various types of simulation.	The main strength of this review is that it showcases research about all types of simulation and learning outcomes in pre-licensure nursing education. A second strength is that our large research team of nine members allowed us to assign pairs of researchers to groups of articles for thorough review of the 852 studies considered for inclusion, thus establishing inter-rater reliability. A limitation of this systematic review is that grey literature, such as government and institutional documents, was not included.	

Low, L. F. (2018)	n/a	A caveat in designing an intervention is that this review only takes into account the viewpoints of health practitioners; the viewpoints of persons with dementia and their carers also need to be considered (e.g. Low et al., 2017). People with dementia and their carers should be part of the design team for interventions on communicating a dementia diagnosis.	This review was limited by the characteristics and methodologies of included studies and methodologies. Making and communicating a diagnosis were treated in quantitative studies as two distinct consecutive procedures. However, our qualitative study suggests that practitioners often view these as intertwined processes. Not all quantitative papers asked about factors of interest in this review, and the diversity of methodology meant that not all data could be pooled. We do not know whether the broad range in responses were because of true differences between samples, differences in methodology in the way the question was worded or a combination of the two. In addition, some quantitative papers did not specify in the question to whom the diagnosis of dementia was told. When not specified, we assumed that the response referred to persons with dementia; however, this could have been interpreted by practitioners as having told either the patient or family. Longitudinal qualitative studies combining observation of clinical conversations and interviews with practitioners, patients and family (Karnieli-Miller, Werner, Aharon-Peretz, Sinoff, & Eidelman, 2012; Karnieli- Miller, Werner, Neufeld-Kroszynski, & Eidelman, 2012) may aid further understanding of how the diagnosis of dementia is communicated and the impact of different communication styles on the experiences of people with dementia and their families. The majority of studies came from developed nations. The rate of dementia communication may be lower in developing countries, where practitioners may have a more paternalistic stance, and where patient autonomy are not as strongly emphasized (Matusitz & Spear, 2015). Data extraction and interpretation were subject to our own experiences and assumptions as researchers interested in the process and barriers to communicating a diagnosis of dementia. We attempted to be objective, and our authorship team came with multiple viewpoints including a member who is a specialist in diagnosis (HB), who has received a diagnosis (KS), who is familiar (LFL) and less familiar (MM) with the diagnostic and support processes. One strength of the paper is the sequential mixed methods systematic review approach which allowed us to describe practitioner behaviour using quantitative data, as well as try to understand the influences on this behaviour using qualitative data. This enabled production of results that are generalisable yet offer a nuanced understanding of how and why the dementia diagnosis is communicated.	

Kaur, J. (2017)	n/a	The protocol was prospectively registered on PROSPERO (CRD42016039675). The review is reported against PRISMA and ENTREQ guidelines and follows Joanna Briggs Institute (JBI) methods, encompassing Sandelowski's segregated approach for the synthesis of quantitative and qualitative data, followed by a Bayesian approach for the mixed-methods data synthesis.	The review is reported against PRISMA20 and ENTREQ21 guidelines and follows Joanna Briggs Institute (JBI) methods,22 encompassing Sandelowski's segregated approach22,23 for the synthesis of quantitative and qualitative data, followed by a Bayesian approach for the mixed-methods data synthesis. However, the data were heterogeneous, from different countries, healthcare systems, and time periods. Furthermore, no data were available from low/middle-income countries limiting the applicability in these settings. This large period in time has witnessed a number of changes in relation to tobacco control, potentially influencing the findings of included studies. As the knowledge of the harms attributed to smoking and SHSe have become more widely known, changes have been made in legislations globally, accompanied by changing prevalence profiles of smoking behaviors and thus SHS prevalence rates.61,62 An English study has however evidenced a continued need to protect children from SHSe post-legislative restrictions and tobacco control policies.63 We identified little qualitative evidence, which subsequently limited our exploration of the contextual factors, experiences and beliefs. Further limitations include the omission of grey literature and the exclusion of papers not available in the English language. During the initial screening stage, papers concerning smoking cessation interventions that did not refer to SHS in the abstract were excluded. Some relevant data may have been reported in the full text. Due to the limited timeframe and resources, it was not feasible to include these papers for full-text screening, thereby risking the exclusion of some articles, such as those focused on the delivery of cessation counseling to maternal smokers. Interventions which were delivered by primary care HCPs in schools and community settings (eg, children's centers) would also have been excluded from this review. These exclusions offer scope for future research with potential to compare findings with those of this review. Despite these limitations, the authors are confident that the key literature in this field have been included and synthesized.	

Shi Shiu, C. (2016)	This approach was also necessary given the limited availability of literature on APIMSM that qualified for this study.	The empirical research is synthesized from both quantitative and qualitative studies using a mixed-research synthesis instead of statistical meta-analysis. This mixed research synthesis was based on an integrated study design, grounded on the assumption that findings are viewed as answering the same research questions, or addressing similar aspects of a specific phenomenon, and thereby do not need to be synthesized by methods (i.e., qualitative and quantitative; Sandelowski, Voils, & Barroso, 2006). A mixed-research synthesis was applied based on the following assumptions: (a) that differences in methods do not necessarily produce differences in findings; (b) that extraction and grouping of findings do not depend on research methods but on whether the study answers the same set of queries; and (c) that findings from quantitative and qualitative studies can be used to corroborate each other, enabling researchers to validate the research findings from studies using different methods and to identify any consistency or discrepancy in findings (Dixon-Woods et al., 2005; Sandelowski et al., 2006; Voils, Sandelowski, Barroso, & Hasselblad, 2008).	Reviews of the literature often result in mixed findings, and although the overall review findings were congruent in most cases, there are several instances where qualitative findings contracted quantitative results (Choi et al., 1995, Poon et al., 2005; Ratti et al., 2000; Shapiro & Vives, 1999). This may be partly attributed to the fact that the relationships under study are not only complicated by social–cultural phenomena, but also by sample bias and the use of clinical versus nonclinical samples. Future research with more sophisticated study designs are needed to clarify such discrepancies.	n/a
Babakus, W. S. (2012)	The adaptation of the mixed-methods review and integrative review allowed for a systematized and rigorous review while including the appropriate studies to fully answer the research questions.	The adaptation of the mixed-methods review and integrative review allowed for a systematized and rigorous review while including the appropriate studies to fully answer the research questions.	The strengths of this review include transparent methodology and the inclusion of all types of research to produce the most comprehensive narrative evidence on PA and SA. This review updates and improves upon previous work through integration of study types to provide the most comprehensive picture of existing evidence in this area. This systematic synthesis of studies also allows for the development of more informed recommendations for future research needs and intervention strategies.	This review uses the EPPI-Centre methods for systematically searching the literature, rigorously assessing the quality of studies, and synthesizing quantitative and

				qualitative studies into one report.
McConnell, T. (2016)	We chose to include quantitative and mixedmethod research as we were looking not only at staff experience but also the impact of those experiences, in order to provide a more comprehensive understanding of healthcare professionals' experience.	This was a systematic mixed studies review following an integrated design to combine and synthesise quantitative, qualitative and mixed-method study's findings. Qualitative research is often portrayed as useful for elucidating new understanding of a phenomenon, while quantitative approaches are often depicted as more useful for elucidating what works. However, combining the two approaches increases the potential for identifying unexpected outcomes. We chose to include quantitative and mixedmethod research as we were looking not only at staff experience but also the impact of those experiences, in order to provide a more comprehensive understanding of healthcare professionals' experience. The review recommendations outlined in the Preferred Reporting Items for Systematic Reviews and Meta Analysis (PRISMA) statement were followed for this review.	This mixed-method review confirms the lack of robust quantitative and qualitative studies relating to staff's experience in providing end-of-life care to children. As such, it is not possible to draw definitive conclusions. However, this review does highlight the gaps and limitations within the current knowledge base. A strength of this review relates to the transferability of findings as included studies were conducted in many different countries, with a diverse range of healthcare staff in a diverse range of healthcare settings, yet showed more similarities than differences in relation to the impact of providing end of life care to children and the most important strategies to help support them.	n/a

Sox, C. B. (2017)	While a mixed-methods approach in research is used to explain and interpret, complement strengths or overcome weaknesses of a specific design, and/or explore questions on different levels (Biddix, 2009), the same idea can be applied to a mixed-methods systematic review of a research topic. By implementing a mixed research synthesis, which falls into the category of mixedmethods systematic reviews, integrating both qualitative and quantitative findings, the utility and impact of the research is enhanced (Harden, 2010) . In addition, a more transformative framework for this theme can then be identified, especially since this theme is currently evolving. Oftentimes, a systematic review does not include enough good-quality evidence to provide answers to the questions being asked. Including a mixed-methods review, however, offers an opportunity to make the conclusions more relevant and maximize the results (Harden, 2010).	The purpose of a mixed research synthesis is to review and summarize the quantitative and qualitative research about a specific phenomenon and abridge the findings in an effort to direct both practice and forthcoming research (Sandelowski, Voils, & Barroso, 2006). Employing an integrated design, the findings of both qualitative and quantitative research are assimilated and one mixed-methods analysis of the findings is created (Heyvaert, Maes, & Onghena, 2011). While a mixed-methods approach in research is used to explain and interpret, complement strengths or overcome weaknesses of a specific design, and/or explore questions on different levels (Biddix, 2009), the same idea can be applied to a mixed-methods systematic review of a research topic. By imple- menting a mixed research synthesis, which falls into the category of mixed- methods systematic reviews, integrating both qualitative and quantitative findings, the utility and impact of the research is enhanced (Harden, 2010) . In addition, a more transformative framework for this theme can then be identified, especially since this theme is currently evolving. Oftentimes, a systematic review does not include enough good-quality evidence to provide answers to the questions being asked. Including a mixed-methods review, however, offers an opportunity to make the conclusions more relevant and maximize the results (Harden, 2010).	While a thorough review of literature was conducted within and outside of hospitality and tourism, some publications may have been missed. The database searches were limited to specific keywords and finite number of databases. In addition, while the definitions of meetings, virtual meetings, and hybrid meetings were given, meetings types and meeting specifics (size, location, etc.) beyond these definitions were not indicated. Offering more specific guidelines for these meetings may have changed the articles included within this analysis.	n/a

Grønda hl, V. A. (2017)	The design was chosen to explore and describe the use of life stories' influence on the person with dementia, the relatives and staff.	A systematic mixed studies review with an integrated design was undertaken to integrate and synthesise results from quantitative, qualitative and mixed methods studies. The design was chosen to explore and describe the use of life stories' influence on the person with dementia, the relatives and staff. The research group strived to use the methodological guidance of the Cochrane Collaboration in the search and also to structure the review together with the guidelines from "Preferred Reporting Items for Systematic Reviews and Meta-Analyses" (PRISMA).	Using an integrated review method provides an opportunity to present a comprehensive understanding of a phenomenon of relevance to health care. Even though only three quantitative and two qualitative studies were included in this review, presenting the existing knowledge is valuable, in order to start creating a knowledge base for using the persons' life stories in dementia care, and also to uncover areas for further research. The four researchers worked systematically in pairs to minimize subjectivity. The quality of the papers was assessed using a reliable quality assessment tool. Any uncertainties were discussed in the research team until consensus was reached. This increased the validity and reliability of the selection and quality assessment process. Different concepts have been used for describing the use of life stories, which made the search process challenging. To strengthen the validity, we elected to use five concepts based on our own knowledge of the field. These concepts were life histories, life story, narratives, diary and biographical approach. No further concepts were identified during the search process. To strengthen the reliability, a search update was performed in September 2015. No further studies were found. References in the chosen papers were scrutinised, but searches for 'grey literature' were not conducted.	n/a

Stevanin, S. (2018)	n/a	A M-MSR study was performed following the method for systematic reviews of Joanna Briggs Institute (JBI 2014) for both qualitative and quantitative research and is reported here according to the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA, Moher, Liberati, Tetzlaff, & Altman, 2009) and the Enhancing Transparency in Reporting the Synthesis of Qualitative Research (ENTREQ, Tong, Flemming, McInnes, Oliver, & Craig, 2012) guidelines	Several limitations affected this M-MSR. Only primary studies were included and despite the systematic approach used, some studies may have been missed; in addition, only English-language studies were included, which may have introduced publication biases. More- over, given that no specific guidelines have been developed to report M-MSR, we used a mixture of reporting elements from ENTREQ (Tong et al., 2012) and PRISMA (Moher et al., 2009) guide-lines. Findings that emerged from the studies were given the same weight according to the convergent qualitative synthesis (Pluye & Hong, 2014), despite the different level of evidence developed by each according to the study design and the methodological approach adopted. Furthermore, the results of some studies were reported providing the p-value as a measure of statistical significance (evi- dence against a null hypothesis) without indicating the estimation of precision (e.g., confidence interval), therefore making the p-value meaningless.	

Dai, Y. (2018)	This approach enabled us to address the acceptability of each PPP intervention from the children and parent perspectives. The review process is listed in Figure 1.	This review adopted the mixed-method for systematic reviews developed by the Evidence for Policy and Practice Information and Co-ordinating (EPPI) Centre to address the review question. This approach begins with a broad review question followed by separate subquestions, which are then used to develop parallel syntheses to address the subquestions. The separate syntheses are then combined together into a 'meta-synthesis' to answer the broad review question in its entirety (Gough, Oliver, & Thomas, 2012). In this review, a narrative summary of the effectiveness of different PPP interventions was implemented, alongside a thematic synthesis of the qualitative evidence of children and/or their parents' experiences and perspectives towards PPP, before completing a 'meta-synthesis' to juxtapose the findings of each separate synthesis. This approach enabled us to address the acceptability of each PPP intervention from the children and parent perspectives. The review process is listed in Figure 1.	Searching, screening, and mapping; synthesis 1: Controlled trials - 1.Quality assessment, 2. data extraction, 3. Narrative summary to answer the effectivenes of PPP; Synthesis 2: Qualitative studies - 1. Quality assessment, 2. data extraction, 3.Thematic synthesis to explore parent and/or children's experiences and acceptability of PPP; Synthesis 3: Meta-synthesis to use the thematic syntehsis to interrogate the narrative summary to answer the review question in its entirety	
Christiansen, A. (2018)	Qualitative and quantitative studies were included in the review to promote a comprehensive synthesis of the available evidence (Sandelowski, Voils, Leeman, & Crandell, 2012; Thomas et al., 2004).	Due to the heterogeneity of outcome measures, a meta-analysis of the quantitative data could not be completed. A textual narrative synthesis was completed to draw the findings together.	This review was limited by the potential of reporting bias that may exist with including only published studies, as published work tends to over report positive and significant findings. Variability in the conceptualisations and measurement of IR may limit the validity and generalisability of the findings. No randomised control trials (RCTs) were found, and there was limited control for extraneous variables.	

O'Brien , N. (2018)	A qualitative synthesis is particularly useful when assembling studieswith different markers of care, as is the case here, where we were interested in comprehensive primary care, inclusive of women's health, and HIV-specific care. A meta-analysis was therefore impossible.	The systematic mixed studies review design allowed us to draw from both qualitative and quantitative evidence to identify features of care considered valuable or desirable to the women seeking care (qualitative), and/or shown to be effective in enhancing access to care (quantitative). As such, our review includes both studies where semistructured qualitative interviews allowed women to name facilitators to care, and quantitative studies, such as pilots and quality improvement endeavors, where healthcare features were tested and measured based on existing hypotheses. We adopted a ''convergent qualitative synthesis,'' as described by Pluye and Hong, meaning we transformed study findings into qualitative themes. A qualitative synthesis is particularly useful when assembling studieswith different markers of care, as is the case here, where we were interested in comprehensive primary care, inclusive of women's health, and HIV-specific care. A meta-analysis was therefore impossible.	A few limitations of this research should be noted. First, multi-faceted improvement studies present challenges for isolating the specific feature or intervention most effective in improving access to care. In addition, as most participants frequented clinical sites or community organizations, our findingsmay not speak to the experience of women living with HIV who do not access care and may be most marginalized. Due to resource considerations, two authors were not available to screen all records or code themes independently. However, as detailed in our Methods section, we countered this limitation with a second reviewer screening a percentage of abstract and full texts, and reflexive discussions among coauthors before final articles were selected and themes confirmed. It was also beyond the scope of this review to consult experts (inclusive of women living with HIV) or explore the gray literature (e.g., conference abstracts, government reports, theses and dissertations). This may have limited the identification of relevant studies and the potential contribution of real-world insights from those working in this field or accessing care. Future research might consider including their perspectives, as well as examples of innovative care models or interventions not published in the peer-reviewed literature. This systematic review, based on studies conducted in 6 high-income countries, identified features of care that facilitate women's access to comprehensive primary care. Our review reaffirms the importance of multi-pronged strategies to meet the care needs of this population and offers examples of valued and effective strategies for care providers, clinics, and greater society to consider in improving the ''degree of fit'' between women's lives and the care services they seek.	

Paalosalo-Harris, K. (2017)	The use of this method ensures a systematic collection of all available evidence in a standardised and repeatable way, producing a balanced interpretation of the findings (Glasziou et al. 2001, Khan et al. 2011). Mixed method reviews can increase understanding of highly complex public health issues (Pluye & Nha Hong 2014).	This was a mixed method systematic review of peer reviewed literature. The use of this method ensures a systematic collection of all available evidence in a standardised and repeatable way, producing a balanced interpretation of the findings (Glasziou et al. 2001, Khan et al. 2011). Mixed method reviews can increase understanding of highly complex public health issues (Pluye & Nha Hong 2014).	A strength of this review was the rigorous process undertaken to search for available evidence. The selection of papers, quality assessment and development of themes were undertaken by both researchers. However, it has to be acknowledged that unpublished studies were not represented and this may be important, taking into account publication bias. All the papers included in this systematic review were rigorously assessed for their quality and found to be of high standard. However, they were mainly descriptive, which highlights the need for further research in this field using more experimental methods.	

