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Sexual Assault and Health: Understanding the Interplay of Trauma-Related Appraisals and Physical Health Outcomes

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Abstract

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Women who have been sexually assaulted are at risk for negative mental and physical health outcomes; however, limited research has tested how psychological responses to sexual assault may influence physical health. The present study tested a longitudinal model examining the association between posttrauma appraisals and physical health problems. Drawn from a larger study, the sample included 156 ethnically diverse women who had been sexually assaulted within the last year. The study used cross-lagged panel models to test for reciprocal relationships between posttrauma appraisals and physical health problems over time. A secondary aim of the study was to test whether other factors that have been previously linked to physical health in the context of the broader trauma literature (e.g., social support, revictimization) moderated the relationship between posttrauma appraisals and physical health problems. Women in the study reported an average of seven different physical health problems three months after the initial interview, with headaches being the most commonly reported health problem. Analyses revealed unique relationships between specific posttrauma appraisals and physical health problems. Physical health problems were predictive of women reporting greater appraisals of alienation and anger related to the sexual assault. Posttrauma appraisals did not significantly predict physical health problems, refuting the hypothesized reciprocal relationships. Revictimization moderated the relationship

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Keywords: sexual assault, physical health, cognitive appraisals

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TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

CHAPTER ONE: INTRODUCTION

Sexual assault is highly prevalent among women nationally and is associated with negative health-related outcomes (e.g., Black et al., 2011; Golding, 1999a; Ullman & Brecklin, 2003). Although there are well-established associations between sexual assault and a myriad of short- and long-term physical health outcomes (e.g., Golding, 1999a), few studies have tested potential mechanisms underlying physical health problems following sexual assault. Understanding the mechanisms at play in the link between sexual assault and physical health is imperative for prevention, intervention, and service provision. Integrating theory and empirical evidence, the current study tested a longitudinal model examining the relationship between posttrauma appraisals and physical health problems following sexual assault.

Physical Health Consequences of Sexual Assault

The National Institute of Justice reports that sexual assault is one of the costliest crimes in the United States, with an estimated annual cost of $127 billion, including costs for medical care (Miller, Cohen, & Wiersema, 1996). Following sexual assault, women seek medical care services at higher rates than women who have experienced other forms of assault or no assault (Campbell, 2002; Kimerling & Calhoun, 1994; Koss, Koss, Woodruff, 1991). Women who have been sexually assaulted are more likely to seek medical health services rather than mental health services (Kimerling et al., 1994; Koss et al., 1991; Resnick, Acierno, & Kilpatrick, 1997). One possible explanation for why

women seek medical health services at higher rates is that women who have experienced sexual assault present with notable and pervasive physical health problems that may require more immediate medical attention. Another explanation may be that it is less stigmatizing for women to go to a medical health provider than for a mental health provider. Although it may be unclear why survivors of sexual assault seek medical services more than mental health services, the high medical health service use among sexual assault survivors points to the importance of better understanding the association between physical health and sexual assault.

Studies examining physical health in the context of sexual assault have most often drawn on samples involving women who have experienced intimate partner violence that included sexual assault. Studies have documented a strong link between sexual assault and gynecological problems (Campbell et al., 2002; Leserman, Drossman, Li, Toomey, Nachman, & Glogau, 1996; Golding, 1996). Campbell and colleagues (2002), for example, found that among women who had been sexually assaulted (regardless of experiences of physical assault), 30% reported experiencing three or more gynecological problems compared to only 6-8% of those who were either physically assaulted or did not experience assault. Women who have been raped (sexual assault involving penetration) are also susceptible to sexually transmitted diseases (e.g., gonorrhea, chlamydia, syphilis, and hepatitis B; Goodman, Koss, & Russo, 1993; Koss & Heslet, 1992).