Tobiano, G. (2018)	n/a	A mixed-methods review was conducted, following (2012) systematic methodology for diverse study types. Our review was underpinned by social constructionism. We acknowledged that each primary author of studies/projects included in our review brought socially constructed understandings, which were combined with our review team perspectives to build understanding on the topic. Gough et al. (2012) suggests a 'fit-for-purpose' approach, where an integrated or segregated approach can be undertaken. A segregated approach allows two or more sub-reviews to be undertaken to answer different aspects of the same research question, and these sub-reviews can be synthesised (Gough et al., 2012). We mapped our design (Supplementary file 1), an important step when combining diverse study types in systematic reviews (Harden and Thomas, 2005). Consistent with (2012) work, this study is a mixed-methods review, because qualitative and quantitative research as well as QI projects were included to answer the research questions. Although Gough et al. (2012) does not classify the types of mixed-methods reviews, mapping the design helped illustrate the importance placed on each study/project included. Priority was not given to any method; it was a parallel design, where the diverse studies/ projects expanded each other.	Four main limitations are outlined for this review. First, thematic synthesis and configuration are interpretive approaches, which can be viewed as a limitation. To address this, reviewers adopted a reflective approach, noting analytic memos throughout the analysis process to ensure decisions were explicit. Further, the main reviewer worked within a larger team, who assessed the analysis at each step of data analysis, questioning or confirming findings. Second, research and QI projects were included irrespective of their quality. The research included was largely of high quality. We identified frequent quality issues with QI projects relating to focus on design, evaluative measures and discussions around sustainability, which could limit the usability of our findings. Utilising two independent reviewers to appraise QI projects against QI criteria was intended to identify these limitations, providing considerations for future implementation efforts. It was promising that our configurative approach, matching research and QI projects, showed similarities across these bodies of work. However, it also highlighted differences, like the lack of patient involvement in QI projects. Without patient input, findings identified are at risk of being nurse-focused. The QI findings provided a different type of knowledge, identifying some real-life feasible strategies and local contextual issues, which can potentially inform ideas for research to understand why and how strategies work. Third, Gough et al. (2012) advocates stakeholder involvement in the review process. Unfortunately, we were unable to complete this in our set time. Thus, strategies arising from this review could be further developed by capturing and including patients' viewpoints in future research. Finally, although we attempted to create an exhaustive search strategy, with health librarian input, we recognise that some research studies and QI projects could have been missed.	Review question: How can patient participation in bedside handover be enacted?; Mapping and screening: 1. Systematic and exhaustive search 2. Screening process; Research studies: Studies examining patients' and nurses' perceptions of patient participation in bedside handover; QI projects: Projects describing the implementation or improvement of patient participation in bedside handover; Research studies: 1. Data extraction 2. Quality appraisal 3. Findings synthesised to answer research sub questions; QI projects: 1. Data extraction 2. Quality appraisal 3. Findings synthesised to answer research sub questions; Across study synthesis to answer

overarching research question

Pezaro, S. (2017)	A more comprehensive understanding of the quality and outcomes of the literature on interventions designed to support midwives and/or student midwives in work-related psychological distress is required to establish a strong foundation for further research and understand the best evidence for the most effective interventions. Previous reviews of this type have not included either midwives and/or student midwives as an isolated study population sample (Awa et al., 2010; Regehr et al., 2014; Ruotsalainen et al., 2015; Guillaumie et al., 2016; Murray et al., 2016; Romppanen and Häggman-Laitila, 2016). Therefore, this review adhered to methodological standards to examine the literature on interventions designed to support midwives and/or student midwives in work-related psychological distress.	The segregated systematic mixed-methods review design, as described by Sandelowski, has been employed (Sandelowski et al., 2006). This methodology is described as 'the design of choice' where a synthesis presents qualitative and quantitative findings separately. This method also allows the researcher to subsequently organise findings into a short line of argument synthesis, which provides a contemporary 'picture of the whole' (Noblit and Hare, 1988; Barnett-Page and Thomas, 2009).	This review was limited to international findings captured withinfirst world countries, although studies conducted in low-and middle-income countries were not excluded from selection. Other studies mayhave been evaded, as this search strategy was conducted using only the English language. Owing to a paucity of information, it has not beenpossible to conduct additional analysis such as sensitivity, subgroupanalyses, meta-analysis or meta-regression.Two of the papers retrieved provided case studies in relation to onesingle intervention. This may have altered the weight of evidence in thisregard. This has also meant that the same 14 participants have beenstudied within 2 of the papers retrieved.There is no clear understanding of how these particular interventions lead to the outcomes they produce, some baseline data is absent and it is unclear whether treatment fidelity measures have been used to assess delivery. Interventions are also not described in such a way that these studies could be accurately replicated (Craig et al., 2008).Moreover, workplace distress, and any change in the experience of orresponse to workplace distress, was not directly measured.Sample sizes were small. Additionally, the heterogeneity of thesesamples made some findings difficult to extrapolate solely to midwiferypopulations. The retrieved studies are not of high quality, and only onestudy included a control group. Therefore, some of the outcomesapparent may be due to other factors such as social desirability effectsor the therapeutic alliance with those administering the interventionrather than the type of intervention or mode of delivery per se	

Melin-Johansson, C. (2017)	n/a	This study used an integrative literature review method developed by Whittemore and Knafl (2005). Their basic principles of conducting an integrative literature review were used, and data were approached by processing and synthesising the different methods in included papers. Methods for mixed-studies synthesis have recently been articulated in a more contemporary text by Pluye and Hong (2014). In addition to separate syntheses by method, Pluye and Hong (2014) describe that using a MSR involves a synthesis of results from studies with diverse design. For example, quantitative data are qualitised or qualitative data are quantified into mutual themes for the purposes of synthesis. The integrative review was therefore conducted based on a MSR to strengthen rigour of the study. We followed the seven stages described by Pluye and Hong (2014): (i) review questions were formulated; (ii) eligibility criteria were defined; (iii) an extensive search strategy was applied; (iv) potential relevant studies were identified; (v) relevant studies were selected; (vi) quality of selected studies was appraised; and (vii) included studies were synthesised. A qualitative convergent synthesis design was used; that is, the results in the quantitative studies were transformed into qualitative findings. The various data sets were integrated in the presentation of the overall result.	This review was thorough and used a structured mixed-studies design. The searches had some limitations; only three databases were used, only papers written in English were included, and searches were limited between 1985–2016. Thus relevant papers may have been missed. On the other hand the 16 papers included were rich in information and contributed valuable information about clinical intuition. A majority of the included articles had a hermeneutic design guiding the analysis and the results were presented using a narrative approach. The inclusion of older and newer papers reflects the debate about nurse's intuition and shed light on the controversial subject of the phenomenon that affects health professionals today. Papers of high or medium quality were included to enhance reliability and credibility, affecting the final outcome of the synthesis. A majority of the included studies in our review used qualitative methods. Qualitative methods are mostly used in papers related to intuition described in a review by Hassani, Abdi, and Jalali (2016). In future research, nurse anaesthetist's use of intuition as a part of the decision-making process when extubating a sedated patient will be explored with mixed methods. There is also a need for the development of multidimensional measuring instruments.	(i) review questions were formulated; (ii) eligibility criteria were defined; (iii) an extensive search strategy was applied; (iv) potential relevant studies were identified; (v) relevant studies were selected; (vi) quality of selected studies was appraised; and (vii) included studies were synthesised.

Kunyk, D. (2016)	The purpose of this sequential exploratory mixed studies review (Pluye and Nha Hong, 2014) was to determine what the extant literature reveals about the process of help seeking taken by health professionals for addiction.	The purpose of this sequential exploratory mixed studies review (Pluye and Nha Hong, 2014) was to determine what the extant literature reveals about the process of help seeking taken by health professionals for addiction. To do so, we first conducted a meta-synthesis of the qualitative literature (phase-one) to garner a broad understanding of the characteristics and processes of health professional's decisions regarding help seeking. We then conducted a narrative synthesis of the quantitative studies (phase-two) to generalize these findings by examining for convergent, complementary or divergent results.	As with all reviews, this study was constrained by the quality and scope of existing published articles; this is clearly a field ripe for future investigation. We were not surprised that the studies were limited to mostly descriptive, observational and retrospective designs. Addiction is a highly stigmatizing disease which cannot be randomly assigned to individuals, and health professionals with addiction are confronted with risks to their employment, licensure and income if exposed. As a result, most of the reviewed studies were limited to investigating health professionals engaged in treatment programs or were cross-sectional surveys of certain populations of health professionals. The limited available research in this field provides justification for performing this review. Further research is needed to understand how to best mobilize facilitative conditions to initiate the help seeking process by health professionals and by their peers, families and patients. In the context of these limitations, the data presented herein provides evidence of the process of help seeking taken by health professionals for addiction.	(1) identifying the review question, (2) defining eligibility criteria, (3) applying an extensive search strategy, (4) having reviewers independently screen titles and abstracts, (5) selecting relevant studies based on reviewing the full text, (6) appraising the quality of included studies, and (7) synthesizing the study findings (Centre for Reviews and Dissemination, 2008).

Lee, A. (2017)	n/a	The York Centre for Reviews and Dissemination guidelines handbook (2009) was used to underpin a mixed method systematic review. Results of the initial search were structured using the Preferred Reporting Items for Systematic reviews and Meta-Analysis (PRISMA) statement. The most recent (2015) PRISMA guidance was adopted (Liberati et al., 2009; Moher, Liberati, Tetzlaff, & Altman, 2009; Moher et al., 2015; Shamseer et al., 2015). PRISMA is an effective and widely accepted tool in the standardization of the information retrieval processes (Moher et al., 2015).	Gastroesophageal cancer is prevalent across the globe, but more prevalent in middle and far Eastern countries, where English is not the primary language. This means there may be evidence published in other languages which was not identified in this review. As identified in the discussion, the range of different timescales and nomenclature applied in cancer research has an impact on results. To identify when a patient actually detected their first symptoms is hampered by several confounding factors. The patient journey through many different healthcare systems is also complex. How patients present in China may differ significantly, to how they present in the USA, or UK for example. Other factors which have an impact on presentation and survival in GOC are the underlying aetiology, the cancer site, the patient attributes and comorbidities. Most of these patients are elderly, so the presence of several other conditions and illnesses is fairly common in this cancer.	n/a

Shaw, J. (2015)	n/a	The approach taken was in line with the segregated system- atic mixed-methods technique proposed by Sandelowski et al. (2006). This approach acknowledges the different epistemological and ontological assumptions that underpin qualitative and quantitative research. It then allows for the findings to be integrated into what Noblit and Hare have termed a 'line of argument synthesis', once the initial analy- sis is complete in each separate tradition (Noblit & Hare 1988). As Sandelowski et al. (2006, p. 7) note, a segregated mixed-methods review: 'is also the design of choice when mixed research synthesis is conceived as the configuration, as opposed to assimilation, of qualitative and quantitative research findings....Unlike findings across studies seen to address the same relationship or aspect of a phenomenon, findings conceived as complementary cannot be reduced. Instead, they can only be organized into a coherent whole'.	There were no good quality outcomes data from intervention studies. Given that we limited our search to English language papers, it is possible that we missed some that addressed the issues in countries other than the UK and the USA. Even if this is the case, the complete absence of research from other countries where research is usually published in English is startling. This is a significant and urgent research deficit. We found it hard to identify a relevant methodological approach to the review process we undertook, given the range of methodological and epistemological traditions that underpinned the studies we intended to include. In the end, the approach suggested by Sandelowski et al. (2006) was best suited to the iterative, mixed method process we used. We made the pragmatic decision to only include published literature of moderate to high quality. This is both a strength and a limitation, given the lack of such evidence we found. There is a growing grey literature reporting service innovations in individual prisons (Robinson 2000, North 2005, Marshall 2010, Albertson et al. 2012). Albertson et al. (2012) also identify the urgent need for evidence of interventions and strategies to improve outcomes for imprisoned mothers (including comparison of outcomes between women with and without mother and baby unit residency). They also suggest the potential of such studies to alleviate short-term distress and reduce long-term health problems.	n/a

Lewis, S. A. (2015)	n/a	A protocol was developed and revised over subsequent meetings to help organize the systematic review and synthesis of evidence. Cochrane (Higgins & Green 2013), Cochrane Effective Practice and Organisation of Care Review Group (EPOC) (2012) and Cochrane Collaboration Qualitative and Implementation Methods Group (2013) guidance were used along with a three stream mixed-method (Evidence for Policy and Practice Information Co-ordination Centre (EPPI Centre)) review design (see Figure 1). Cochrane processes and Cochrane EPOC guidance included defining the scope of the review, the search for and how effect evidence was appraised and how data were extracted and synthesized. Qualitative and mixed-method evidence was synthesized using a thematic synthesis approach (Thomas & Harden 2008). Finally, an overarching synthesis was undertaken to map children and young people's views against the programme theories, logic and outcomes of selfmanagement interventions. From the entire synthesized dataset we then developed a new logic model for a medication management and seizure management intervention pathway for children and young people. Demonstrating where gaps in self-management interventions exist, from the realms of theory to conducting interventions and mapping against the views and experience of children and young people.	Overall intervention study quality was weak and all studies had methodological deficiencies such as poor randomization procedures and allocation, lack of blinding and the absence of intention-to-treat analysis approaches. Quality of reporting of intervention delivery, how the primary and/or secondary outcome measures were assessed and reporting of key findings was also variable. Medication adherence was generally self-reported and not supported by biochemical measures. The majority of qualitative studies and mixedmethod study were data rich and supplemented the gaps identified in intervention studies to inform future research studies.	Review Objectives; Search strategy; ABSTRACT, TITLE SCREEN AND QUALITY APPRAISAL; DATA ABSTRACTION AND SYNTHESIS: Synthesis 1 - data extraction, narrative summary, findings; Synthesis 2 - Data extraction, thematic synthesis, findings; SYNTHESIS 3: Overarching narrative synthesis of entire dataset to address review objectives

Poikkeus, T. (2014)	This method was chosen because it brings together both quantitative and qualitative studies (Grant & Booth 2009).	A mixed-method systematic literature review (Oliver et al. 2005, Thomas & Harden 2008) was conducted following the guidelines of the Centre for Reviews and Dissemination (Centre for Reviews & Dissemination (CRD) 2009). This method was chosen because it brings together both quantitative and qualitative studies (Grant & Booth 2009).	This review has some strengths and limitations that should be noted. First, studies in this review were conducted in different kinds of clinical settings and nursing cultures. On the one hand, it may render comparison of the studies difficult. On the other hand, it provides a global view of the phenomenon in question. Second, the inclusion of only studies written in English may be seen as a limitation, in that studies written in other languages were not included. However, these studies written in English originated from various countries worldwide, adding to the global view. And again, English is regarded as the common scientific language in which the most important research is currently published. Third, no studies were excluded after the quality appraisal and this may increase the risk of bias in the review. Using second-opinion validation and similar criteria and statements for independent evaluation of studies increases the validity of this review. Fourth, a search strategy limited only to electronic databases could increase the publication bias. However, a search strategy of combining terms and phrases in multiple fields (mp) with Boolean combinations is likely to produce more robust search strategies than any approach based on MeSH strategy (Wilczynski & Haynes 2004). And finally, the included studies did not lend themselves to conducting a meta-analysis and a mixed-method review is said to weaken the effectiveness of a systematic review (Jadad et al.1998). Nonetheless, including quantitative and qualitative studies in this review allowed a broader perspective of the support for ethical competence of nurses.	n/a

Brewster, L. (2014)	n/a	A systematic search focused on research addressing frontline staff acceptance of telehealth was conducted. For the purposes of the review, the term 'telehealth' was a primary search term, but it should be noted that inconsistent use of terminology (e.g. telehealth, telemedicine and telemonitoring) impacted on study selection, as a significant number of articles had to be located in full-text form to ascertain the nature of the equipment used within the study. Similarly, front-line staff' needed to be defined; the term is used here to describe any healthcare personnel involved in the direct delivery of telehealth or associated patient care. Service delivery is often conducted through multidisciplinary teams, with nurses contributing significantly, although job titles varied throughout. An initial scoping review identified an absence of relevant randomized controlled trials (RCTs) or cohort studies. Consequently, all study designs were included in a mixed-method systematic review to ensure a comprehensive representation of current evidence.	Review limitations include the quality of reporting in included studies, which restricted the data that could be extracted about service implementation. For example, many studies introduced telehealth in a RCT environment, and there was little discussion of the timeline of the introduction of the technology, which might influence acceptance. There was also inadequate detail about telehealth technical specifications and manufacturers. While there is value in comparing patient and staff acceptance, studies reviewed here often focused on patient views to the detriment of detailed analysis of staff acceptance.	

Skirton, H. (2012)	n/a	We conducted a systematic review. The use of this method ensures that all relevant evidence is taken into account and that the data are synthesized to produce overall findings and enable valid conclusions to be drawn. The method described by the Centre for Reviews and Dissemination (2008) for the conduct of systematic reviews was followed, including identification of clear inclusion and exclusion criteria, quality assessment of studies to be included, and undertak- ing both a descriptive and narrative synthesis of the results. We also augmented database searches with hand searching to ensure that we retrieved the maximum number of eligible papers. The Centre for Reviews and Dissemination (2008) suggests this is required when dealing with qualitative or mixed method studies, as indexing of those papers may not be accurate. The search was undertaken during February 2011.	A limitation of this review is the lack of studies directly measuring competence. However, one of the strengths is the broad range of settings where data were collected by the authors of the 11 included studies. However, this diversity precluded direct comparisons across countries and across disciplines and further studies that enable data to be collected and compared across specialties and countries would be helpful. Development of validated tools to assess competence of nurses would facilitate these studies.	

Coles, E. (2012)	A mixed-methods 'combined separated synthesis' approach was used to blend quantitative and qualitative evidence within in a single review. This allows a meta-synthesis of the combined quantitative and qualitative evidence which has certain advantages over traditional systematic reviews.	For instance, the data search is 'purposive rather than exhaustive since the purpose is interpretive explanation and not prediction' [13] and it is not necessary to find every study since the principles of 'conceptual saturation' are incorporated into the planning of the search strategy [14]. Therefore, following this methodology, this review started with the broad-based research question, 'What is known about community-based health and health promotion services for homeless people' (Fig. 1). A systematic search was undertaken to map and screen the literature on community-based health and health promotion services for homeless people. The identified studies were grouped according to broad design type and were characterized either as 'intervention' to describe those of which used quantitative methods with self-report outcomes, or 'qualitative' to describe those which used qualitative, ethnographic and mixed-methods approaches. The term 'qualitative' was used with caution 'because it encompassed a multitude of research methods' [14]. Parallel sub-reviews were then conducted which permitted two sub-questions to emerge (Fig. 1), relating to (i) health and health improvement, and (ii) engagement with health and health promotion services. The quantitative and qualitative findings were merged in an interpretive narrative summary and thematic matrix to address the refined research questions.	There are some limitations however. For instance, the fact that this review was limited to studies conducted in developed, industrialized countries may be perceived as a weakness; however, this decision was taken because the type(s) of homelessness and socio-demographic characteristics of homeless people in emerging economies tends to differ, as do the societal structures and conditions that contribute to, preserve or address homelessness. An additional limitation may be the choice of the combined separate synthesis methodology which necessitates the reporting of the intervention and qualitative studies separately before combining in a thematic synthesis. It is possible that critical information is lost as a consequence of combining; however, in the process of synthesis we ensured that the emerging themes were 'transferable across the different study contexts' to ensure the fidelity of the information retrieval [46]. Despite concerns regarding the quality of some of the research and the representativeness of the sampling, the evidence from this work illustrates the difficulties in conducting robust evaluations of communitybased health promotion with excluded groups, but shows that appropriately designed communitybased interventions will improve the health of people experiencing homelessness.	REVIEW QUESTION: 'What is known about community-based health promotion for homeless populations?' MAPPING AND SCREENING EXERCISE: 1. Systematic and exhaustive searches identified 8,435 citations 2. Retrieval and screening of full papers resulted in 13 studies DATA EXTRACTION AND QUALITY APPRAISAL: Conducted within each study type. Intervention studies; Data extracted from studies to describe their characteristics and assess their methodological quality and risk of bias. Qualitative studies; Data extracted from studies to describe their characteristics and assess their methodological quality. IN DEPTH REVIEW:

				Conducted across both study types, Emerging themes (across all studies) Synthesis of findings to answer sub-questions: 1. To what extent does community-based health and health promotion services improve the health of homeless people? 2. What factors enable homeless people to engage with community-based

De Cordova, P. B. (2012)	To be comprehensive, all types of study designs were included in the review. Due to study heterogeneity, a meta-analysis could not be performed.	Limitations and strengths of the evidence: Employee outcome studies had generally smaller sample sizes than the quality outcome studies and researchers often used cross-sectional designs based on self-report. Another limitation of the quality outcome studies is that researchers only studied the relationship between time of admission/discharge and mortality.	There are strengths and limitations to this review. The search was conducted over several months and although every effort was made to be comprehensive, it is still possible that some studies were missed. Publication bias may be present; however, we did find studies that found no differences diminishing our concern about this potential bias. Only studies published in English were included in the review. Study appraisal was conducted using a well developed instrument; however, due to the inconsistencies of definitions, study designs and outcomes there was no meta-analysis conducted. Finally, due to the volume of studies included in the review, quality appraisal was conducted by the first author and supervised by the senior authors.	
Wulff, K. (2011)	n/a	A mixed-method systematic review was undertaken using the following guidelines, Systematic Reviews: CRD's guidance for undertaking reviews in health care, from the Centre for Reviews and Dissemination Handbook 2009 (http://www.york.ac.uk/inst/crd/pdf/Systematic_Reviews.pdf). We conducted a scoping review first, which allowed us to refine our protocol and search strategy that guided this review. We also consulted extensively with a health sciences librarian experienced in systematic reviews. All review stages (search, data extraction, quality assessment and synthesis of results) were guided by the CRD Handbook.	This review has some potential limitations. First, while the aim was to combine multiple findings to reach a conclusion on nursing MATs and patient safety, a potential reporting bias in the primary studies may exist. Published studies tend to report mostly positive findings, and synthesized study results are interpreted from this data-reporting practice. However, we did find that negative, positive and nonsignificant findings were reported across studies; therefore some balance is evident in this synthesis. Secondly, only US, Canadian, and Dutch articles describing the effects of MATs were reported in the literature. Although implementation of MATs systems in healthcare organizations is extensive, it is possible that more countries have implemented than are publishing their findings. Thirdly, our search strategy restricted titles or abstracts to English language because it was the language of proficiency of our research team. This may have resulted in overlooking additional studies.	n/a

Roberts, A. (2009)	A systematic review appeared to be the most appropriate way forward in the first instance, as there was an absence of sy nthesized evidence or clinical guidance concerning thisgroup of women. To inform the design an initial key word scoping exercise of CINAHL and MedLine was undertaken to identify the range of methods used in potential evidence of interest. Using key words such as contraception, women, satisfaction and choice we were able to rule out a meta-ethnographical design as a number of potential mixed-method and quantitative studies were located. A mixed-method design was therefore chosen as most appropriate and a protocol was subsequently refined to minimize bias, add transparency and provide clear, structural and theoretical guidance when conducting the review (Jackson et al. 2005, EPPI 2007).	The design incorporated the following methodological frameworks: • A structured, phased design was used as a framework for searching and managing evidence to meet each objective (see Table 1), based on the EPPI Centre approach (Thomas et al. 2003, Oliver et al. 2005). • Principles from the Cochrane Guidelines for Systematic Reviews of Health Promotion and Public Health Interventions Taskforce were used to inform the searching and retrieval of mixed-method evidence (Jackson et al. 2005). This application of Cochrane guidance helped ensure high standards of reliability and validity. • Finally, principles and techniques from the narrative synthesis toolbox were used to synthesize evidence (Oliver et al. 2005, Popay et al. 2006).	In the spirit of transparency, two methodological issues are worthy of discussion. The searches identified unexpected evidence focusing on sex and drug workers, contraception and STIs, rather than birth control, and this evidence was excluded from the review. Phase 2 studies were not all qualitative in design as anticipated, and therefore we carried out a mixed synthesis of both qualitative and quantitative studies. These changes to the protocol were considered strengths, as the review design was tailored in response to the type of evidence found. Although the chosen age range for this review was 40 years of age, current clinical guidance tends to categorize medically women in a group over 35 years. It is generally recognized that systematic review conventions do not usually include content analysis of policies and clinical guidelines to identify key concepts of interest such as choice. However, we considered our review to be strengthened by the inclusion of this material, and the findings highlighted concerns about the facilitation and transfer of evidence into practice. We limited the search of policy and clinical guidelines to UK, EU and WHO guidance that had been implemented in the UK. We are uncertain whether the outcome of the policy review can be generalized to other parts of the world, and would recommend that local policy reviews be undertaken. Locating all relevant qualitative evidence is problematic as search terms are frequently more geared towards quantitative research (Flemming & Briggs 2007). However, the databases used and supplemental searching strategies were deemed appropriate to meet the needs of the review. In searching for empirical evidence, we included international evidence to increase the breadth and depth of multi-ethnic, religious and cultural perspectives. We took a pragmatic view that the UK is a multi-cultural country with a significant transient population of immigrants, migrant workers, travellers/tourists alongside settled immigrant communities and the indigenous population. Women's choices and lifestyles are generally known to be linked and influenced by cultural and religious practices brought from their native country to the UK, and continued to varying degrees through successive generations (Hennink et al. 1999). This view was reinforced by clinical colleagues who managed contraception services locally.	Table 1 Structured four-phase design Phase 1: Review and content analysis of policies and clinical guidelines Phase 2: Identification and synthesis of qualitative evidence to determine the views and experiences of women in relation to contraceptive choices and accessing services Phase 3: Identification and synthesis of mixed-method evidence to determine the facilitators and barriers to complying with (or not) a contraceptive method Phase 4: Overarching synthesis of the evidence obtained from phase 1 to 3

Roberts, S. H. (2011)	According to Pope and Mays (2006) 'Narrative synthesis is rooted in a narrative or story-telling approach and seeks to generate new insights or knowledge by systematically and transparently bringing together existing research findings' (p. 145).	A narrative synthesis approach was adopted (Mays et al. 2005) in order to synthesize diverse studies in a structured way. According to Pope and Mays (2006) 'Narrative synthesis is rooted in a narrative or story-telling approach and seeks to generate new insights or knowledge by systematically and transparently bringing together existing research findings' (p. 145). The technique aims to move away from traditional literature reviews where studies are reported sequentially with little integration of the findings. In line with this approach and by retaining a systematic approach to searching the literature, this synthesis aims to identify key themes arising in the literature and to develop a narrative which encompasses these themes. Thus, relevant data were extracted from identified literature followed by a thematic exploration of the relationships among findings to synthesize and interpret the evidence in a meaningful way relevant to the research question. Though the data were extracted from quantitative, qualitative and mixed-methods sources, the outcome data of interest were of a similar nature and thus did not require multilevel or parallel synthesis as recommended for other types of mixed-method reviews (Noyes et al. 2008).	As we intended the review to be as broad and as inclusive as possible, we adopted a narrative approach to the synthesis, which has several limitations. Whilst this approach allows an evidence synthesis from a greater variety of study designs than a systematic review approach, this generosity introduces other problems for the reviewer (Pawson & Bellamy 2009). First, the number of studies to be included can potentially be unmanageable; second the number of data items that could be extracted from each study also increases exponentially; third, the dissimilarity of study designs and formats makes it more difficult to extract a common body of materials from each study; and finally, appraisal of quality is also more difficult with such variety of study designs and paradigms. Pawson and Bellamy (2009) also raise the possible problem of publication bias with a tendency for evaluations to emphasize positive aspects when reporting the inner processes of a programme. Limitations specifically for this review also include the reliance on reviewers' reading, thinking and interpretation of the literature, which may have introduced bias, though this was necessary to assimilate the varied evidence currently available. The lack of a formal quality appraisal process is also a limiting factor. The varied study designs and the need to extract specific data about reported incentives and barriers, typically qualitative in form, meant That assessing study quality was less important than assessing the quality and relevance of the data. In this sense the review resembled a realist synthesis. Although again, this may have introduced possible bias, this was necessary to capture relevant data for this review. A further limitation of this review was that studies published in languages other than English were not examined which may result in some important omissions	

Sedgfield, A. (2015)	n/a	Dissertation study. PRISMA guidelines for the development of the review protocol were adopted in order to minimise bias and allow for replication (Moher et al., 2009). A sequential explanatory mixed methods, narrative review was conducted through the integration of findings from quantitative and qualitative research as shown in Figure 1 (Harden, 2010; Pluye & Hong, 2014).	There was an element of publication bias within this review because it excluded unpublished studies which had not been peer-reviewed. Therefore, it is possible that the findings in this study could be exaggerated because nonsignificant findings within the grey literature were excluded (McAuley, Pham, Tugwell & Moher, 2000). For instance, one unpublished dissertation found that a stress-reduction programme demonstrated better improvements in reducing anxiety in pregnant women compared to the mindfulness-based intervention (Bratton, 2008). The focus of this review was on maternal anxiety and stress, however the author acknowledges that in reality there is a high co-morbidity of anxiety and depression and so potential studies may have been excluded due to the eligibility criteria. Furthermore, although none of the reviewed studies provided quantitative outcome data for fathers, one qualitative paper identified a theme (not included within this review) relevant to fathers feeling more prepared for parenthood (Gambrel & Piercy, 2015). This study also suggested that including mothers and fathers (or birth partners) together in the intervention enhanced the couple's relationship, which has clinical implications for future research.	Review Question; Search, screening, Eligibility, identification of studies; Synthesis 1: Quantitative quality assessment, data extraction, synthesis of effect sizes; Synthesis 2: Qualitative quality assessment, data extraction, synthesis of themes; Synthesis 3: Integration of quantitative results and qualitative findings (Harden, 2010)

Langer, L. (2018)	In order to construct an evidence-informed theory of change of ML4D I require a synthesis of two types of information: (1) evidence of ML4D's effectiveness, defined as aggregative data measuring the impact of mobile learning in LMICs and (2) analytical themes of mechanisms and contexts to explain this impact (or lack of impact). These analytical themes will allow for a configuration of the potential impacts of ML4D, unpacking the black box of how the interventions might have led to the established outcomes. I therefore design two distinct review modules to be able to generate both types of information and to synthesise them in a mixed-methods synthesis. Each module follows its own logic and design applying an aggregative and a configurative approach respectively. This two-module mixed methods review approach is presented in Figure 4.2.	follow a mixed-methods systematic review design in this thesis. This mixed-methods design is operationalised through a two-module review approach.	Despite following accepted guidelines and methodological protocols for gold standard systematic reviews in social sciences (Gough et al 2017; Campbell Collaboration 2015), the nature of conducting a systematic review as part of a PhD thesis necessarily limits some technical aspects of the review process. First, as a single reviewer technical quality assurance processes such as double-screening and double-coding could not be conducted. Second, the registration of the review with an umbrella review organisation such as the Campbell Collaboration was not possible as I could have no longer controlled the timelines of conducting and concluding the review. Third, as the timelines of the review and its publication are set by the period of PhD registration, the review is unlikely to be as up-todate as usually expected for publication, in particular if conducted at the beginning of the PhD. This limitation applies to my systematic review in particular and despite experimenting with different methods to keep the search hits up-to-date, my review only includes primary research until June 2016 when I ran the last full search update. In addition, I conducted a mixed-methods systematic review, a review approach which presents a minority among the systematic reviews in the social sciences (Snilstveit 2012; Langer & Stewart 2014). While this meant that I address common limitations of effectiveness systematic reviews, such as only including a narrow range of research and only investigating the question of intervention effects, on the downside, there is no agreement on methodological approaches to the precise conduction of mixed-methods reviews. I therefore developed a range of review steps more iteratively and while formulating an a priori review protocol, did not submit this protocol for publication. For the same reason, I did not report my systematic review following PRISMA reporting guidelines (though all PRISMA items are covered between chapters 5 and 6, and appendices 4.1–4.3 and 5.1–5.3) and did not conduct a strength of the evidence and recommendation assessment, such as the GRADE or CERQUAL frameworks.	Exhaustive search: for all publications commenting on the application of mobile technologies to support education in LMICs **Towards an evidence-informed theory of change for mobile learning for development** - Aggregative review module: Impact evaluations: Aggregation of effectiveness - Critical appraisal 1, Meta-analysis Answers review question 1 Configurative review module: Qualitative studies - Arranging knowledge on mechanisms and contexts; Critical appraisal 2; Thematic synthesis Answers review question2. Mixed methods synthesis answers review question 3

Table 2

Characteristics of Included Application Studies

First Author	Country of Publication	Year of Publication	MMRS Framework	MMRS Label	Field/Discipline
Larsson, G.	Norway/ Sweden	2016	Sandelowski et al., 2006	A systematic mixed studies review	Psychology
Sandlund, M.	Sweden/UK	2017	Pluye & Hong, 2014	A systematic mixed studies review	Health/Medical
Teskereci, G.	Turkey	2018	CRD guidelines, 2009.	A mixed-methods systematic review	Health/Medical
Charles, J. M.	UK	2016	Pawson et al., 2005 - The realist approach	A multi-streamed, mixed-methods systematic review	Health/Medical
Fritz, N. E.	UK/USA	2017	JBI approach and extraction tools	A mixed methods systematic review	Health/Medical
Hoang, V. L.	Australia	2018	JBI guidelines for mixed-methods systematic reviews (2014).	A mixed-methods systematic review	Health/Medical
Tsimicalis, A.,	Canada	2016	Heyvaert et al., 2011	A mixed-methods systematic review	Health/Medical
Klassen, K. M.	Australia	2018	JBI	A mixed-methods systematic review	Health/Medical
Stephen, N.	UK	2013	Petticrew M, Roberts H (2005)	A mixed methods systematic review	Health/Medical

Skirton, H.	UK	2013	CRD(2009)	A mixed methods systematic review	Health/Medical
Farrance, C.	UK	2016	EPPI-Centre Approach (Thomas et al., 2004).	A mixed-methods systematic review	Health/Medical
Guillaumie, L.	Canada	2016	Thomas et al. 2004, and Harden & Thomas 2005	A mixed-methods systematic review	Nursing
Sznitman, S. R.	Israel	2016	Pluye & Hong, 2014	A mixed methods systematic literature review	Public Health
Arrowsmith, V.	UK	2016	EPPI-Center approach	A mixed methods systematic review	Health/Medical
McCutcheon, K.	UK	2015	JBI User guide version 5	Mixed methods systematic review	Nursing
Kolehmainen, N.	UK	2010	Popay et al. (2006)	A mixed-methods systematic review	Health/Medical
Hoare, K. J.	New Zealand	2016	JBI, 2014 - contingent methodology	A mixed methods systematic review	Health/Medical
Cunningham, J.	UK	2015	CRD, 2008	A mixed methods systematic review	Health/Medical
Heyvaert, M.	Belgium	2014, 2015	Heyvaert et al., 2011	A mixed methods research synthesis	education
Puzzolo, E.	UK/USA/Germany	2016	EPPI-center approach	A mixed-methods systematic review	Environmental science

Lloyd, M.	UK	2018	Thomas, Ciliska, Dobbins and Micucci (2004),	A mixed-methods systematic review	Health/Medical
Thompson, J.	UK	2017	Sandelowski et al., 2006	A systematic review of quantitative and qualitative research	Health/Medical
Husebø, A. M. L.	Norway	2018	Gough et al., 2012	A mixed-method systematic review	Nursing
Kennedy, F.	UK	2012	Oliver et al., 2005	A mixed method systematic literature review	Nursing
Mathieson, A.	UK	2018	Pluye & Hong, 2014	A systematic mixed-studies review and qualitative synthesis	Nursing
Kang, E.	Australia	2018	Pluye & Hong, 2014	A systematic mixed studies review	Health/Medical
Olson, J. K.	Canada	2018	Pawson et al., 2005 - The realist approach	A Mixed Methods Systematic Review.	Nursing
Low, L. F.	Australia	2018	Pluye & Hong, 2014	A systematic mixed studies review	Health/Medical
Kaur, J.	UK	2017	JBI, 2017	A mixed-methods review and synthesis	Health/Medical
Shi Shiu, C.	USA	2016	Sandelowski et al., 2006	mixed research synthesis	Social sciences

Babakus, W. S.	UK	2012	EPPI-Centre approach	A systematic, mixed-methods review	Health/Medical
McConnell, T.	UK	2016	Sandelowski et al., 2006	A mixed-method review	Health/Medical
Sox, C. B.	USA	2017	Heyvaert et al., 2011	A mixed research synthesis	Social sciences
Grøndahl, V. A.	Norway/ Sweden	2017	Cochrane Collaboration (2011)	A systematic mixed studies review	Health and Social studies
Stevanin, S.	Italy/Finland	2018	JBI, 2014	A mixed-method systematic review	Nursing
Dai, Y.	UK/ China	2018	EPPI-Centre approach	A mixed-method systematic review	Health/Medical
Christiansen, A.	Australia	2018	JBI	A systematic mixed-method review	Health/Medical
O'Brien, N.	Canada	2018	Pluye & Hong, 2014	A systematic mixed studies review	Health/Medical
Paalosalo-Harris, K.	UK	2017	CRD, 2008	Mixed method systematic review	Health/Medical
Tobiano, G.	Australia/ UK	2018	Gough et al., 2012	A systematic mixed-methods review	Nursing
Pezaro, S.	UK	2017	Sandelowski et al., 2006	A systematic mixed-methods review	Health/Medical
Melin-Johansson, C.	Sweden	2017	Pluye & Hong, 2014	A mixed-studies review	Nursing
Kunyk, D.	Canada	2016	CRD, 2008.	A mixed studies review	Health/Medical
Lee, A.	UK	2017	CRD, 2009	Mixed methods literature review.	Health/Medical

Shaw, J.	UK	2015	Sandelowski et al., 2006	Systematic mixed-methods review	Health/Medical
Lewis, S. A.	UK	2015	EPPI-Centre approach	Mixed-method systematic review	Health/Medical
Poikkeus, T.	Finland	2014	CRD, 2009.	A mixed-method systematic review	Nursing
Brewster, L.	UK	2014	CRD, 2012	A mixed-methods systematic review	Health/Medical
Skirton, H.	UK	2012	CRD, 2008.	A mixed-methods systematic review	Nursing
Coles, E.	UK	2012	Oliver et al., 2005; Harden, 2006	A mixed methods review	Social Work
De Cordova, P. B.	USA	2012	CRD, 2009.	A mixed-methods systematic review	Health/Medical
Wulff, K.	Canada	2011	CRD, 2009.	A mixed-methods systematic review	Nursing
Roberts, A.	UK	2009	EPPI-Centre approach, 2007	Mixed-method systematic review	Health/Medical
Roberts, S. H.	UK	2011	Mays et al., 2005 - A narrative synthesis approach	A narrative synthesis of qualitative, quantitative and mixed methods studies	Health/Medical
Sedgfield, A.	UK	2015	Pluye & Hong, 2014	A mixed methods systematic review	Health/Medical

Langer, L.	UK	2018	Thomas et al., 2003 - Two-Module review approach	A mixed-methods systematic review	Education

Table 3

Summary of critical review of final set of methodological studies with quality evaluation scores and number of citations

Framework and citation	Distinguishing factors	Strengths	Weaknesses	Quality Evaluation Score	Citations
Mixed Methods Research Synthesis (Heyvaert, Hannes, & Onghena, 2016)	Oriented to general research platforms. Builds on preceding publications leading to the proposed framework. Comprehensive and simplified. Includes sampling and report writing stages.	Appears well grounded in the literature. Simple presentation, easy to follow steps using common language. Adaptable to various designs and types of MMRS studies.	Users require more background knowledge and context on MMRS to apply approach effectively.	9	36
Meta-modelling (Lemire, 2017)	Oriented to program evaluation contexts. Recommends sequential syntheses of quantitative and qualitative studies and focused on implementation and effectiveness studies. Structure and transparency are emphasized where critical program components are first located within implementation studies, then summarized across these studies, and finally integrated with findings from effectiveness studies by way of Qualitative Comparative Analysis (QCA). The author considers the approach more operational and transparent than the procedural steps and analytical processes envisioned and prescribed by the EPPI and realist synthesis approaches. Focused exclusively on implementation and effectiveness studies.	Transparency and systematic procedures emphasized. Outlines specific procedures for systematic and transparent study identification, extraction, coding and analysis. Concrete and analytical data display techniques support procedural steps. Verifiable and transparent integration facilitated by Qualitative Comparative Analysis. Operational and pragmatic--- focuses on specific and studies with specific types of information allowing for a more focused and purposeful synthesis of different types of studies. Weaknesses	Difficulty of distinguishing between the implementation of the primary study and the reporting of the primary study. The quality of the component coding for the QCA and in effect to the robustness of the causal recipes identified is questionable. The provision of more comprehensive program and context descriptions would surely enhance the analytical potential of research syntheses, meta modeling included.	9	1
Sandelowski et al., 2006	Highlight aspects relating to design issues i.e., mixed methods approaches	Elaborate frameworks for the three MMRS designs, contingent, integrated, and segregated discussed in one place. Differences across designs per purpose and study selection for inclusion well discussed.	Focused on design and less on the methodological aspects of employing the various designs. Users need to have good background of mixed methods research literature and designs.	8	232