Sexual assault-related health problems are not limited to gynecological problems. Across studies, sexual assault has been linked to lower self-perceptions of health and greater self-reported symptomatology across the body (Campbell, 2002; Campbell et al., 2002; Coker et al., 2002; Golding, 1994; Golding 1999a; Golding, Cooper, & George,

1997; Goodman et al., 1993; Koss et al., 1992; Koss, Heise, & Russo, 1994; Koss et al., 1991; Kimerling et al., 1994; Leserman et al., 1996). Survivors of sexual assault have reported experiencing a range of chronic stress-related health problems (e.g., high blood pressure, abdominal pain, digestive/gastrointestinal problems, chronic pain) and central nervous system health problems (e.g., headaches, fainting, back pain; Campbell et al., 2002; Golding et al., 1997). Examining a multitude of physical health problems is therefore important when understanding health correlates of sexual assault.

The association between sexual assault and general physical health problems has been well established in the literature; however, most studies are limited to cross-sectional and retrospective data. Little is known about the longitudinal progression of physical health problems proximately following sexual assault to inform health prevention and intervention efforts. Additionally, though sexual assault has been linked with negative physical health outcomes (e.g., Campbell et al., 2002; Coker et al., 2002; Golding 1994), not all women who have been sexually assaulted report physical health consequences. If sexual assault alone does not always directly lead to physical health consequences, then what factors contribute to health problems? To better understand the link between sexual assault and physical health it is necessary to explore reports of physical health symptoms over time while testing potential mechanisms that may contribute to physical health risk.

Posttrauma Appraisals and Physical Health

Posttrauma appraisals – perception of one's own thoughts, feelings, and behaviors following a traumatic event – may be important to consider when examining physical health outcomes of sexual assault. Studies have demonstrated a significant link between

posttrauma appraisals and mental health outcomes, including PTSD, depression, and dissociation (DePrince, Chu, & Pineda, 2011; DePrince, Zurbriggen, Chu, & Smart, 2010; Ehlers & Clark, 2000; Foa, Ehlers, Clark, Tolin, & Orsillo, 1999; Halligan, Michael, Clark, & Ehlers, 2003; Martin, Cromer, DePrince, & Freyd, 2013). For example, following interpersonal trauma, links have been documented between appraisals of fear, alienation, shame, and posttraumatic stress symptoms; appraisals of shame and self-blame and depression symptoms; and appraisals of betrayal and dissociation symptoms (Andrews, Brewin, Rose, & Kirk, 2000; DePrince et al., 2011; DePrince, Huntjens, Dorahy, 2015). While the existing literature supports the link between posttrauma appraisals and mental health outcomes, little is known about the relationship between posttrauma appraisals and physical health following sexual assault. Given the research on the impact of psychological processes to physical health, posttrauma appraisals seem like a plausible factor that should be further examined.

The current study therefore seeks to address this gap in the literature by applying theory and empirical studies from the broader trauma literature to understanding physical health sequelae of sexual assault. In particular, emotional processing theory and psychoneuroimmunology (PNI) point to cognition as a potential pathway by which sexual assault may cause negative health outcomes. Emotional processing theory (Foa & Kozak, 1986; Rauch & Foa, 2006), originally used to explain the development and maintenance of Posttraumatic Stress Disorder (PTSD) symptoms following trauma exposure, can be used to help explain the link between trauma exposure and physical health consequences. Following sexual assault, victims may develop cognitive distortions about the self and the world (e.g., the world is completely unsafe), which may influence

how they interpret and respond to their environment. A person who views the world as completely unsafe, for example, may experience hyper-aroused physiological responses that, in turn, impact physical health over time. The ways in which survivors perceive their traumatic experiences has been shown to significantly contribute to health outcomes beyond objective factors of severity (e.g., perpetrator's degree of force, physical injuries, presence of a weapon; Weaver & Clum, 1995).

PNI, which is the study of the interrelations between psychological processes and the nervous and immune systems (Cohen & Herbert, 1996), is another useful framework for understanding the relationship between sexual assault, cognitive processes, and subsequent physical health problems. For over two decades, the literature on PNI has demonstrated that the way people think and feel following trauma has a measurable effect on the immune system (for review see Kendall-Tackett, 2009). Understanding how a person responds to sexual assault is, therefore, important for understanding later physical health. For example, a woman who perceives her sexual assault with appraisals of fear may experience changes in physiological response (e.g., increased stress response system; suppressed immune functioning). Over time, these physiological changes may result in greater physical health problems relative to a woman who does not perceive her sexual assault as such.

Additionally, although less studied, there seems to be a reciprocal interaction between cognition and health, such that physical health may also influence cognitive processes. Human and non-human animal studies have shown that physical activity (and thus physiological processes) impacts cognitions (for review see Hillman, Erickson, & Kramer, 2008). In a study on depression and physical illness, as an example, Aneshensel

and colleagues (Aneshensel, Frerichs, & Huba, 1984) found a reciprocal relationship between depression and physical illness over a one-year period. Although there are no studies to date that have tested the reciprocal relationship between posttrauma appraisals related to sexual assault and physical health, understanding physical health trajectories following sexual assault may be useful to better understand the ways in which survivors cognitively respond to and perceive sexual assault. For example, a woman who experiences significant physical health problems following sexual assault may perceive the assault differently – with greater anger, shame, or self-blame, for example – compared to someone who does not experience physical health problems following sexual assault.

The current study adds to the existing literature on trauma and physical health by testing a reciprocal relationship between physical health problems and posttrauma appraisals over time among a sample of women who experienced recent sexual assault. Findings from the current study may inform the next level of research on health outcomes of sexual assault by testing whether posttrauma appraisals related to sexual assault are associated with changes in the course of physical health problems. Additionally, findings will demonstrate whether physical health problems contribute to changes in posttrauma appraisals related to sexual assault over time.

Previous Research Linking Trauma and Physical Health

Researchers have examined mechanisms associated with physical health in the context of an expansive range of traumatic experiences (e.g., childhood abuse, intimate partner abuse, combat, motor vehicle accidents). Specifically, researchers have tested if trauma-related characteristics, psychopathological factors, and social factors contribute to

the link between trauma exposure and physical health. In regard to trauma-related characteristics, both the number and type of trauma experienced have been associated with physical health outcomes. Exposure to multiple traumatic events increases risk of experiencing physical health conditions, including cardiovascular disease, hypertension, gastrointestinal disease, diabetes, arthritis, and obesity, relative to individuals who have experienced only one trauma or no trauma (Arias, 2004; Husarewycz, El-Gabalawy, Logsetty, & Sareen, 2014; Kendall-Tackett, 2002; Moeller, Bachmann, Moeller, 1993). Stein and Barrett-Connor (2000) observed a dose-response effect in a study with older adults, such that individuals who experienced more than one sexual assault were at an increased risk for health-related problems relative to individuals who had experienced a single episode of assault. Survivors of multiple sexual assaults are also more likely to rate their health as poor (Golding et al., 1997). As individuals who experience sexual assault are at an increased risk of being victimized again (Classen, Palesh, & Aggarwal, 2005), revictimization may be important to test as a contributor to physical health outcomes following sexual assault.

The type of trauma experienced has also been linked to physical health outcomes. Injurious traumas (e.g., physical assault, sexual assault), psychological traumas, and witnessing traumas are associated with physical health problems relative to other forms of trauma (e.g., combat-related trauma; Husarewycz et al., 2014). Additionally, the perceived severity of the trauma has been associated with physical health outcomes. Experiencing rape and life-threatening physical abuse, for example, has been linked with worse health effects relative to sexual assault involving attempts or non-life-threatening assault (Leserman et al., 1996). Abuse perpetrated by a close other is also related to a

greater number of physical health problems relative to abuse perpetrated by either an acquaintance or stranger (Freyd, Klest, & Allard, 2005; Goldsmith, Freyd, & DePrince, 2012). These findings demonstrate that the severity of the trauma (e.g., rape versus attempted rape) and the victim-offender relationship may also be important to consider when testing factors that may influence physical health after sexual assault.