EPPI framework (Thomas, Harden, Oakley, Oliver, Sutcliffe, Rees, ... & Kavanagh, 2004)	Oriented towards health research. Simplistic, considers evidence synthesis separately per the primary study design before integrating it in final stages to inform overall questions. Could be complementary, confirmatory, or refuting.	A pioneering technique in MMRS review methodology. Offers an alternative to Bayesian methods for combining diverse evidence and study types in systematic reviews. The integration of quantitative with qualitative evidence to provide insights provides more context to the quantitative findings. Parallel considerations and work on quantitative and qualitative studies allows for knowledge creation by both strands, individual quality evaluation of retrieved studies, focus on separate but related questions, and the parallel synthesis of evidence better aligns with conventional systematic review methods. Advances relevance of systematic reviews by employing relevant procedural steps for each strand.	Approach appears to suggest predetermination of review stages and steps, which is almost impossible in MMRS studies because many decisions and processes are emergent. Little guidance on the type of evidence used and why especially for the qualitative views. Decisions on quality of evidence particularly for qualitative studies prone to reviewer subjectivity. Also, guidance on decisions regarding the findings of the two syntheses required especially for conflicting results.	6	445
Integrative review (Whittemore, & Knafl, 2005)	Oriented to nursing research. Considers the combination of methodologically diverse evidence and particularly across experimental and non-experimental studies.	Includes a systematic and rigorous approach to the process of integrating data from differing sources with an emphasis on data analysis.	Broad definition for the approach. Focuses on diverse studies based on design (i.e., experimental versus non-experimental). Data analysis is comprehensively discussed but other processes need more work.	8	4092
Meta-needs assessment (Gaber, 2000)	Documents serve as the data. Methodological aspects are grounded in principles of meta-analysis	Focused on synthesizing specific type of evidence--- needs assessments--- for specific types to inform human service personnel. Utilizes meta-analysis and mixed methods research strategies. Insights from mixed methods research inform comparison and analysis of	Grounded in principles of meta-analysis thus inherits related problems. Uses qualitative studies as 'supportive' rather than equal sources of information.	7	26

		data from diverse sources in the same project.			
Realist review (Pawson, Greenhalgh, Harvey, & Walshe, 2005)	Based on realist approach to evaluation. Steps are overlapping and iterative. About refining theories and second thoughts. Program theory is the unit of analysis.	Accommodates diverse evidence sources theoretically and methodologically. Consider structural and social accounts during analysis and contemplates process and illuminative data. All evidence is given equal weight. Requires expertise to apply.	Delivers explanatory rather than generalizable truths and contextual fine-tuning rather than standardization. No guidance n addressing conflicting evidence especially since evidence is equally weighted. Clarity on quality evaluation and variation in quality across diverse sources of evidence needed. Further work on integration needed. Requires expertise to apply.	8	1631
Comprehensive Literature Review (CLR) (Onwuegbuzie, & Frels, 2016)	Highlights the cultural aspect in literature reviews using diverse sources. Conceptualized as a multimodal meta-framework.	Comprehensive. Considers cultural perspective in applying MMRS frameworks. Considers theoretical and conceptual aspects of analysis.	Requires sufficient background knowledge for reviewers to apply effectively. Appears complex to conceptualize. No clarity on data analysis for evidence from diverse sources.	8	18
Question Eligibility Source Identification Selection Appraisal Extraction Synthesis (QESISAES) (Pluye, Hong, & Vedel, 2016)	Under development as a Wiki page. Considers and open to input from different researchers.	Presented as a protocol, though it is stated some of the stages are iterative. Comprehensive, involves description of what each stage entails and provides relevant citations and examples. Considers the various MMRS designs and how to apply each step.	Presenting the user information and description side by side with respective steps would make the Wiki and Framework user friendly. Under-development, more guidance on the various stages.	8	4

The Joanna Briggs Institute model of mixed-methods synthesis (Pearson, White, Bath-Hextall, Apostolo, Salmond, & Kirpatrick, 2015).	Adopts a segregated approach (Sandelowski et al., 2006). Separate syntheses of each component of review. Utilizes Bayesian approach to 'qualitize' the quantitative synthesis. Findings are pooled with the findings of the qualitative synthesis.	Developed and funded by a specific institution therefore training and resources for synthesis and analysis are provided. Well researched and applied by institute. A manual provided with approach to guide users.	Emphasizes one approach for aggregating evidence when synthesizing data and integrating evidence. Bayesian approach specifically used. Needs training to apply related skills such as translation approaches. E.g., the verbal count approach.	8	12

APPENDIX D: REFERENCES FOR INCLUDED APPLICATION STUDIES

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APPENDIX E: EXPERT REVIEW INTERVIEW RESULTS AND ANALYSIS

Table 1

A Summary of the General Characteristics for the Interviewed Expert Reviewers

General characteristics
MMRS Experience
➢ 10 years on realist ➢ 16 years (since 2003) ➢ 3 to 4 years on synthesis, mixed methods design in evaluation and research for about 10 years, some experience in mixed methods in evaluation but not too much in mixed methods synthesis designs. In the last two to three years I worked on an evaluation project which was a meta-evaluation synthesis ➢ 6 years. So since 2013. I started my work on mixed methods research synthesis in 2013. ➢ 5 years ➢ At least 35 years ➢ I've been involved or worked for the Joanna Briggs Institute for 16 years o we deal with systematic reviews and evidence based practice. So I've been involved in that area for 16 years o but I've only really come on to the mixed method side of things, since 2015
Experience with specific methodological concepts
➢ **Interviewee # 1** o Qualitative: 2 theoretical, 2 empirical; Quantitative: 2 theoretical, 3 empirical 2; and Mixed methods: theoretical 2, empirical 2 o If speaking for specifically realist reviews, I have high experience for both empirical and theoretical. So, 4 and 4 ➢ **Interviewee # 2** o I've had quite a lot of experience with both ▪ High experience or moderate experience… three or four for those two ▪ Qualitative: 3 theoretical, 4 empirical; Quantitative: 3 theoretical, 4 empirical; and mixed methods: 3 theoretical, 4 empirical ➢ **Interviewee # 3** o Qualitative synthesis: 3 theoretical, 2 empirical; Quantitative: 3 theoretical, 2 empirical; and mixed methods: 2 theoretical, 2 empirical ➢ **Interviewee # 4** o Qualitative synthesis: 4 theoretical, 3 empirical; Quantitative: 4 theoretical, 3 empirical; and mixed methods: 4 theoretical, 4 empirical ➢ **Interviewee # 5** o Quantitative I have less experience with that so I would put two for practical and one for empirical o Qualitative synthesis: 3 theoretical, 2 empirical; Quantitative: 2 theoretical, 1 empirical; and mixed methods: 4 theoretical, 3 empirical ➢ **Interviewee # 6** o Qualitative synthesis: 4 theoretical, 4 empirical; Quantitative: 4 theoretical, 4 empirical; and mixed methods: 4 theoretical, 4 empirical ➢ **Interviewee # 7** o I'd probably just say probably average to moderate for all three components o overall I've had more experience with quantitative synthesis so I might rate that as a three, and qualitative too. Um, I guess mixed methods…. Three o Qualitative synthesis: 2 theoretical, 2 empirical; Quantitative: 3 theoretical, 3 empirical; and mixed methods: 3 theoretical, 3 empirical

Primary methodological orientation

- Realist
- Anti-orientation
- usually mixed method research evaluation designs with a little bit more focus on quantitative. I have a quantitative background, but then I came to mixed method designs
- I would say mixed and pragmatic. Hopefully unaffiliated to any particular camp.
- Mixed methods
- Transformative mixed methods
- we do all three types of reviews as well as others. So I've got… that's probably a bit of a hard question to answer
    - I guess if you look at my publications I've done more quantitative than qualitative,
    - but now I' m kind moving into mixed methods.
    - So… um, I guess I would go with mixed methods now that this is kind of my niche area
    - I've done obviously quite a number of quantitative and qualitative mix work
    - it's changing now, I am doing mixed methods, but it used to be quantitative. But yes, it's kind of heading towards both to be honest qualitative and mixed methods

Mixed methods research synthesis frameworks familiar with

Interviewee # 1

- The ones that we use within realist reviews and variants, there off
- Most commonly used one is Pawson's five steps from 'evidence-based policy realist perspective', his book from 2006

Interviewee # 2

- Realist, EPPI-Center review, Critical Interpretive synthesis (Mary-Dixon Woods), the matrix approach, Sandelowski's (***Note, some mix in understanding between MMRS framework and synthesis approaches***)

Interviewee # 5

- I'm quite familiar now with the EPPI-Center approach because I'm doing the postdoc here.
- the JBI, described very clearly in the manual. I have read via books as well. Really details a lot. And in your review, you decided that the realist synthesis is a mixed methods synthesis..., which I'm not really convinced, but I've read on this approach. I haven't applied that, but I have taken some training, so I know what is Realist synthesis, but I haven't used it.
- I did my PhD with Pierre. I can say that Pierre developed his own framework, which is, you know, is a wiki toolkit.

Interviewee # 6

- I am quite familiar with the ones that come from positivism and the ones that come from constructivism, the ones that come from pragmatism, and the ones that come from the transformative point of view. The only kind that I would do would be transformative.

Interviewee # 7

- Obviously the JBI one,
- very familiar with Sandelowski's work.
- Obviously Pluye and Hong's work
- we've had a bit of a look at and Heyvaert and Colleagues.
- I guess kind of limited guidance from Campbell and Cochrane Collaboration.

Frameworks used in practice

- Realist reviews, I probably have conducted somewhere up to about 20 either directly or you know with other people
- yeah we've used both… we've done realist reviews, not so much. And we've also done, obviously the other one...
- We build our own synthesis framework for our recent meta evaluation, but I think there we were influenced by more meta-evaluation designs. There's also a range of designs available which come more from the side of the evaluation community which is sometimes a little bit separated from Social Science Research on… I don't have much experience.

- It's mostly from different organizations for example so we're one from USAID from the United Nations Development Agency, there's another one from the World Bank. I don't remember the names of the authors now because I'm thinking more on this organizational levels, but… but we published our design and we also have the references for the designs that influenced our design
- EPPI-Center and the realist, and… In evaluation cycles, most people will be familiar with the realist synthesis. It has a long history in realist evaluation.
- I also have encountered in conferences just in the fall I was on a panel with two other people that are doing mixed methods reviews, but they are not well known approaches. I mean it is kind of like the approach I proposed which is not widely used.

- the Meta-modelling approach that I worked on came out of those two. The realist and the EPPI-Center approach.
  - Have I used them directly? I once served as sort of an advisor on the realist synthesis review. A small one… but it was entirely unclear to me what the procedures were. It was too unclear, and I can see in there… review of the realist review is an ongoing issue for people who work with realist reviews. The lack of procedural guidance.
  - Did you say you have used the realist review at least in your own work?
    - No, no, just in a modified structure for the meta-modelling approach.
- I haven't used both but I know them
- Transformative
  - Have not used either of the two frameworks
- I haven't but obviously when we developed our guidance we did an extensive review of the literature so we're quite familiar with them. No, I haven't actually done any work following those frameworks yet

Other notes

- I work in health services research, I am a medic

Table 2

A Summary of the Issues General to MMRS and MMRS Frameworks for the Interviewed Expert Reviewers

General to MMRS and MMRS frameworks
Steps for designing a mixed methods study
Interviewee # 1 ➢ Pawson's book: 'evidence-based policy: a realist perspective'—5 steps ➢ Obvious things o Develop a research question---Objective is to answer using a realist review o Focus the question o Content expertise of the review team o Develop a program theory o Search for data --- formal rather than informal o there is the usual sort of boring stuff that everyone does for reviews ▪ Sift through the data ▪ Database searching--- backward and forward citation tracking ▪ Searching is purposive ▪ Set inclusion/ exclusion criteria--- need a good librarian ▪ Retrieve and screen the full texts ▪ Decide on relevance and sufficiency of rigor for each source--- predominantly driven by its ability to inform program theory

- Go through the data refining program theory authoritatively. The first initial program theory may or may not be realistic in nature but the end of the program theory should be.
- Need to refocus question as you progress depending on what is available

- Come up with some sort of recommendations and the recommendations are predominantly realist in nature

Interviewee # 2

- we start with the problem, the question at hand
  - So we start dialogue with them to understand you know, the problem and how whatever policy development process we're involved in or it might be in terms of commissioning local public health services… But whatever it is, we spend time trying to make sure that we understand the context of use
  - We want to understand how the evidence is going to be used
- And then from there, we would then think about, well, what sorts of evidence do we need to answer that question.
  - if we've got quite a strong underpinning principle of the way that we do these reviews voices of people who are affected by it too are sometimes sort of ignored in terms of research processes and decision making
- In terms of the steps… we would start with the problem and we also start with the way in which we think, you know, is good practice to do this sort of thing, which is a round of… which concerns respect to informing what we are doing. We think about that, then we develop research questions, and then we identify the types of research that are going to be in the review.
- At that point, we might say to ourselves, oh; we've got something that looks like a mixed methods research study here. But that's a source of the outcome of that process at the beginning.
  - So assuming that we have decided that we are gonna have some kind of multi components review, we've got different types of evidence to bring together.
  - What we will do is sort of think up front about the way in which the different types of evidence are going to answer our question… and what value is added by bringing them together.
- We obviously know different questions can be answered by different types of research, which is one… But also what work is done by that deliberate juxtaposition or integration of different types of research perspectives... different types of evidence. So that's step one before we do anything else.
- Then once we've sort of considered all of those aspects of it then we'll, start drafting our protocols, etc. So we'll define the search strategy more…

Interviewee # 3

I'm reflecting on what we did in this Meta-evaluation, evaluation synthesis design.

- So this would all happen in this first step when we design studies, when we start the synthesis design.
  - We were starting with looking on a subset of our database and first being clear about the evaluation background or you can also call it research background. And this includes, thinking about the object, the evaluation object or the research object, the context of the evaluand, the purpose of the studies and what was the leading research questions
  - identifying the area of interest of these synthesis study and Part of this first step is also being clear/ specific about the focus. So is it actually a causal focus that we are following, do we have primarily causal questions in our set of research questions or primarily non causal questions.
  - assessing the relevance of and development intervention…

- And the second step would be Actually establishing or… reconstructing the theory behind your area of interest
    - being explicit about the theory of change the generic one
    - being probably also clear about the main mechanism
- I don't know if it's step three, but something after being explicit about the theory behind the evaluation object. That which is about some mixed methods research design
    - we haven't really thought about this too much before running into a search strategy. But afterwards now… today, I would think, well, maybe it's a good idea to already have a good feeling, what kind of mixed method research designs are potentially in your sample or in your database because then you can also already in your search strategy
- In your search strategy you… can already built some set analysis for your mixed message research design.
- defining the inclusion exclusion criteria would then be the next step afterwards and this is based actually on the steps before right? so the evaluation background, the theory. and probably also on your knowledge about the potential mixed methods designs that you have.
- after having a strategy and then you search for the data, then you would appraise quality, in evaluation we call it a meta-evaluation so… doing an evaluation of the evaluations. Assess the quality of your data… of the research, which is in your sample
    - I would also have a separate set of quality assessment criteria for the qualitative part, another one for the quantitative part, and then the third one for the mixing strategy. So looking precisely on for example, how they triangulated the data, the methods and the research perspectives and so on.
- then I would do the thematic data analysis to synthesize the findings. Followed by actually another synthesis where I bring together the information from the thematic data analysis with the quality assessments
- And then of course report writing would be the final step

Interviewee # 4

- first couple of steps are quite similar in my mind to traditional systematic reviews. Focused on meta-analysis and…. I would say the first step would be to define the scope of the study. And that would involve…, carefully defining and formulating the questions of interest. That could involve a scoping review to understand what is going on, any literature on the program of interest and the kinds of outcomes that might be relevant to the questions of interest. I use the PICO framework, which I am sure you have encountered. But that I would say would be my first step
- The second step would be coming up with a search strategy, also defining the key terms, the databases… the search…. The search strategy, coming up with a relevance criteria… and again, this is very similar to traditional reviews.
- then the actual, conducting of the actual search… I don't know if that would be a separate step or it would be the same step. But actually an initial pool of studies together. Usually in classic literature it says that is one step, I think in practical terms in my experience it involves some back and forth
- I would say there is a step that involves some kind of screening, usually multiple rounds of screening of relevance. … two to three to four rounds first you will get the titles and the abstracts, then you might look at the introductions, then you might go deeper and deeper and deeper. Until you find the studies that are relevant
    - In the context of mixed methods, it also involves sorting. So we want to pull out the studies that go into the qualitative synthesis, and then we might sort out the studies that might go into the quantitative synthesis.
- then after that, I would say you go into the synthesis steps. Some approaches want them parallel… basically impossible. Unless you have two teams that work on them literally, parallel.

- I prefer sequential steps, so I would say first you would have a step where you would focus on the qualitative strand. And you create based on those you, create hypotheses about how and why the intervention… the program works.
- Once that has been completed, I would go in and continue work on the quantitative synthesis. Again trying to determine outcome patterns across the studies in the quantitative studies

- Finally, I would do an integration
- And the conclusion, I think that would be some kind of reporting

Interviewee # 5

- So for me, a mixed method research synthesis study is a systematic review. So for me, you have to follow the usual step of a systematic review.
- first step, you have to define your review questions. After that you have to define your eligibility criteria. After that you have to develop your search strategy to find stuff. Either… and decide where to search, search sources, and after you have to do the screening of the abstract and the title, select the full text… the quality appraisal, the synthesis and interpretation. So what you usually do in a systematic review
- but what's different from the typical just RCT is that you including all/ other types of studies.

Interviewee # 6

- if you go to my mixed methods design in evaluation book, then you go to page 126 – 127, there are six steps there. So that's what I would recommend.

Interviewee # 7

- Obviously, things like you know development of a clear view question and objective development of
- inclusion and exclusion criteria
- Development of a search to locate all those potentially relevant studies or papers
- obviously critical appraisal of assessment of methodological quality
- leading to the extraction and analysis and synthesis,
- and then obviously the presentation and interpretation of the results.
- But I guess in terms of mixed methods the big issues really relate to that extraction and synthesis and integration phase
  - Well I think that is because of the complexities associated with those types of reviews

Design in mixed methods research synthesis

Interviewee # 1

Focus on realist reviews

- It's area driven and it uses a realist logic of analysis
- Taking a realist perspective would mean that you would deliberately have to have an ontological stance. Because that informs your epistemological claims and then that informs your methodological practice
- If you don't have a clear ontological stance, making sense is meaningless

Interviewee # 2

- I think that's what I was talking about when I was referring to the work that was being done. By the integration of the different types of evidence. So, you know, for example, as I mentioned before, you know, if we're thinking about ensuring that the perspectives of the people who are affected by the intervention are given a priority…
  - You know, in one review, what that might mean, is that we prioritize the outcomes that particular groups of people talk about. We might get those perspectives in, by going and talking to people and having that sort of engagement with people or,
  - you know, in this context what we're doing is we're bringing that perspective in through research…. Through what Might be called qualitative research that is with interviews and focus groups.

- So what that does for us is give us an empirically grounded conceptual framework for the other parts of the review. What we've often done is use that part of the review to develop for example, logic models and theories of change and causal pathways to understand what is going on in the long term quantitative studies.

- So, you know, one of the earlier reviews... We treated the views of the people affected by the intervention the most as the kind of expert views. Because they're the ones who are living in those conditions… and affected by them. And so… according to that theoretical framework, what could be the drivers of heterogeneity between the studies... So sort of developing theories which might explain differences between the studies.
- And then, we would then take those theories to the quantitative studies, we would use the subdivisions that those theories suggested as ways of partitioning variance and determining heterogeneity.