PTSD, a common correlate of sexual assault (Ullman & Filipas, 2011), has been significantly associated with perceptions of health and self-reported physical health problems following trauma exposure (Dobie et al., 2004; Kendall-Tackett, 2002; Schnurr 2015; Wagner, Wolfe, Rotnitsky, Proctor, & Erickson, 2000). Schnurr and colleagues proposed a model in which PTSD mediated the relationship between trauma and physical health (Schnurr & Green, 2004; Schnurr, Green, & Kaltman, 2007), although findings varied across different types of trauma exposure and populations. One study found that posttraumatic symptoms mediated the relationship between victims' responses to the trauma (i.e., perceptions of life threat, distress) and physical health outcomes; however, posttraumatic symptoms did not moderate the relationship between characteristics of the trauma (i.e., number of traumas, type of traumas, age at first trauma; Irish et al., 2013). Additionally, in a primary care setting, PTSD mediated the relationship between trauma (physical, sexual, psychological) and health for men, but not for women (Norman et al., 2006). Taken together, the literature demonstrates an association between PTSD and physical health; however, the mixed findings regarding PTSD suggest that other factors, beyond PTSD, contribute to physical health outcomes for women.

Social support has also been associated with physical health (for review see Berkman, Glass, Brisette, & Seeman, 2000; Uchino, 2009). In general, individuals with

low social support are more vulnerable to illness and distress when experiencing increased stress relative to individuals with greater social support (DeLongis, Folkman, & Lazarus, 1988). In the context of interpersonal violence (including sexual assault), social support from family, friends, and intimate partners has been shown to facilitate survivors' recovery. Positive social support is related to lower symptomatology, whereas a lack of social support has been linked to increased distress (Thompson et al., 2000). The literature indicates that social support is associated with better functioning of the cardiovascular, endocrine, and immune systems, as well as lower rates of mortality (for review see Uchino, Cacioppo, & Kiecolt-Glaser, 1996). Additionally, social support has been shown to influence health-promoting behaviors (e.g., physical activity, dietary habits, tobacco and alcohol consumption) impacting physical health outcomes. Based on the established connection between social support and physical health in the broader literature, social support appears to be an important factor to test as a contributor to physical health outcomes following sexual assault.

The Current Study

The existing literature suggests that the relationship between sexual assault and poorer health is complex, and further indicates that experiencing sexual assault is not solely responsible for an increased risk in physical health problems. To date, no available studies (of which we are aware) test the relationship between posttrauma appraisals and physical health following sexual assault. Addressing this gap, the current study tested the longitudinal relationship between physical health problems and posttrauma appraisals using cross-lagged panel modeling (see Figure 1 for the hypothesized model).

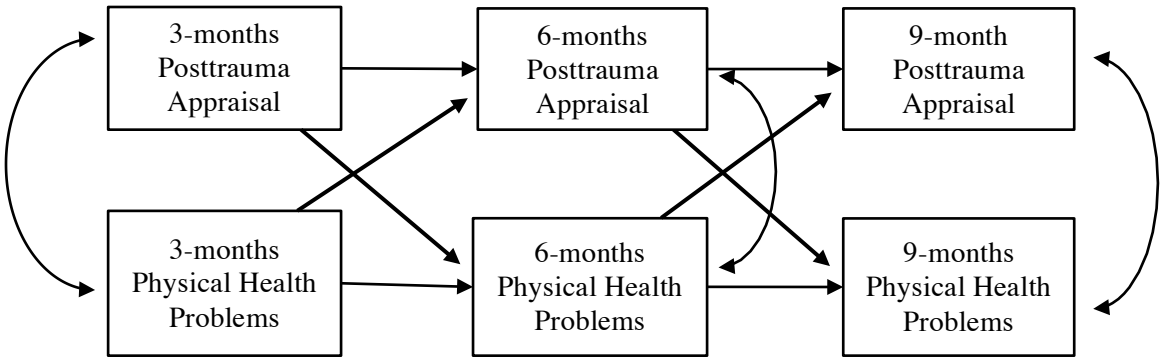

Figure 1. Hypothesized cross-lagged panel model of posttrauma appraisals and physical health problems.

The current study examined the course of a wide variety of physical health problems, ranging from symptoms and complaints to more serious health problems. Additionally, this study examined six different posttrauma appraisals related to sexual assault (betrayal, shame, self-blame, anger, alienation, and fear). Each posttrauma appraisal was tested separately with physical health problems to inform the temporal relationship between each posttrauma appraisal and the quantity of physical health problems women experienced. It was hypothesized that there would be a reciprocal relationship between posttrauma appraisals and physical health problems, such that each posttrauma appraisal would be predictive of change in the number of physical health problems over time, and that the number of physical health problems would be predictive of change in each posttrauma appraisal over time. No a priori predictions about differences between specific posttrauma appraisals were made.

A secondary aim of the current study was to understand whether factors that have been associated with trauma exposure and physical health in the broader literature influenced the strength of the relationship between posttrauma appraisals and physical health problems. Namely, the current study tested whether revictimization, PTSD, and

social support moderated the relationship between posttrauma appraisals and physical health problems following sexual assault. Given the connection between these factors and physical health following trauma, it was predicted that revictimization, PTSD, and social support would influence the relationship between posttrauma appraisals and physical health over time. Results of the moderation models would help inform under what conditions posttrauma appraisals predict physical health problems and vice versa.

Statistical Method. The current study implemented a three-wave cross-lagged panel model approach to explicitly test the longitudinal relationship between posttrauma appraisals and physical health problems across time. This longitudinal analytic approach allowed for testing of the causal ordering between posttrauma appraisals and physical health problems by providing an estimate of the lagged effect of each variable on the other. The cross-lagged regression coefficients provided information regarding how much variation in posttrauma appraisals at Time 2, for example, predicted change in the number of physical health problems between Time 2 and Time 3 (Berrington, Smith, & Sturgis, 2006; Selig & Little, 2012). A positive, significant cross-lagged regression coefficient running in both directions between posttrauma appraisals and physical health problems would demonstrate a reciprocal relationship, in which both posttrauma appraisals and physical health problems exert a causal influence on the other over time. The cross-lagged panel models also measured the temporal stability, or autoregression, of each construct over time while controlling for the other lagged antecedents (Kearney, in press). For example, the model measured whether the number of physical health problems at Time 2 predicted the number of physical health problems at Time 3. The models also assessed synchronous correlations, which measured the relationship between

each construct at the same time point (e.g., posttrauma appraisals at Time 2 and physical health problems at Time 2).

CHAPTER TWO: METHODOLOGY

Participants

Recruited as part of a larger longitudinal study ($N = 228$) on understanding social reactions of different actors following disclosure of sexual assault (DePrince, Dimitrieva, Gagnon, & Srinivas, 2017), the sample of the current study used data from 156 adult women, ages 18-62 ($M = 34.2$, $SD = 11.8$). For the larger study, participants were enrolled who identified as a woman, 18-years or older, proficient in English, experienced a sexual assault within the previous year, and disclosed the sexual assault incident to a formal support person, such as a community-based service provider (e.g., counselor, medical personnel) or criminal justice-based personnel (e.g., law enforcement). Specific to the current study, only participants from the larger study who answered questions regarding their physical health at the second interview were included[1].

The sample was diverse in regard to age, racial/ethnic backgrounds, sexual orientation, martial status, education level, work status, and perceived economic status. Participants described their racial/ethnic backgrounds as follows: 68% White/Caucasian,

[1] Participants who were included in the current study did not significantly differ from those who were excluded regarding sociodemographic and sexual assault characteristics. In regard to posttrauma appraisals, participants in the current sample endorsed significantly lower mean scores for fear at the second interview ($t(176) = 2.19$, $p < .05$) and betrayal at the third interview ($t(158) = 2.11$, $p < .05$) relative to the women who were excluded from the current study's sample.

20% Black/African American, 17% Hispanic/Latina, 6% American Indian/Alaskan Native, 3% Asian, 1% Pacific Islander, and 6% other (of note, women could identify with more than one racial/ethnic group). Eighteen percent of participants identified as lesbian, bisexual, asexual, or another sexual orientation identity. Just over half (52%) of participants in the sample reported being single and never married, 10% married, 8% living with someone with whom they are not married, 17% divorced, 7% separated, 3% widowed, and 3% other (e.g., common law, engaged). Participants in the study reported their highest level of education completed as follows: 10% some high school, 15% high school graduate, 50% some college, 19% associate's degree, and 5% four-year college degree. Forty six percent of participants reported being employed (full- or part-time), 42% were unemployed, 23% students (full- or part-time), and 14% some other form of work status (e.g., retired, homemaker, military, seasonal work; of note, women could endorse more than one category for work status). Women reported their perceived economic level as follows: 56% lower-income, 17% lower-middle income, 19% middle income, 6% upper-middle income, and 1% upper income.