Interviewee # 3

- in my view, I would really conduct a separate subgroup analysis for each mixed method design. So I think I would separate sequential designs from the nested designs, from the parallel designs to first of all, see whether or not there are differences within these design groups.
- I mean, you could stay at another full sample analysis, I think, and probably also controlling for the different designs, but I would also be interested whether or not we have different conclusions based on the design that we chose. I would expect that there are probably differences because… the whole methodological strategy changes when you have, for example, between sequential design or a parallel design. But I don't know

Spoke mainly of design with respect to primary studies included in the selected set. Had no knowledge of mixed methods research synthesis designs.

- so there I think I have to say that I'm actually not so familiar with established designs. We build our own synthesis framework for our recent meta evaluation, but I think there we were influenced by more meta-evaluation designs. There's also a range of designs available which come more from the side of the evaluation community which is sometimes a little bit separated from Social Science Research on… I don't have much experience

Interviewee # 4

- I sort of follow the EPPI-Center. I think that separate syntheses for the quantitative and qualitative first. I would emphasize the quantitative synthesis follow the qualitative because I believe it is important that you do not use the same data for both generating hypotheses and testing them
  - For the qualitative studies, depending that is a big… component of course when we talk about what that would look like. But I tend to focus, for the qualitative I tend to focus on implementation studies, fidelity studies. So studies that are really good on identifying the critical ingredients of interest. That's what the studies do well and so I would use them for that in the context of a mixed methods synthesis
    - That is sort of a 'horse for the course approach'. Are really good at identifying the critical ingredients, core components of a program those I will focus on first. To create hypotheses about what it is about the program that might make a difference or not.
- The second step in the design there is more classic meta-analytic to me. So I will use effect size calculations, typically experiments are high end, quasi-experiment studies. What those studies do really well, is they give you unbiased effect estimates that tells you something about the outcomes. That is the design that I would follow. A sequential, with a qualitative first and quantitative last, followed by integration.

Interviewee # 5

- Clarification

- I don't know what you mean by design
- Based on Sandelowski and others, I also developed designs. I don't know if you have read the paper on the convergent and sequential design

- It's systematic review. So for me, design is important because it will help you… Like in research, any, type of research, designs are there to guide you into how to Present and how to conduct your review
  - And a key part of all of this is how do you combine them… Because if you don't combine them we can question maybe it's two independent reviews.
- Also, the designs are there to guide you into how the integration could be done. So Sandelowski suggests like the three different types… if you go to one of them, you can gauge what question you can ask, how to present, how to conduct…. I think that design is very important.
- Follow-up
  - you did mention your design approach, which I read or I've looked at... What would you say is the key difference?
    - for me there's Two main types of design. There's a sequential and convergent as what you see in mixed methods research
    - And We decided to look at the literature on mixed method because it's a basic. Like why do you do mixed methods I do research, primary research or review, it's like the same reason.
    - in the literature on mixed methods, convergent and sequential are the most basic designs that you can see. There is more complex ones
    - there's not one design that is better than the other, it depends on your question. So if you want to orient… one component will influence the other… the qualitative will help you to identify the main themes and after you will analyze the quantitative based on the themes that were developed for the first part, then, for me that's a sequential. Its sequential because they are dependent.
    - But you can also decide to have two different, I would say parallel paths independently and after to combine them. That is what we often see in the EPPI approach. We use the matrix approach to combine but It's not… there's not one better than the other, it depends on your review question…. it depends on what is available in the literature. And after, based on that you decide which design, you're going to use

Interviewee # 6

- You know, it depends on how you are using the words, but… by segregated if you mean quan and quant stay separated and by integrated they come together, then it's not really mixed methods if you segregate.
- I would probably say that I wouldn't do any of those, that I would do a transformative mixed methods design that would mean that I would be engaging with populations throughout the study and using input from the various populations to inform next steps. So I think it's a different design than saying… I am gonna have some quan and quant… am gonna look at them together or one is gonna depend on the other. I think its much more complicated than that.

Interviewee # 7

- JBI has guidance on mixed methods reviews. We've actually just released our updated guidance over the last week.
  - It's just gone up within the last week so it's free to access now. And it's changed dramatically since the version that you looked at
- I am coming with my JBI hat on, which talking about um…. two approaches… so we aligned very much with Sandelowski's work and Pluye and Hong's work. So we are looking at integrated and segregated approaches.

- it really relates back to the nature of the question and what the question is trying to answer

Critical issues to be considered when conducting an MMRS study

Interviewee # 1

- I mean, it will only be about realist reviews. I don't really use any other approaches
  - Quality Standards, reporting publication standards, and training materials for realist reviews
    - In terms of how would we run it, we would run it to based on those standards because those are the current international consensus standards on how you would run it
    - There is an eight item quality checklist that people can go through using rubrics... you just have to make sure you hit all of the things, your question has to be appropriate, you've got to use the appropriate logic of analysis, you've got a reasonable search strategies, people have got to report in a particular sort of way, etc.
    - "I think there's a big difference between having a series of frameworks and then actually being able to do them"

Interviewee # 2

- I think what's important is that they're done with the objective of the review in mind
- Sometimes, you know, you can treat them sort of almost as standalone pieces of work. And weirdly, the qualitative works better
- The other sequencing usually is you know, get the theory right get the framework right, get this… like your understanding of you know, if there's a causal relationship in there you know, what is it really and that kind of thing. And you can get that from the more qualitative literature, and so you can sometimes publish that as a standalone piece of work which you can then take to the quantitative.
- But you know, if you think about the meta analyses for example, they are kind of incomplete, if you try and do them without that conceptual framework. The whole point of doing the mixed methods is so one informs the other
- I think it's the fact that it is a mixed methods study and there's no point in pretending that they're two separate… two different bodies of evidence. But you've got an overarching research question that you need to use them to answer

Interviewee # 3

- I would say, well first of all, the components, the qualitative, quantitative, and mixed method components, they have to be quite flexible because there is actually a huge range of variation between or within these components for all three of them. So, I mean, there are the standard designs the studies follow, but they are always adapted to the context, to research questions, to Logistical backgrounds of the studies and so on.
- it's very essential to distinguish between what I said in the beginning, the causal and non-causal focus of the observations, so the primary research. So there are huge differences in the components, when it comes to causal questions or to non-causal interests of the study.
- There is another community… the political science is a mighty method… I call them the mighty method community. There was a prominent publications By Gary Goertz for example. Where he distinguished between this within case and cross case analysis, and causal mechanism analysis and they are usually more explicit about how they deal with causality and sometimes the mixed method community is not so explicit when it comes to their mixed method designs
- Yeah, I mean not really about the synthesis frameworks or the review frameworks, but the realist framework is very close to how we would actually follow what we call a realist evaluation approach and so… I have no experience with a review approach, but I can understand it a little bit when I read it. And the other one, the EPPI-Center quite simple.

Interviewee # 4

- I would say for the qualitative synthesis component, how to asses quality. And that will actually go into you know when you do the actual screening, there should be some kind of… in mixed methods synthesis there should be a step that involves quality appraisal. That goes for both the qualitative and the quantitative synthesis component.
    - You should have some sense of… some kind of appraising the quality of the studies. But to me, it is hard to do with the qualitative synthesis component. And because the studies are so diverse, and it's hard to develop.
    - There are many many frameworks as you are probably aware
    - And the type of framework that you use would influence your findings right? And so, we have to be very careful about these quality appraisals and how we use the quality appraisals. That is a big ongoing question I think in the qualitative synthesis.
- Another thing about the qualitative synthesis is… the big question is, what is it that you are extracting from those. How you extract them is an issue.
    - If you look at the quantitative synthesis component, it is usually pre-given in the sense that when you are doing meta-analysis, you know exactly what you need. You need the types of information from the study that will allow you to calculate cohen's D. So its given. So you know exactly what you are looking for.
    - But with your qualitative studies, what is it that you are looking at? Are you looking at any testimonies by participants in the program, are you looking at the final concluding remarks summarized by the authors of the article.
        - It is much more difficult to figure out what is it that you are extracting and how do you do that. Do you use specific analytical strategies.
    - I use causation coding, but there are many many other coding strategies that you could use. So that's a much bigger question in qualitative synthesis components.
- Another big question with the qualitative is what do you include in that component?
    - Again if you are doing a quantitative component with meta-analytic procedures, immediately focusing on the studies that allow you to do that. So your experiments, and different variances across experiments.
    - But for the qualitative experiments it is more unclear. There could be so many studies. Are you only focusing on case studies, implementation studies, fidelity studies, and the list goes on and on…
    - So again some kind of specification as to what goes in that bin
- For the quantitative component, big issues to be considered I would say, in general, there are very few
    - even for well established programs, like… and ACT… which I have worked on, you still have at the end of the day over the course of many decades of research identify typically somewhere around 15 studies that allow you to do meta-analysis
    - And so the big issue is… you will often end up with relative a small number of studies with high variation. Though high variation that you can't reasonably meaningfully compute a combined effect size
    - The big issue is how do you with relatively small n still examine the variation? So that's a big big issue. A big issue… of meta-analysis in general.
- For the mixed methods, synthesis component I would say the number one issues is integration.
    - What does that look like? What do you actually do when you integrate findings? What is the analytical strategy? So I have used QCA, but there are many other… I know some of the EPPI-Center folks have also started using QCA, but there must… some use matrix… you know, organize their findings in a matrix. Like what is it? What is that moment that… that analytical moment of integration?

What is it? That is absolutely key to get some systematic approaches and some transparency around that moment

Interviewee # 5

- Clarification
  - And what do you mean by critical issue.
- There's the typical challenge that you have when you do a systematic review. But I would say… you have to multiply it by two or three when you're…
  - Just starting by how do you formulate your review question.
    - Do you need to have a mixed methods question...
    - does it need to be one quantitative question, one qualitative question, and one mixed method or can you only have one
    - Developing good questions; one question or several questions.
- And then after that, another challenge is when you search the literature. You might have…
  - do you have to develop a search strategy just for quantitative research, just for qualitative, or it has to be one general strategy for the whole topic?
  - it will take more time than other reviews because your search strategy is broader and you are interested in more stuff.
- Quality appraisal is indeed challenging because you have different type of study designs
- Synthesis is very challenging also. Which strategy… like especially what… depending on the design that you use, so how you can link the design and the synthesis method that you're going to use… That's another challenge, but choosing which synthesis is another challenge.
  - And I think the most Important part of mixed method that you have to do is integration. And often people like put that at the end, but I think they should put it on… from the beginning
  - So, Integration is key in mixed method, either in primary, secondary research because it… it's the added value of doing both
  - So how do you combine the results, findings of the qualitative, quantitative aspects
- And I think the last challenge that just pop up in my head the terminology
  - So here we call it mixed method, and also mixed methods reviews. When I work with Pierre he call it mixed studies reviews, because for him, it's mixing studies. But here we are mixing more than studies, we are mixing different sources. So yeah, but people will use mixed method because they're using different synthesis methods. So they only have one type of studies but because they are using… So like we have meta-analysis and thematic synthesis, oh its mixed methods… we are doing a mixed methods… So, something like that

Interviewee # 6

- Well, I think, overall, for no matter what., whether it is qualitative, quantitative, or synthesis, that its making sure that you are being inclusive… Like, just saying… oh, I have mixed methods questions…. What do those questions come from… you know. Can I just sit down and make them up, can I do it based on the literature? You know, I mean to me… we really miss important steps or we miss the potential for systematic change by not engaging with communities through the full range of stakeholders from the very beginning and then every single stage of the process

So in this case you are thinking even during… when we are working on the research question, we should be including the communities

- … you know how else do we know that we have reasonable questions within that context.

Interviewee # 7

- Clarification
  - Can you explain what you mean by critical issues?

- So when you talk about methodological quality you are talking about purely when you synthesize the evidence.

- what I was thinking in terms of qualitative synthesis was issues around reflexivity, issues around extracting data verbatim, issues around the aligning with the approach that is stated, and whether you know the authors of the review actually follow-up. Are those the kinds of things that you are talking about?
- the methodological quality and how that impacts on the findings and interpretation of the findings
- I guess obviously the extraction and reflexivity and issues around ethics and all that I think can be for quantitative as well. I guess for quantitative synthesis a lot of the things are around you know the interpretation of the findings, double data entry, considering what kind of technique or analysis technique you are going to follow. Um, issues around heterogeneity, the decision to pull studies, all those kinds of things
- And then anything specific to mixed methods synthesis component?
  - I think it really relates to, again, kind of extraction and integration. So what technique you are going to integrate, how you are going to transform, are you going to quantitize or qualitize. All of those aspects kind of in that second level of analysis.

Table 3

A Summary of Issues Applicable to the Two 'Most' Prevalent Frameworks for the Interviewed Expert Reviewers

Strengths and weaknesses of the two frameworks (realist review & EPPI-Center review)
Interviewee # 1 ➢ Realist reviews I think are excellent when you have outcomes, which are context sensitive and complex open systems ➢ It's not particularly good at telling you if something is efficacious. So for example, if you've got a closed system and you want to understand whether or not something is efficacious. ➢ You would definitely not do a realist review of those particular things. Don't do a realist review to tell you whether drug X is efficacious. It's a complete waste of time
Interviewee # 2 Realist strengths ➢ I think the critique for the analysis around the realist review is, very strong. I think that... It's a nice sort of working it through of probably scientific realism. And Popeye with Sort of a spattering of... It's quite interesting to read or position his sort of philosophical approach coz they're call it realist ➢ I like quite a lot about the sort of like the philosophical and conceptual framework on it. What's interesting is how heterogeneous realistic reviews actually are out there in the world ➢ It's just quite nice communication tool and also it… nice conceptually it is… it embeds the intervention within the context Realist weaknesses ➢ In terms of disadvantages, I think it's much weaker in terms of how you actually go about doing detail of the reviewing ➢ And the other was that the slightly ambiguous relationship between empirical justification for knowledge claim and knowledge claim ➢ But it's quite ambiguous… he's balancing on long lists of this nitch of empiricism and rationalism. EPPI-Center strengths ➢ What we usually do is to spend a long time on the scoping and we do a broad map. And then in consultation with the people are gonna be using the review, we then say, okay so they are

the priorities of the review. At that point we then say, okay, so, you know, maybe we'll look for the trials and the and the qualitative studies

- You could get quite different results from trials, or from interventions depending on how you went and implemented the same thing
- it gives you is a theoretically grounded framework within which you can explore diversity in terms of finding the Trials and it also ensures that the perspective of people affected by interventions are given equivalent weight to The perspective of the weight.

Interviewee # 3

- I think for this question. I cannot really tell to be honest. The same actually for question 10.

Interviewee # 4

- The realist review
  - the focus on understanding the mechanisms. so the theory based component of it
  - I think it lacks procedural clarity. I think that is a weakness. I also thinks it's a weakness that it includes in my perspective too broad a range of evidence.
    - And that again really begs the question, then how do you integrate these different pieces of evidence?
  - I am also concerned about process.
    - The conclusion shouldn't be influenced by the sequence with which you introduce the evidence. I am concerned about that.
- The EPPI-Center review
  - I like the structure,
  - I like the transparency… Again the focus on trying to… understand not just the effect of something, but how and why the programs make a difference.
  - I like how it is laid out in separate… into separate synthesis strands.
    - I am still unsure about the parallel strands. I think the sequence is a little bit different.
  - I like the use of the matrix approach and the use of QCA obviously as well is worthwhile pursuing.

Interviewee # 5

- Realist review
  - Strengths
    - that it can really answer a question that is completely different from other systematic reviews. It's not about what works. It's about what works, for whom, under what circumstances… It's much broader, it uses another worldview. It's not positivism, it's like really realism.
  - Weakness
    - like it's complex. So, it takes more time, it takes prior training. You cannot just read the paper and say, oh yeah, cool, I am going to do realist synthesis tomorrow.
    - It's something that takes more time because it's more theoretically based, so you have to find prior theory and the middle range. And they have their very own literature on like synthesizing knowledge , like the middle range theory and… So it takes a little bit of time. To understand, what is realist synthesis and how to apply it. But the advantage is that there's a great network that is available. I don't know if you're on the REMESIS list.
- EPPI-Center review
  - Strength
    - it's easy to apply, right? It's the vocabulary of systematic review. It's not something completely different, they don't have their own terminology. The only thing that is there, they call it matrix approach. But that's easy to do, and it's easy to understand, it's easy to apply.
    - for mixed method review the most important points integration so the matrix approach provides a clear tool for integration for me. For me it's

truly a good example of that and it's very similar to what we called in mixed method research the joint...

- Weaknesses
  - I would say, realist synthesis, they have a whole website, they have Training documents they have a lot of stuff, but EPPI doesn't have much Compared to the realist one, but at the same time, it's not as complex as the realist.
  - Do we need that much, like it's not very difficult to do the method. You just need a table, two columns, maybe they can provide more information on how, like, do you combine because it's not just presenting them in the table, like after that what you do with it?
  - if you just present that in a table that's not integration. Integration comes from; oh, oK, now that you have an overview of everything so what can you do with it? And I think that is not very well described. That could be a weakness

Interviewee # 6

- I think they each give a very rudimentary framework, with making assumptions that the researcher knows what's best to do. And so you know, if you are looking for something that's simply straightforward, follow these steps, then that's a strength. But if you have concerns that perhaps you might be asking the wrong questions, you might be asking people who have a vested interest to maintain a status quo that's not fair to others then you are just doing work that sustains the status quo. That's a major weakness.

Interviewee # 7

- Realist review
  - Strengths
    - it takes quite a flexible iterative approach,
    - and it's very conscious of the context.
    - It's obviously very good for dealing with complex interventions. It's good in the sense that you can use it and you can confirm your findings with theory
  - Weaknesses
    - and I guess with a lot of these frameworks the guidance is quite limited on how to conduct one. From what I know, this is quite a time consuming resource kind of intensive process and its not for beginners
    - there could be issues around you know, transparency and reproducibility when you are dealing with this kind of iterative process and the decisions made in justification and so forth.
- EPPI-Center review
  - Strengths
    - the good thing is that you are kind of using validation and triangulation. You are using one type of evidence to kind of integrate the other.
      - It is good at identifying gaps in research by doing that process.
  - Weaknesses
    - the limited kind of guidance available… there is some issues, I guess depending on…, because you are relying on the judgement of the reviewers and that kind of transparency.
    - Um, and I guess based on the fact that there isn't a lot of guidance how do you deal with data when you know the two synthesis have conflicting results

Feedback on rating the realist and EPPI-Center frameworks

Interviewee # 1

- Actually what you're doing is actually quite a difficult task. I mean, maybe for other review processes it's kind of okay because they may or may not have specific ways of trying to do things.
- There's going to be great difficulty in trying to assign points to some things.
- when you're talking about, for example, something like the realist review so for example, this is just the first one, quality
- I wouldn't be quite sure… you know, about how I would apply that to a realist review
- qualitative components, the quality and design for the qualitative component is not addressed, supportive arguments are… Well, you see, here we come to an epistemological problem, which is, if you're developing theory, yes, it is important, potentially, to think about the quality of the actual data and the trustworthiness of the data. But you can't just think about the trustworthiness of the data. You also have to think about aspects of the theory because you need to judge how good your theory is. So that would be a missing component.
- I could use the highest quality of qualitative studies on the planet, but I might still have terrible theory.
    - And then the same for the quantitative component... And the mixed method component.
- I find it quite hard to operationalize much of this for the greatest reason. I mean, some of these are completely sensible, for example you know terminology, logical flow, procedures. Yeah, of course. I think that's about transparency
- So that the quality bit I thought we could quite operationalize.
- If you're working on realist reviews, it's not just the assessment of the quality of the source that is important. You do have to think about the quality of your arguments. Yeah.
- you have to think about the quality of your theories which requires you therefore to have a process for assessing how good your theories are, some of which, which is about… And there are multiple ways of doing so. And it's one of the contested epistemological problem. So that's quality
- to at least be explicit about how they are going to judge the quality of any of their theoretical outputs.
- quality of integrity. Yeah... Supportive arguments... I think it's more than just the argument. I think that one of the things you might want to start looking at is… is that if you are going to build arguments, the arguments tend to be stamping the things that underpin theories.
- for us to work out whether… or how we can go about judging whether some theories are more better in some ways than others
- the ones that I suggest we use in realist reviews are… influence the best explanation. Which is a sort of a particular way of saying that actually what we're looking at is the explanatory purchase of a theory. So that may be the aspect of integrity, rather than just saying, well, supportive arguments,
- It's interesting. It's important that people do have supportive arguments, but then they have to tie that to the data and I can see, then why you have quality, but then you then need to move up one further step; how do you judge that something is supportive. Coz ultimately it's an interpretation and it's very much in the eyes of the beholder, hence the need for transparency.
- So once you get through to structure, I think that's the easiest bit. Where in effect you just ask people to lay out what they're doing so that at least you can follow the structure, though, probably if individuals are going to… if review types are going to be coming up with other theories or explanations, then… whilst you might still follow the structure, you might end up with slightly different interpretations of the data.
- And then the last one is clarity. Yeah, I mean, I think, again, clarity is fairly clear. You've got to ask people to be transparent and those seem like reasonable expectations really.

Interviewee # 2

- I don't tend to do so well with rating things. And certainly, I wouldn't aggregate them… because that sort of suggests that they're all completely equal in terms of weight. It reminds me of some sort of thing that we do in terms of critical appraisal in primary Research
- we tend not to take an average of things and compare them because you know, it's sort of saying that overall its equivalent to… in terms of weight to the quantitative component, for example, in its own or you know, integration is just as important as organization is here
- it was hard for me to unpack exactly how you'd come up with this scores because I think for example… for realist, you've got a one for structure and integration and I wasn't quite sure whether that was a three
- Because I think you've got the same challenge with it, that we have when, we're doing a critical appraisal of primary research.
- Are you appraising the reports or the… whatever text is in front of you or are you appraising the underlying approach
- I think that you know, there are many things I like about the realist approach… But I think it's sampling can be weak
- there are lots and lots of different ways of doing redistribution, identifying research for inclusion in them. But I would have said, that overall, the guidance available for that part of the realist review might be very clear. Or it might not. But… either way… I don't think that you can defend an approach which doesn't have an obviously justifiable basis for making sort of authors do different things
- I think you've got to really think through the adequacy of the quality of the guidance and operationalizability. But also sort of what's underpinning it and how that will affect the way in which the review in itself is done and is perceived.

Interviewee # 3

- I think for this question. I cannot really tell to be honest. The same actually for question 10.

Interviewee # 4

- Clarification:
  - Is this a rubric that was initially intended for rating frameworks or for rating individual mixed methods reviews or the source
  - so which description of the framework did you use? Like for the EPPI-Center, did you use published applications of the EPPI-Center reviews to sort of… when you were doing these ratings, or what were you looking at?
  - … so I am asking this because it seemed like for some of this, I could see how you might apply it to like an actual… application of a framework, not as much how you would apply to rating the framework in general. So if you look at like the last… on the rubric on page… the last one… Which has the language, logic flow, procedural…
- Like the 'sentence structure is complex and challenging to follow', the development of the framework fails to address key issues about mixed methods. Like I am just wondering like, where would you… I don't know whether the EPPI-Center would describe this or would they write a book on it. So sometimes it's hard like… it's hard to see… like when you write some of the very earlier ones you have.
- Like the formal quality of quality and process of sampling is unclear…That's a good one. That makes sense. The … quality and process of sampling is unclear… again that makes sense. It makes very good sense. But if you go to the fourth rubric, table… qualitative component. The rubric.. "the quality of the design for the qualitative component is not addressed. Supportive arguments and evidence are not provided."
- I am not sure what that last bit would look like… supportive arguments and evidence? Like what is evidence in this context. Like… so that would be… if I were to apply this, I would be unclear on what that means.
- **Question:** you think it would do better if I was rating some actual applications for the framework, right?

- Yeah I think that might be… because ultimately that is the true test of the framework. I mean the frameworks are just like…. It's just a recipe, right?
  - like how does this actually play out in the real world. And then let that reflect back on the framework.

- I like your thinking. I like that you pursued this kind. This is a… I mean, I am a former consultant so I like rubrics, I like that it might just be a step on the way… right?
- I think it is too hard to…you know the specific ratings. I think you would have to know more about what went into you decision making and…
- And what you like… to see like the materials that you actually looked at and… I mean, the chance for inter-rater reliability is just like you know… low
- or you could have different people apply the same rubric on each framework…
- I'm not sure because like the other one is structure. So reporting is, it depends on what you mean. Because if it's like you know the coherence, you have like the logic and flow which we could also link with coherence. Yeah, so, I didn't really know exactly the difference

Interviewee # 5

- Clarification
  - So my first question is how did you develop the rubric? And where is it in the document?
    - So I would suggest you to validate that
  - When I read your rubric, I had a lot of question
  - What do you mean here. What does that mean, and I wasn't very sure. I had difficulty judging if your rating was good or not because there's some criteria that I didn't understand
  - so okay, so leading component for me isn't really important. Question: I wasn't really sure what you mean transitions. Like, do you mean like coherence between the different steps, right?
  - Integration is integration of the different components right?
  - Exactly so for me, because on the page before, you have mixed methods component, which is integration for me. And after you have integration. So, I didn't understand the difference. So that's why I needed to ask you, what was the difference?
  - Organization, is that the way like to present, is it like reporting? That wasn't clear for me what you meant
  - The outline is…, what do you mean by outline? The steps?
- Feedback
  - So like in the same question you have like, it's unclear and complex, but It can be complex and clear or it can be unclear and not complex right?
  - there are some different construct that I had difficulty to understand what it is, like for example, leading component for me it's not something that's important
  - In general, in mixed method, like even in primary before in the literature, maybe back in 2005, they always had like a more quant or a more qual, but more and more weight distancing from like, is there a component that is more important than the other. So for me, the same applies for reviews, I don't think that you need a leading component.
  - because for me, this is coherence and it's important… in fact all research has to be coherent between. But for me what you just described… I didn't understand it the way you just described it when I read it.
    - Yeah, maybe or maybe you can reformulate… like rewrite… what you just told me and we can try to find a term that would be better for that. I don't know…
  - So change like to report. So how the document is reported is… But still you're talking about organization is unsatisfactory and ending is unclear. I didn't really

understand like, ending, you mean conclusion? Like conclusion is not clear, but organization…. So how the document is presented… is not well presented. Right?
        - It's two different things. Right? If the conclusion is clear or not and if it's well presented. So and I don't see the link between both, it's two different concepts.
        - So I should split them. Right? Yes, because if its about reporting, like what's your conclusion do with… like it's not about the reporting, right? It's something much more complex to write a clear conclusion. Maybe the conclusion should be with the coherence. Because, like, if the conclusion doesn't match with the rest, I don't know. Like for me, like I said like there are some places where you have two concepts
    - It's for me, as I said, like there's someplace where there's two concepts when you describe it I said, "maybe it's well presented," but still the conclusion doesn't, it's not clear right
        - OK, so the same will apply for the clarity at the end. So clarity probably is related more with the reporting right?
        - So maybe if your item on organization is about reporting, you should put it on clarity
    - The steps are unclear and poorly communicated. So, as I said, it's still two concepts… can it be not clear but well, communicate? Or can it be poorly communicated, but the steps are clear?
        - Like for example, you can say; step one, step two, step three. So it's very clear, but inside that there's like no content
    - … It's the two concepts and your description. The same thing for step. So procedure and step I didn't Really know the difference, because for me, procedure is composed of steps. So still like it can be unclear, but complex, for example, realist synthesis is very complex, right?
        - But people can write it very clearly
- They have reporting guidelines and all the things. So, still for me, unclear and complex, it's hard to put in the same box
- So it's a bit confusing… the step is the procedure, the outline…
- Yeah, I would say start with what PRISMA did, because PRISMA Was developed based on research and it's becoming a standard… So start with PRISMA and see how you can adjust stuff because currently, there's a lot of overlap and there's a lot of stuff here that is not clear. For example development, I didn't understand what you meant. The development of the framework failed to address key issue about mixed method research. How do you judge that?
    - but it's a clarity. So I didn't really understand that part. And you talked about a jump from the beginning at the beginning you talk about process of sampling?
    - I don't think it's a common term that you use. Processes maybe. And often we talk about the selection of studies, right?
    - … we don't have a sampling strategies as in primary research. For the sample, you want to have an exhaustive literature search including all of the studies
    - So I wasn't sure about the process of sampling
- Is it like for example… your overall question is the "*overall quality and process of sampling is unclear*. *Supporting argument*…" So what you want to know is, did the author justify… the sampling strategy. So, for example in the case of qualitative, you would have more purposive, compared to quantitative, you want more an exhaustive one. But Like what is important in that is that the author somewhere justified right? What they did
    - So maybe it's more about the justification…
- I didn't understand because… if you consider that your mixed component is integration, I didn't understand the process of sampling in the mixed method. Because mixed method is… in fact, when you do a mixed method your sampling is more of either the qualitative and

quantitative part so that when you have your paper you come to combine them. So that mixing the components is the combination

- But you don't necessarily do a specific strategy for the mixed method component. You are using the finding of both parts, the qualitative and quantitative and combining them. So like, I didn't understand how to judge the criteria the mixed method component, process of sampling isn't clear. Can you really have that part? I am not sure.

And so I think I was trying to target that but maybe I will think about it more… just from our conversation, I think my use of the word component was a bit misplaced there because by component I am making it more like the actual process when you're doing the mixed method synthesis. Right? But not the primary studies.

- It depends on the design that you use
  - For example, like if… I don't know if you remember the design that I developed… in the convergent there is three different levels of integration so if you integrate your components or your studies at the data level, everything is analyzed with one synthesis method. So the method can be either qualitative or either quantitative
  - like if you decide to do an automatic synthesis to analyze all you studies, you won't really have a quantitative component. Right?
  - In fact, your mixed methods component is when you're going to analyze everything and you're going to use one method which is qualitative
  - So that's like the first design. But if I am using the more EPPI-approach design which I call it at the other level. So you have your quantitative and your qualitative studies, you analyze them separately with their own... you will probably have your qualitative and quantitative component and after, when you use the matrix approach, you will have the mixed method component
  - So that would fit what you're describing here. It would fit better with that
  - And if you use the parallel design, the mixed method component will be probably weaker because in the parallel design the integration is more in the discussion and it's not always very explicit. So the JBI approach for me is more of a parallel design because they do not describe very well how to integrate, but they will say it in the discussion. Some report will have a table, but not very… it's not a mandatory step for them. Though, JBI have a clear qualitative component, a clear quantitative component, mixed method component is less clear.
  - And then in sequential you can have both, all the three

Interviewee # 6

- I gotta say, I really just didn't get into the details of what you did. I thought that was above and beyond what I was prepared to respond to and so … depending on the extent to which you had criteria that considered engagement with marginalized communities or full range of stakeholders you know. If those things aren't there, then I would say the ratings would need some revision.

Interviewee # 7

- I noticed in your notes you did not include any other information it was just the frameworks provided, and I thought, when we are looking at the frameworks as is without any supporting information, it is very hard to answer a lot of those without the supporting info.
- I kind of went through and did kind of a rough writing. And I guess overall based on what I just said previously, I tended to write down a lot of these aspects compared to your writings. *(See CS-Ratings doc)*

- In terms of the final section on clarity, I pretty much got spot on with what you had rated, but I just felt like the information on those other components, a lot of it wasn't clearly explicitly stated in those frameworks
- if I'm just looking at those two framework documents you sent through, there is not a lot of details on them to support those scores on that rubric and I found it quite hard because it just was not… the data wasn't there. Whereas if you could look at other papers of supporting material, you could probably rate that higher
- Yeah. And also just to ask about the frameworks that you provided, did you just extract that verbatim from somewhere or?
- I think the other point was I think you made a note about writing… was it the leading component as for… something in the notes about that
    - So you put the frameworks don't emphasize one type and for that reason you put a score as four, whereas I would have thought if they are not clear, I would not have given them four. I would have done the opposite and given them a poor score if that hasn't been emphasized. So I guess I was a bit more brutal to them compared to you.
- I did score them, as I said a bit more brutal than you. So I guess framework one for kind of integrity was fairly low kind of 1, 1.5 whereas framework 2 was slightly higher. Do you want that information or… (See CS-Ratings Doc)
    - I just jotted it down with a pencil on your thing so it's a bit of a mess.
    - But I haven't given you kind of the explanations, but I can send it through to you if that will be of use
- Right, yeah. I guess just to summarize, I rated very similar to you on clarity, but other components I thought based on… different, yeah, I can write it down for you right now.
    - I guess when you rated something I tended to write it down kind of at least half to one below you.
    - kind of the issues that were rated the poorest across the three frameworks for probably integrity as I said for framework 1, Um, and design for both of them. And the sampling, kind of I rated between kind of two to three.
    - And I guess it was probably the definitions of what was meant by integrity and sampling as well probably would have been clarified a little it better.
- did you see the other form where I did provide the ratings… what did I call it? Um, "rubric with descriptions". The first page. Did you happen to look at that document?
    - A little, I guess a little bit more detail might have helped.

Table 4

A Summary of Issues Applicable to the to the Researcher Developed Framework for the Interviewed Expert Reviewers

Strengths and weaknesses of the developed framework
Interviewee # 1 ➢ so let's have a look to define topic of interest ➢ I think that there are certainly certain things which from the perspective of, for example, doing a realist review, they seem very sensible things, you know. So for example, the scope of the study that seems very sensible as, which is, you know, define the topic area, what's the question… I think if you're doing a realist review your philosophical assumptions would be that you'd have to be a realist, or at least understand what that means, you'd have to buy into it, but yourself understand what it means. ➢ I think I could agree with the purpose of the MMRS study itself. So if you put the purpose of the review for the purpose of application, that's absolutely fine.

- Develop a protocol, yes, review boards, absolutely consider team expertise and resources, scoping if unfamiliar with topic area. Those seem quite sensible things to do.
- I think within the literature just searching, I mean we've got a number of librarians that we work with. There are some subtle differences. So, one of which is that for realist reviews, you tend to not have to do such exhaustive searching And that the searching may be repeated. So that's a sort of potential need to have to revisit the searching rather than thinking of the searching as a… "wow you know I'm going to do it once and for all and then that's no more searching unless it's a year old and if I'm going to publish, I gonna need to update that kind of thing…" The searching is certainly different, and then I think there are people who've written about this, for example, there's a chapter in doing realist research by Andrew booth, Simon Briscoe and one other. There are other colleagues that talks about how it's slightly different.
- Between scoping searching and evidence synthesis through realist reviews, we would actually develop what's called the program of theories which is a formal thing that you need to do.
- Evidence retrieval, I you know, I think that's completely sensible, you know, defining the inclusion exclusion criteria, define the construct of interests, to… criteria. Um, clearly document the studies' selection processes absolutely fine. It seems quite sensible.
- Quality appraisal is where there probably would be differences, we wouldn't exclude documents based on poor quality because poor quality data could potentially still contribute some particularly conceptually some ideas to theory. I mean, if you want to look at it one way, if I wanted to be difficult; I could say to look how would you count an expert report by American Medical Association. Yeah. On a condition is that qualitative data. And the question is I don't know, right? Coz it's a mixture of both. Actually, the form, it's a consensus statement or some description, an expert opinion. I wouldn't classify that as qualitative data, not in the traditional sense. So hence I think that's why using… to me the term mixed methods is actually… I prefer… if you're gonna call them anything, I prefer multi method.
- So narrowing it down to qual and quan I think is slightly unhelpful. So therefore, quality appraisal… I mean, I don't know, I mean, there probably are appraisal tools for the way reports have been produced, but that doesn't necessarily mean that even within, you know, just because… a report has been produced in a rigorous manner does not necessarily mean that the conclusions of it are what has been assessed.
- But the quality of the debate and the strengths of their arguments for a conclusion are not judged. You know, now, that to me is actually the most important bit on that document. The production process is not necessarily as helpful.
- So quality appraisal is slightly different, I think that's probably where there's going to be the biggest departure from a realist review, other than as I said earlier, the need to produce program theory.
- Data analysis and synthesis, yes, need to reflect on diverse evidence and design. I think the data analysis doesn't necessarily consider diverse evidence types. Data analysis is using what's called a realist logic of analysis. And the evidence synthesis is about producing a realist program theory. So it's actually synthesizing to produce a theory, and then that begs the question of how do you know, the theory is any good. Well, you have to look at what arguments it's based on and then you look at what data those arguments are based on there's quite a bit of judgment involved.
- I would completely agree with you, as you've mentioned in other bits earlier, it's all about transparency. So you can see where the disagreement, are. So I'm not sure there's integration and mixing because those are just to me mealy mouth words which don't really explain anything, about what in the world they are doing. You know, in a realist review, it's very clear, you're producing a realist program theory and you are using a particular means of explaining causation and that's applied in a sort of consistent logic throughout the analysis and synthesis

- so there is one more thing on there actually, you probably should ask people to be clear about conflicts of interest and funding sources... And then source of funding as well. I think that's coz it's not necessarily as a conflict of interest, I may not have a conflict of interest because I'm actually, you know, not getting any money from Coca Cola but Coca Cola may still be funding my review.

Interviewee # 2

- it's very similar to actually what we do at the moment. I think your summary of what we do is bit short. And in terms of the scoping of our work, that's, I think, You're quite right to emphasize the importance of that. And that's what I hope comes across in the book
- It was interesting… Um, the philosophical assumptions for the study… coz we kind of never do that. In that, I mean we don't sit down together and think… you know, we've not done phenomenology for a while so that this one.
- the assumption almost at the beginning is that you're doing a mixed methods synthesis. So, you know, as I said, we start with the problem and the question. The mixed methods thing arrives if it does… sometimes it doesn't. Sometimes a mono-methods review, does the job so I think that's, something that I would add to the scope. You know, I only do an MMRS study if it's justified. You've got to think about what you need to do and absolutely the expertise and the resources available to review team are really important. Scoping searches, yeah scoping searches or mapping. Sometimes we map the… it's like a more formal scope of the evidence. I mean, I mentioned that before, that mapping is really an important part of our approach. I would add… I suppose you've got the expertise of the review team, but in the evidence search, you must consult an information specialist, especially If you're looking for diverse evidence
- But certainly, you know, the need for having information specialist involved.
- No, it makes perfect sense. I mean, the appraisal is good, the analysis and synthesis… Yeah, I mean there's just so many different ways of doing the synthesis.
- Well, what I would add on the integration is… you know; thinking about what the integration of the different types of evidence does over and above just having one of them on their own, you know, there's something about it, making it more than just the sum of the two parts
- And yeah in terms of writing the reports, the danger with the mixed methods reports is that they get really, really long and actually what I found works best in communication with decision makers is to start at the end.
- in terms of writing the report from mixed methods. It's probably that you want the integration to be in the finding and, you know, it might well be that no matter how proud you are of the other parts of the report, you just need to de prioritize them

Interviewee # 3

- And what I really liked Is that you, you are very explicit about the scope of the background section. So your. Step one.
- Also comparing it to the to the two you provided the realist review and the EPPI-Center approach. This is very close, actually to what we did. We spent actually some time having some leading questions in this section about the scope and yeah, especially that you include the… philosophical assumptions behind it the ethical considerations and the purpose descriptions. I think this is very useful to spend some time on the step one
- What I also liked is that you included a first literature search before thinking about the inclusion exclusion criteria.
- And I also liked that you have a very explicit separate step for the quality appraisal.
- I already told you how we… integrated the information from the quality assessment later on in our synthesis design. I wondered from your approach what is your idea. What are you actually doing with the information on the quality later on. How do you continue to work with this information in step 5, 6, 7. That was not so clear to me,
- Probably in your step five, you can add another bullet point how you… Or step six probably even, how you follow up on the information you get from your quality appraisal or what's

your idea to sorting out the second best evidence at step four. And then continue with a subset of the best evidence I don't know.

- also one that I mean this relates a little bit to my focus on the causal or non-causal or internal validity, external validity theme. I wondered if this does play any role here so I mean having causal or non-causal questions together in one research design usually is one part of the motivation for a mixed methods study later on.
    - I didn't find it very explicit here in your framework
- And Let me see, I took another note… At what stage do you consider the different mixed method designs? Is it step six then for you? I mean, whether sequential, parallel and so on. Nested design, does it play any role in your framework?
- Otherwise looks quite good it's quite comprehensive and I think that's a good idea. I mean, because it's a complex approach, I think that there is need for complex frameworks. So I think it's good that you were very explicit in your bullet points and I really liked that you have quite… already many aspects included. So that's helpful I think when thinking about… I mean, it's always a case in practice that you will adapt this framework to your study later on. So I always like it when it's more comprehensive and it's explicit on the different dimensions you have under scope of study and evidence search and so on... So yeah, I think it's a very helpful piece of work now.
- No, I think I wouldn't remove anything. There was nothing that I marked here. My main question was about, is it probably worthwhile to think a little bit more about this causal/ non-causal separation somehow… probably also, related to this, the role of mechanisms. So is the synthesis study more interested in the if answer to what extent or how much questions or more on the why, how something is related to each other and yeah I don't know….

Interviewee # 4

- I like your steps. I think you are right on generally in terms of the steps. ... They make very good sense. I like the outline that you have.
    - Try to take it to that next step, say quality appraisal, and… I would offer more on that. Like what exactly are you suggesting there? … Consider diverse evidence, what does that really mean. I can consider that, but what does that amount to?
        - I think for the integration, what are you offering there? What is the analytical strategy to approach it?
        - For the appraisal, like do you have specific frameworks that you would recommend?
        - When you select your evidence, think about the types of studies that you include in the qualitative or the studies you would put in the quantitative.
        - And then for the data analysis and synthesis, what is the order?
        - Because when you are sitting there with all your studies on the table, which pile do you dive into first.
- I would say more specificity and procedural guidance on each of your steps would take you a step further.
    - So you have a concrete approach that you suggest, this is how we should go about it.
        - The best you can say is we could do this in sequential, or I completely disagree with the bias by using the qualitative first or the reverse. We should look at the outcomes and we should then go in and try to understand when we know the outcome patterns. You can make that argument, right? So get it to that level.
        - I mean I started as a practitioner so I always wanna know what should I do? And I guarantee you, if you take it to that level, people are gonna take it and run with it and use it. Practitioners and Evaluators…
- I wouldn't necessarily remove anything. I mean, some of the statements there … could mean so many different things right? Conduct a scoping search, so it hard to know exactly… I would say in general, be more specific on the procedural steps involved in each step. What

does a person need to do. What does an interested research synthesizer… what would a person need to do? And if you like to PICO framework for… you know… add that to the research question.

Interviewee # 5

- You identify philosophical assumptions, but I would be surprised to see that. Except if you use a realist synthesis, it's clear that they will clearly identify different philosophical assumptions… but It's not always the case
- The purpose of mixed… and justify the application. So justify the choice of doing what, when you say… What do you mean by… I was wondering, do you mean like to justify why they decide to… rationale of doing the
- IRB approval is not always necessary. Because you're doing your review. So I feel like… yes develop a protocol and the last part for me is not always necessary
- The scoping… wasn't clear for me. What was the difference between the last one… scoping search and in step two you also have conducting a scoping search
    - For me, for more clarity, you should put the scoping in one of the box because if it's confusing. So either put it in the scope or in the evidence search. Maybe more in the scope… For example, in the EPPI-Center, most of their review will do a scoping search. A scoping search is done to have an overview of how extensive the literature is and after to guide, to refine the questions.
    - Because like policymaker often have like very broad questions. But they have a topic so at least… and like, when you're doing a scoping you say, oh here's what's available in the literature in general, so what would be your interest. Because we cannot address this, this, this is evident… been done. So here's what the literature says, but what should we dig deeper
    - So often, the scoping is done in order to have… as I said, the overview of how extensive the literature and to refine your questions, maybe it can more relate to step 1
    - And it will help also to develop the language as you said. So maybe the scoping I would put that before.
- And literature search. I wasn't sure… the meaning of it and the difference between literature search and define your search strategy
    - But because literature search; if you say its overall, your title is evidence search, right?
    - So I didn't like… either there's no difference in the literature search and the search strategy or…
    - For me literature search is very broad. It doesn't like… when do literature search, you will need to define, you will need to identify which database, like where you want to search. You have to identify the sources. So that… I think that's missing
    - So maybe like, identify your sources, where you want to search and after define your search strategy.
    - Identify sampling strategy, so sampling again. For me, as I said, I understand your point that some more qualitative part will talk about other type, but sampling for me, it's not a very common term.
    - And didn't understand when you say consider diversity of evidence source is… So maybe that's the one on identify your source of evidence. Right?
    - what you have to do is identify the source of evidence
- And I agree that you have to have a diversity of course, not just committed to the base but sources. And identify the software, so that's like new. So not typical but it depends on, like, where… for example, in the EPPI reviewer. The system, you have like the, bibliographic management
    - Like Endnotes, Zotero, Refworks… You have like software that exists to do systematic review. So EPPI reviewer… and that's different from bibliographic

software. So what you mean by software, maybe you can clarify that because it's different

- the step three… when I read the step three, so define inclusion strategy, define construct, define the context; for me, it should be before step two
    - Because if you don't define your construct, you don't know what you're looking for in the literature. So it's important to define that before doing your search strategy.
    - But, the last point, *clearly document selection process* is something different.
- So I would put the first three bullets of the step three for step two, and I would… define concept, define inclusion criteria… before the evidence search, before the searching you have to find something… you have to find what you are looking for
    - Or maybe put it in the scope. I don't know, but It has to be before the search.
- And after, you have to… the last bullet on the selection is for me, a step on its own.
- So step three is to select. So clearly it's not theory document because in your framework you are mixing recommendation and step. Like you are reminding people, *oh, don't forget to be transparent, don't Forget to clearly document,* and at the same time you are putting verbs, like define…
    - So you're mixing the two together. So maybe you have to try like separate them. So there's steps; you have to define your inclusion, you have to define your construct, you have to do that. Clearly document something is an advice. Yeah. Right? It's not a step
    - No, because document is like advice. Because in the selection process... is to screen. In fact, in the selection process, the first step of the selection process is to screen title and abstract. The second step is to find full text of included abstract and title, the third step is to identify relevant content. You see, so that's the steps.
    - But to clearly document is an advise. Don't forget to clearly document. But for me, I would separate them, because if you want to explain, and to remind people of stuff important, like for me, its hints, like clearly document, but it's not a step
- And *evidence retrieval*, I don't know if it's a term, look at the PRISMA, I don't know if they use evidence retrieval, or selection, or identification, or… I would really recommend you to look at the terminology that is used in the PRISMA.
    - All of them, like evidence search, evidence retrieval. A common term that is used in the PRISMA, like, do you say, if it is retrieval or do you say selection or do you say…
    - I don't know what's the typical term. But I would suggest to use like common term, don't Invent the one.
- In step three, you're talking about consider context of primary study. I wasn't sure what is context. What do you mean by context?
    - So that for me is in *eligibility criteria* so If you would define your question as I'm interested in this topic and only in rural blah blah
    - And that For me is more like, you've considered the context. So it's not a step
    - You see the difference between a step… here's what you have to do want to do. Don't forget that, oh, there's like hints
    - For me consider context is something different. Either you… Because it can also be linked with data collection
    - Extraction in fact. To remind people that you have to extract information on data on the context in time. So, but for me, it's not a step
    - the third bullet is not something that should be there
- The other one, *consider diverse evidence type in source*. So you see, that for me is not a quality appraisal, it's a little bit similar to evidence search, consider diversity of sources. So you put that in quality appraisal but it doesn't tell you what to do in quality appraisal. It's a hint. But it's not linked to quality appraisal
    - So identify tool is one, and the last one is the same thing; *consider issue of validity*. So consider so

    - Appraise the validity using the tool.
    - Like, the first step is to identify tool. And the next step is to use the tool to appraise the quality. And still like quality is very blurry, because you use validity, legitimacy. And in your rubric I think you use integrity
    - There's different terms, I would suggest to you to try to use common terms, but use one. Like appraise the quality, since you have quality in your title
- One step that is missing here is *data extraction*, because you put the data extraction in step five. But for me it's different when you do data analysis and data extraction
    - So I would put the step on its own, data extraction and in data extraction you can put… develop a coding form… and develop a data extraction sheet
    - A strategy, develop that and after have… pilot test your sheet with like two persons independently. Extracting to make sure that it's clear, rigor and stuff like that
    - But I would have like a step on its own; *data extraction*
    - *I didn't understand what you mean by related strategy. Data extraction and related strategy…*
- So if you're talking about like how do you transform the stuff, for me that's more related probably synthesis than the data extraction. Because the data extraction is like, you look at the paper and you cut and paste… like you extract the information, but you're not transforming it, right? You are just extracting it
    - So for me, that's data extraction. But if after you have to convert it so, oh, I'm going to use a quantitative content analysis
    - So, I'm going to interpret that part that I extracted into a theme or convert it into numbers, so that's gonna be the synthesis.
    - so in your step data extraction, you will describe what you need to do. So, what you just said. Its like… clarify, or develop the coding scheme. Right?
    - developed the coding coding scheme. Right. It's sort of data extraction
- Before that, I forgot… reflect on design. So the term reflect, like I didn't really understand what you mean by reflect.
- So maybe here, instead of reflect you can say, choose a design. Instead of reflect back, just like you have to choose a design.
    - Because there is no other place in the other step that you are talking about design…
    - You don't say choose a design or something. So maybe it's at a place here where you have to chose a design
    - So, in my opinion, I think you can put it in step five
- That step would be to choose a design. It's because, why would you do that…. If I'll have like your design put more earlier, but when you do your review the design will depend on what synthesis method you decide. But it will also depend on what you're going to find
- That step would be to choose a design. It's because, why would you do that…. If I'll have like your design put more earlier, but when you do your review the design will depend on what synthesis method you decide. But it will also depend on what you're going to find
- Like if you don't have a lot of like… I don't know, you're planning to do a meta-analysis, but at the end its like you do not have enough studies or you have one RCT; You're not going to do a meta-analysis, probably you will have like… it's very easy to iterative, right?
- The other question that I had is, what is the difference for you between data analysis and evidence synthesis? I didn't really see the difference
- Okay, so if you don't do a synthesis, you're not really doing a review. Because for me, a synthesis… synthesis is defined as; you're developing something new based on the finding of different studies
    - So if you're just describing like, study one…. Study two… there's no synthesis. But you can say, kind of an overview, but it's a very… there's no result. For me, it's very boring. Right?
    - Exactly right. So for me, when you do a review, usually we will talk about synthesis. If primary research will talk about analysis. So for me it's the same

thing. So maybe the step is to identify the synthesis method. And after is, I don't know. Conducting them
    - Yeah, then conduct the synthesis
    - Exactly, and probably one of the... You can have the integration after, but the integration is…
    - I find it interesting to put the emphasis on integration, because if you put it in step 1 It's getting a little bit long.
    - Yeah, exactly. So, but it's still like it's part of synthesis, but it's like combining the findings of the quantitative, qualitative that you have. But I understand why you did it this way
    - But it can be part of five are on its own
    - If it's on its own then it's like oh yeah, don't forget the integration. Whereas if you put it in five it gets a little bit lost and it's still a very important component. So, It's really up to you
- Another question, I didn't understand the translation of evidence. The second bullet
- And all the rest is like hints. Like transparency is a decision made so it's… it's not a step. Like a said, I think when you modify your framework, remember like there is steps; that for me is like 1234, and there is reminders. And it's the same thing in step 4, it's a reminder. Consider... it's all like stuff that you have to remember.
- Writing report… For me it's all hints. It's good to remind people, but it's as I said you're mixing both steps and hints. I don't know, maybe have two columns
    - Here's the step you should follow and here's some reminders that you have to think about.
    - So for example like the search, you can have also even more detail. It's like to remove duplicates you know. So I don't know how detailed, you want to be, because you can be even more refined. Because if you look in more than one database for sure, you will have duplicates
- What I would suggest Is that you assess your rubric, in fact, you assess the EPPI and the Realist synthesis Info. As I told you, for me, it doesn't make sense. There were not developed as guidelines to do mixed method reviews. So if you want to use your rubric. I would say use like, I don't know, the JBI manual that was developed for that or Heyvaert book that have very clear guidelines. It will make more sense for me than using the realist approach
- Because realist synthesis, first, it doesn't call itself mixed method review, right? It's called realist synthesis or realist review. So I don't know if Pawson will say, how come like if you are appraising realist synthesis for mixed method reviews, you are appraising it for something that it's not even developed for that
- I totally agree that realist… and it's like, it's a great way of using quantitative and combining them because it's very clear, but it doesn't call itself a mixed methods review approach. I don't think the developer will ever call it that

Interviewee # 6

- I did notice that you use the word stakeholders more often than others. I thought that was good. Um, I don't know and you can tell me if this is a correct interpretation, the extent to which your framework is inclusive of those strategies that would be needed to include people from marginalized populations. From my experience there needs to be an inclusion of an analysis of barriers that people experience and facilitator supports that are needed for authentic engagement. Um… coz otherwise, you know you get the people that match your thinking about, *this is the way that data gets collected*.
- in studies that I have done, we encounter challenges with trying to get members of marginalized communities. We have a choice to make, to say well you know we tried but we couldn't get them. So that will be a limitation of our study. Or to say, is there someone from that community who can enlighten us about what kind of supports are needed so that they can be authentically engaged. And that might mean, you know changing the timing of when

things are done. We might think, oh maybe the evenings are good times, but maybe those are not good times for people who have to work in the evenings or people who have family responsibilities. Is there another way to do this that might be more supportive? So I think really looking at that kind of… what are the strategies that are needed in the beginning, also ways to figure out mechanisms for communication that are appropriate. You know, again if you are thinking of an academic audience you might think, you know, emails are great, you know, or I will write something, you know and send it to them for comment. Maybe that is not the best way to do with all your audiences. You know, it's not a systematic review, but we just finished a study in Kenya on an educational intervention and we had to talk to the people at the school and say, are there parents that we can talk to find out, what are the best ways to share things. And… you know, they were able to give us some insights. Like these are the ways that we communicate with parents and these are the ways that are familiar to them. Maybe you could… adapt your strategies so that you are being more responsive to where they are. And so… I think having that included in thinking and you know, it's not just a question of developing the questions, but if we think that we are looking for research to synthesize, and we are limiting ourselves to that which gets published, are there other perspectives that don't reach that audience that would be relevant?

- So before we go making conclusions based on the research that's available, how can we expand our understanding of what's needed in that context so that we don't reach a conclusion that says, oh this is the intervention that's best
    - there is more for us to know and so don't limit ourselves to what might come directly from the synthesis of prior research
- I think also a very deliberate inclusion of a strategy for the use of the information
    - I mean if you publish something that reaches a certain audience. If you are addressing something that is only a concern 100% to an academic audience, and for publication, it's just fine you can just stop there. But if you are actually trying to address an issue of relevance to a broader community. And it doesn't matter what that is
    - How are you gonna share the results in ways that they can be used as a basis for action? Otherwise, I don't see a point to doing it
- just on those two pages that I mentioned, 126 and 127, it's got a… you know, a succinct description of what I think a systematic review could… how you could design one so that it could have a transformative effect.
- I think we have a responsibility to be culturally responsive no matter what kind of a study we are doing. If it is a systematic review, if it is a mixed methods systematic review or if its an evaluation in itself, you know, whatever it is. There is you know… we are completely immersed in a cultural context and that cultural context is very complex in certain contexts certain things will be relevant and not relevant in other contexts. How do we make ourselves aware and how do we incorporate that then into the design of the study that we are doing.

Interviewee # 7

- Clarification
    - So the ones that you targeted… that you chose you said that the most prevalent, was that based on the results of the whole review or how did you determine the most prevalent?
- Well I think straight away you can obviously tell that you've got a lot more detail, a lot more steps in there, so that's gonna help everyone. There is obviously gaps as you said in the two that we've used as examples and you've obviously considered other ones so I think just the immediate amount of detail was very very useful. Um, I guess if we wanna break it down…
- so in terms of step one, I'd suggest the scoping search if I am familiar with the topic here, I would say you do a scoping search even if you are familiar with it. I think you would this regardless.
- Clarification

    - Um, is this framework suggesting that you do all of these things or are these just kind of things to consider? Coz I am looking at say the first one where you say, "Identify your philosophical assumptions" which is not common across all of these types of reviews. So is this something you are recommending for someone doing a mixed methods review following this approach?
- So I guess that answers my next point I had it written down here. When you've got purpose of the study and justify the application. That probably involves indicating if say primary studies or evidence are available that looked at making the inclusion criteria and does that indicate including indicating if other systematic reviews have been conducted and if so, why are they different. So just, I guess more detail is what I am saying but you got the main points covered there
- And I did notice in step one and step two you've got scoping search twice? I wasn't sure about that
- I looked at those first two steps and essentially for a lot of those things obviously fit in developing a kind of a priori protocol so I guess in my head that's the kind of phase that you do it all together. So you're defining your topic, you're looking for evidence to see if anything's been done, developing your inclusion criteria you know, and all that your search strategies and so forth. So I thought they could be kind of almost a meshing of step one and step two if that makes sense.
- In terms of step 3, you know, defining the inclusion and exclusion criteria, again, why is that not kind of in your protocol, that's what you should be defining before you start for transparency, so I wasn't sure why it's there
    - I also wasn't sure where it says define construct of interest
    - It does, you make it sound a little bit like construct validity. Is that….
    - I think that would be more, as I said in this kind of section when you are doing the protocol. So I would actually move that up. But that's an interesting point that I kind of haven't considered or we haven't considered and I haven't seen that come out across a lot of the approaches or frameworks that we've seen. So that's a really interesting point.
    - Yeah, I think that's an interesting point. I think it could actually be at multiple stages of your framework, to be honest, like you define it in your protocol. And then obviously you could bring it out. Once you get your results and even in the discussion if there was issues around that as well.
- I didn't have any Comments with column step four.
- Step five again when you've got to reflect on the design you have chosen and make a choice.
    - I guess with my JBI hat on again. It was really relating it back to that apiori protocol where that should have been defined, coz I guess when I'm looking through this is it almost seems like you encompass kind of the iterative component of mixed methods. And that's why I was asking, is this kind of what you're prescribing or you just kind of trying to include all considerations.
    - I guess when you refine this you might want to kind of differentiate, if that makes sense.
    - step five, Um, as well I guess when you're talking about data extraction and related strategies, you're talking about things like transformation is that right?
    - when you're talking about evidence synthesis. Does that… does that include the integration side is that that the second level of synthesis
        - I would take that last point out because I don't think it sits well, or maybe consider rephrasing
        - I'm kind of not sure what you're talking about, coz like are you talking about like you say for a segregated where you do a set of independent syntheses… And obviously step 6 is about integration or mixing them. So what is the evidence synthesis supposed to represent?

- on to Step six. talking about an integrated approach or sometimes that can happen at the same time, when you're doing synthesis and integration. So I guess as you said, if you're going to represent this visually you might be able to get that clarity.
- The only other comments, I thought with step 7 is maybe adding something here about you know, including recommendations for practice and further work in the area if you've identified gaps

Table 5

A Summary of 'Other Issues' for the Interviewed Expert Reviewers

Additional notes
Interviewee # 1 ➢ Classification of realist review as an MMRS framework: o I wouldn't put it in the mixed methods category I would put it in theory driven category. o Yeah, because the product is a theory. It's ultimately a realist theory that the implication of that is, it has a specific means of trying to explain causation within the theory, but it's still theory driven ➢ If you mean mixed methods is just qual and quan, then it's far too narrow. Okay, if you say mixed methods is qual, quan, editorials, opinion pieces, substantive theories… because there are substantive theories…You know, there are very few original ideas on this planet. Most things obviously have been researched by somebody either in a similar field or in a different field, and I think it's actually short sighted and blinkered to not look beyond the field that we come from ➢ I'm just curious what you what you're hoping to do with the framework. ➢ But I think the reality is that the frameworks are at best an Introduction. We, as in those of us who work within realist reviews tend to find that they are sometimes very problematic in the sense that people think, oh, I have a framework if I follow it I'm basically doing the research of this type, you know, so if I follow courses five steps I'm doing a realist review. And actually, the bottom line is no. Yeah, there's more to it than the framework and that doesn't mean frameworks are not useful. ➢ And I think that's true of anything really, you know, just because you've read the Cochrane handbook doesn't mean you can do a systematic review. Well, you might be able to do one badly or by chance you might do one really well. So I think there's a big difference between theoretical knowledge which frameworks can provide you know, here are the steps, here's what you do, here's the detail ➢ Versus the experiential knowledge of actually having done one with guidance, because otherwise, what ends up happening I think are reviews, which are certainly Frankenstein, people have made mistakes. they don't really understand what mistakes, they've made. They get annoyed when people tell them that they have and it becomes an unproductive process and potentially quite wasteful…. ➢ No, I think you're absolutely right in the sense of, it's a developing field. And then I think one of the big problems here, it's the usual business that happens in research, which is everybody wants to be the first person that comes up with a method, you know, hey, I've got my novel method you can name it after me. Yes. And actually, they're all I would say, actually, that they… a lot of them lack coherence that's probably why. And I think the whole muddiness just comes through, you know, what are we using different sources of data for. The question is, be clear about it. So even if all you end up exposing is that what a complete muddle it is, and how different frameworks seem to either contradict themselves or, you know, also be unclear about what people do. I think that's actually not necessarily a bad thing. I am not necessarily sure that that will… I mean it will certainly advance the field. I

think, whether or not that will make it more… make practice better is always a slightly different issue… it's very difficult to change people's practice.

Interviewee # 3

- Yeah, I think the only additional thought I have on… is one that I mentioned earlier, for me, I mean for our institute German evaluation Institute here, we see a potential in bringing together this debate from the mixed methods community and the multi-method community at the moment they are quite separated.
- but I see actually a potential in bringing these debates together because I see them quite separated and both have their potentials and challenges. And so, yeah, it's probably wise to think a little bit more in this direction of multi-method research
- And I think, a very good argument for your research is that I see an increase in the amount of multi-method studies and mixed methods studies. And so there's actually a need for good frameworks on the synthesis of these mixed methods studies. So, and there's a huge potential actually to support in our field evidence based decision making and Development Corporation, but also in other fields and disciplines, actually.

Interviewee # 4

- there seems to be a lot of confusion about, when we are looking across these types of synthesis, it seems everybody is struggling with the moment of integration and how to… you know, organize the evidence. And then you have all these people finding it and trying to use it because they feel like pound cake, but then you should actually be rating the pound cake to see how does this actually play out in the real world. This could be actually what you focus on.
- I mean, these frameworks change over time, like so you have the EPPI-Center. I don't know if there is one EPPI-Center approach. I mean in one really work, they use a matrix approach to integrate the findings and now they seem to be using more QCA.
- and when you look at the realist synthesis, it's even…. It's… because of the realist tradition, and it is anchored in the realist tradition, it defies procedural… you know, they will say, we can't give a recipe, because there is no recipe. That's not how we do research in evaluation. So just be careful. And be careful especially when you assign numbers because that always allow people to… oh, they will… oh how can you say… 3.5 and…? Be careful how you use it and you know, it might just be a step on the way for you to better appreciate the strengths and weaknesses of these approaches
- Have you already read the review of the realist synthesis framework?
- in your assessment of the realist synthesis, it is definitely worth including some of the findings from that review. I think it will add really well to what you seem to be pushing for your framework
- That's a good idea. Yeah, anything that could bring you closer to practice. Have you applied it?
- because that is really more than anything… we want to bring it to practice. We want to apply it, so it is not just a good idea, but it is a good idea when you apply it and you have your lessons learned. I think that would be great.
- So find a good programme. You know a good intervention. You want to have something that meets a couple of decades where the research behind it is really labeled and do some, you know. It took me quite a bit of some time to find a good
- I agree with you that it's one of the most popular frameworks, but I will say it later, I don't think it's a mixed methods methods synthesis approach. I am not sure it is fair to appraise it using your rubric. It doesn't make sense, but we will talk about it.
- So there is a lot of stuff that you can do for MMRS because it's a very new field. So no matter you do. For example you can really focus on the integration. How you do integration and here is some guides. There is a recent paper that was published last year that suggests five different strategies.
    - But there's still a lot to do with that, so integration focusing on that.
- The other one is focus on reporting

- I don't know if it will be that helpful. Because people that start, they need to know how to do it even if its just the general steps
- it's the general steps of doing a systematic review. But in more challenging and in more complex contexts. So Maybe address how to address the different challenges. That could also be interesting. But I would focus on something more specific than more general how to conduct

Interviewee # 6

- well I think the notion of a systematic reviews has a lot of potential because you know, one study can only do so much, but if you have a range of studies and you are looking at them together, then it's helpful to get that broader perspective of what's going on. I think the big cautionary tale, I think there is two, one is to be inclusive of the culture and context within these individual studies. You know and that is not what a positivist would say.
    - But I think if we don't do that, then we're at risk of saying things work across general populations when they actually might be harmful to other populations. So I think there is a risk of that…
- So the other one… Um, is really focusing on, how do we integrate things into a systematic review. When it's not published research.
    - You know, I think that's a big challenge because by definition the systematic review says that you are looking at individual studies trying to integrate them in some way. But, again, my concern is the way that limits the perspective that you've taken the understandings that you have

Interviewee # 7

- I would say now our guidelines aligns very well with Sandelowski's approach and Pluye and Hong's approach.
- So based on the review of all of the reviews, we are proposing convergent approaches but we kind of broken them down into kind of two kinds of groups. It's either the segregated approach or the integrated approach and it obviously depends on what question… and Um, if it can be answered by both quantitative and qualitative research obviously use an integrated approach. Whereas, if they can, if they are about a particular phenomenon or particular dimensions of a nominal phenomenon you take a segregated approach. Obviously with the integrated, you then have to do transformation, whereas with the segregated approach, you do your independent synthesis and then you bring it together and you kind of create a line of agreement.
- No, I think it's really useful, I think you've done a good job. It's hard. It's a complex group. There's so many different kind of approaches and thoughts. And when there's not a lot of detail. It's very hard to grasp.
- I've been doing this kind of for the last few years, but it's still a hard… it's a complex area. And as I said, we've just released our guidelines but we've got a number of projects that we need to work on because we just simply don't have the answers yet. We need to conduct kind of more work on that.
- So we've just done the review as a manual. We've just submitted a paper based on that chapter, and now we're working on doing to worked examples. So during the segregated and integrated approach, and I'm sure once we do that, like, you know, a whole lot of other issues will come up
- About realist review
    - I guess in terms of the work we've done and when we reviewed the literature, our group didn't classify it. We looked at it, obviously. But I guess our stance, at the moment, or my personal opinion would be that it doesn't clearly sit under that term.
    - guess if you look back to the universal steps of a review, it doesn't fit all of them I would suggest. But as I said that's quite a not a controversial issue, but you'll Get a lot of differing opinions and I'm sure you've obviously received them already.
    - Yeah, it meets, but I guess at this stage initially it doesn't clearly fit in, but that doesn't mean things will change

Figure 1

A Picture of the Summary of Attempted Ratings for the Realist and EPPI-Center Review Frameworks by Interview # 7 with Comments on the Rubric and the Rating Process.

Summary of ratings and scores for the two most prevalent frameworks (1 & 2)		
	Framework 1	Framework 2
QUALITY (Design)		
Overall	3.5 3	3.5 2.5
Qualitative Component	2.5 2	3.5 2.5
Quantitative Component	2.5 2	3.5 2.5
Mixed Methods Component	2.5 2	2.5 2
Total Scores	11/16 (0.688; 68.75)	**13/16 (0.813; 81.25)**
QUALITY (Sampling)		
Overall	4 3	3 2.5
Qualitative Component	2.5 2	3 2.5
Quantitative Component	2.5 2	3 2.5
Mixed Methods Component	2.5 2	2.5 1
Total Scores	11.5/16 (0.719; 71.88)	**11.5/16 (0.719; 71.88)**
QUALITY (Integrity)		
Overall	2 1.5	3.5 2.5
Qualitative Component	1.5 1	3 2.5
Quantitative Component	1.5 1	3 2.5
Mixed Methods Component	1.5 1	2.5 2
Total Scores	6.5/16 (0.406; 40.63)	**12/16 (0.75; 75.00)**
STRUCTURE		
Overall	3.5 2.5	4 2.5
Leading Component	4 1	4 1
Transition	2.5 2.5	4 3
Integration	1 1	3 3
Organization	4 4	4 3
Total Scores	15/ 20 (0.75; 75.00)	**19 (0.95; 95.00)**
CLARITY		
Overall	3.5 3.5	4 2.5
Language	4 4	3.5 4
Logic and Flow	3.5 3.5	4 4
Procedure	4 4	3 3
Steps	3.5 3.5	3.5 2.5
Outline	3.5 3.5	3.5 3
Development	1 1.5	2 2
Total scores	23/ 28 (0.821; 82.14)	23.5/28 (0.839, 83.83)

General notes on the frameworks:

The frameworks do not emphasize one type of evidence (i.e., qualitative or quantitative) thus for the 'leading component' aspect when evaluating the structure, both frameworks received full scores of 4. This interpretation could differ per reviewer during application.

The frameworks were rated based on how I felt the presented information in the framework spoke to me. I did not consider additional information provided in prints accompanying the frameworks. To be thorough shouldn't additional sources be considered?

No user guidelines are provided for these frameworks. A user has to read accompanying prints to apply frameworks with fidelity. This is the case for all reviewed frameworks except the JBI approach which is provided with a manual. The manual is expansive to read for a reader looking to understand and quickly apply the framework.

Hard to answer rubric w/out supporting info.
Frameworks provided don't breakdown qual and quant components

Table 6

A Summary of Pictures of Pages from the Book with Field Notes Taken During Interviews

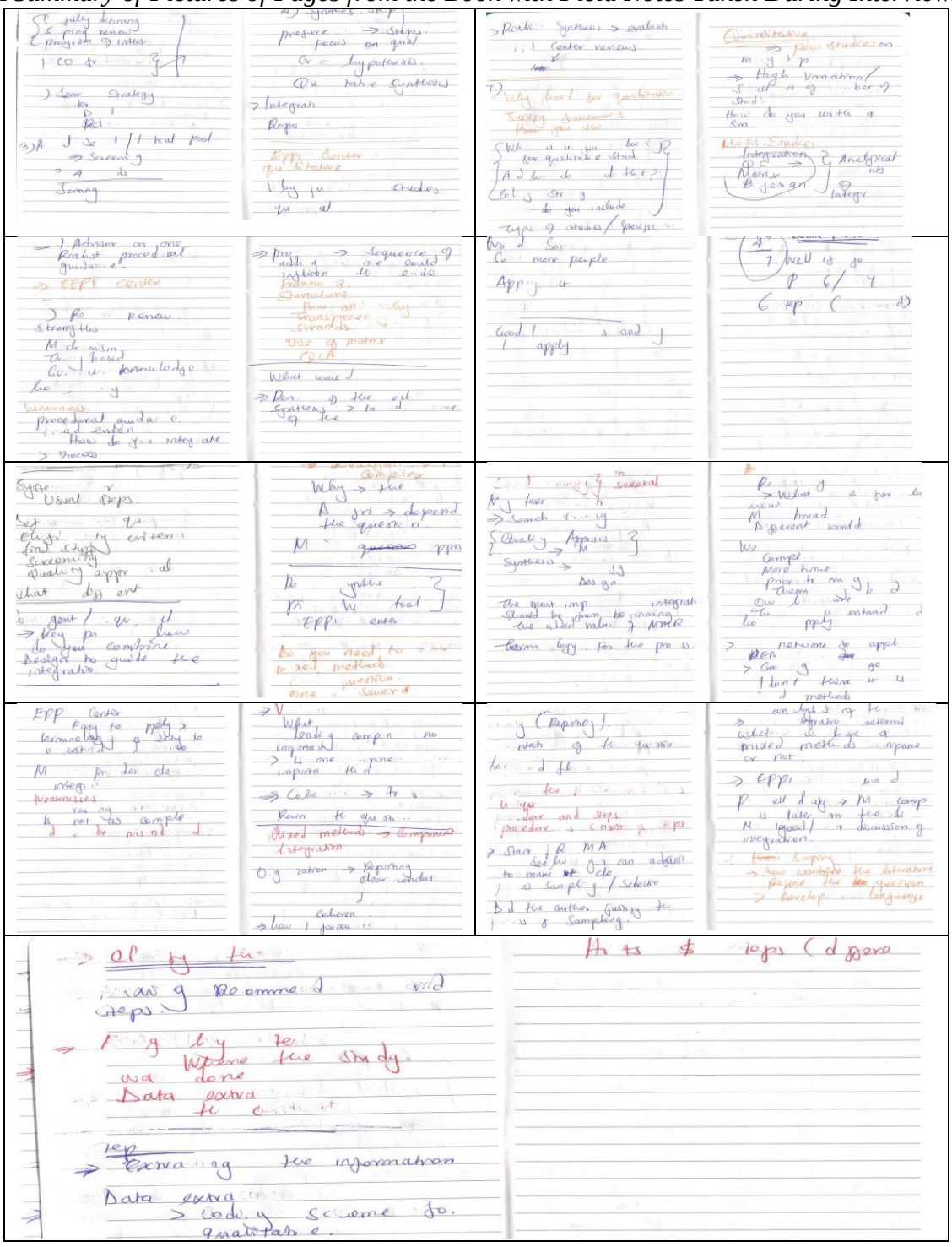

Table 7

Summary of Feedback on Framework Steps and Processes by Participants/ Interviewees

Step	**Participant/ Interviewee feedback**
Step 1	*Interviewee # 1* Agreed *Interviewee # 2* Agreed with -Emphasis on scoping -Expertise of the team Suggested to add -Consultation with stakeholders to determine need for MMRS *Interviewee #3* -Agreed with philosophical assumptions, purpose of study and keeping ethical issues in mind *Interviewee # 4* N/A *Interviewee # 5* Suggestions -Have scoping review here and before searching -Exclude; 'philosophical assumptions' and 'IRB approval—not always necessary -Revise/ reconsider language for; 'identify purpose for MMRS' and 'justify rationale for application' *Interviewee # 6* N/A *Interviewee # 7* Suggestions -For scoping search—familiarity with topic shouldn't matter -Philosophical assumptions—not common, could exclude -Clarify the statement, 'purpose of the study and justify application' -Have scoping search under step 1 and not both step 1 & 2
Step 2	*Interviewee # 1* -Collaboration with Librarian -Search is exhaustive for realist reviews *Interviewee # 2* -Consult with information experts *Interviewee # 3* Agreed with -Initial literature search before inclusion/exclusion *Interviewee # 4* N/A *Interviewee # 5* -Agreed with 'diversity 'n sources'

	Suggestions -Be specific for 'identify information management strategy/ software *Interviewee # 6* Suggestions -Consider perspectives outside traditional research resources *Interviewee # 7* -Could combine steps 1 & 2 -Have scoping search under step 1, not under both 1 & 2
Step 3	*Interviewee # 1* Agreed *Interviewee # 2* Agreed *Interviewee # 3* N/A *Interviewee # 4* N/A *Interviewee # 5* Suggestions -Replace bullet three—'consider text' with 'eligibility criteria' -Move three bullets—'define inclusion criteria', 'define construct', and 'define context' to step 2 -Make 'document the selection process' a separate step. *Interviewee # 6* N/A *Interviewee # 7* -Define inclusion/ exclusion earlier—Move it up and before evidence retrieval stage -Define construct earlier—under steps 1 & 2
Step 4	*Interviewee # 1* -Sources valued for contribution to theory for realist reviews *Interviewee # 2* Agreed *Interviewee # 3* Agreed with -Separate appraisal step Comment -Comprehensiveness & explicit bullets helpful for practitioners *Interviewee # 4* N/A *Interviewee # 5* Suggestions -Move 'consider diverse evidence types and sources' to 'evidence search process' as hint/advise

	Include -'Identify tools' and 'appraise validity using identified tool' as steps *Interviewee # 6* N/A *Interviewee # 7* Agreed
Step 5	*Interviewee # 1* -Employs realist logic to produce program theory -Process is subjective---calls for transparency *Interviewee # 2* -Note---different synthesis techniques *Interviewee # 3* N/A *Interviewee # 4* N/A *Interviewee # 5* Suggestions -Reconsider/ revise language for; 'translation of evidence', and 'related strategies' -Separate data analysis and data extraction -Replace, 'reflect on design' with 'choose a design' and 'data analysis' with 'identify synthesis method' -Don't use 'data analysis'—is for primary studies context *Interviewee # 6* N/A *Interviewee # 7* Suggestions -Move 'reflect on design' up -Clarify 'related strategies' and 'evidence synthesis' -Exclude or rephrase 'evidence synthesis'—is more like integration
Step 6	*Interviewee # 1* -Agrees with transparency -Argues terms integration/ mixing 'meaningless' Interviewee # 2 -Clarify value for integration earlier
	Interviewee # 3 N/A *Interviewee # 4* N/A *Interviewee # 5* Suggestions -Could move integration under step 5 *Interviewee # 6* N/A

	Interviewee # 7 Suggestions -Integration and synthesis could occur under the same step
Step 7	*Interviewee # 1* Add steps for -Clarity about conflicts of interest and funding -Limitations and strengths of review *Interviewee # 2* When reporting -Consider length and target audience -Include integration *Interviewee # 3* N/A *Interviewee # 4* N/A *Interviewee # 5* Suggestions -All bullet points as hints/ advise *Interviewee # 6* Suggestions -Consider different audience and diverse ways of reporting *Interviewee # 7* Suggestions -Add/ include, 'recommendations for practice and further work'
General comments	*Interviewee # 1* Add a step between scoping, searching and evidence retrieval for -Developing program theory for realist reviews *Interviewee # 2* Method is emergent--dictated by problem, research question and evidence types -Framework related to personal work, shorter than their work *Interviewee # 3* Concerns -Use of quality appraisal information to sort evidence types--- for causal/ non-causal question -Implications for different mixed methods designs -Role of mechanisms *Interviewee # 4* -Appreciated steps and outline Suggested -More specificity and procedural guidance for steps -Ambiguity in meaning for some statements—could be clarified by clarity and procedural guidance *Interviewee # 5*

	Suggestions -Two columns—steps and hints -Revisit EPPI-Center and realist evaluation frameworks -Consider using other MMRS framework for comparison besides realist, e.g., JBI -Refer to PRISMA for common terminology in the field for; quality appraisal, sampling in step 2, & evidence retrieval in step 3 *Interviewee # 6* Suggestions -Inclusion of stakeholder perspective throughout -Include criteria for identifying barriers to engaging peoples and facilitator support for engagement -Be culturally responsive and consider context for primary studies
	Interviewee # 7 -Appreciated details and steps -Could combine steps 1 & 2