Procedures

The study was approved by the University of Denver Institutional Review Board. Women were recruited to participate in a larger project by flyers circulated physically and electronically through community and system-based agencies. Women also heard about the study from other participants. Interested women contacted the research team and were asked three screener questions to assess for inclusion criteria: (1) Are you 18 years or older? (2) Have you experienced an unwanted sexual experience in the past year? (3) Did you disclose the sexual assault to a formal support person, such as a

counselor, medical provider, or law enforcement? Women were also provided with additional information about the study, including the type of questions that would be asked, voluntary nature of the project, length of the study, and financial compensation. Eligible and interested women were then scheduled for an in-person interview conducted by female doctoral students trained in clinical psychology, including the author, at a university research office.

Consent information was provided both verbally and in written form. A "consent quiz" was administered to ensure that all participants understood the consent information (e.g., the type of questions they will be asked, voluntary nature of the research project, confidentiality procedures). Only participants who were able to answer all consent quiz questions correctly by the second administration were enrolled in the study. No one failed the consent quiz at the first interview. Following consent procedures, participants responded to both written and verbally-administered questionnaires that were part of the larger study. Particular to the current study, participants were asked to respond to questions regarding sociodemographic characteristics, information about the sexual assault, posttrauma appraisals, perceived social support, and PTSD symptoms. Participants were compensated $50 for their time and provided either $10 to offset transportation costs or a cab fare. Childcare was also available if needed.

Participants were then invited to take part in three follow-up interviews: 3-months (Time 2), 6-months (Time 3), and 9-months (Time 4) later. Follow-up interviews were offered by phone for participants who could not come in for the interview at the research offices (e.g., moved out of state). At the beginning of each follow-up interview, interviewers reviewed the consent information from the first interview (e.g., voluntary

nature of the research project, confidentiality procedures), and re-administered the consent quiz to ensure participants' understanding of the consent information. No one failed the consent quiz at any of the follow-up interviews. Similar to the first interview, participants were then asked to respond to both written and verbally-administered questionnaires. Specifically, participants were asked about experiences of revictimization and posttrauma appraisals. Participants were compensated $55, $60, and $65 for Time 2, 3, and 4 interviews, respectively, as well as provided either $10 to offset transportation costs or a cab fare at the end of each interview.

Measures

Sociodemographic characteristics. Participants were asked to answer questions about demographic background at the first interview, including age, racial/ethnic identity, sexual orientation, marital status, education level, work status, and perceived economic status.

Sexual assault information. Information about the sexual assault that occurred within the previous year, including approximate date of the sexual assault, type of sexual victimization, and relationship to the offender, was captured using the Sexual Experiences Survey – Short Form Victimization (SES-SFV; Koss et al., 2006; 2007) at the first interview. SES-SFV is a widely used behavioral instrument that assesses victimization and perpetration of unwanted sexual experiences. The measure asks women if they have experienced a particular behavioral description of an unwanted sexual act, as well as how the offender(s) completed that act (e.g., continual verbal pressure, physical force, while under the influence of alcohol or drugs), and the relationship to the offender(s) (i.e., not close, some association, close association). If women experienced

and disclosed more than one sexual assault within the past year, women were asked to focus on the most recent sexual assault. The SES-SFV yields prevalence scores of sexual assault by category: sexual contact, attempted coercion, coercion, attempted rape, and rape. As experiencing rape has been linked with worse health outcomes (Leserman et al., 1996), a dichotomous variable was created, such that 1 indicated experiencing rape and 0 indicated experiencing sexual victimization other than rape (i.e., sexual contact, attempted sexual coercion, sexual coercion, and attempted rape) during the sexual assault. Using scoring from Goldberg and Freyd (2006), the relationship to the perpetrator was coded from 0 to 2, such that 0 indicated a not close relationship (e.g., stranger), 1 indicated some degree of association (e.g., acquaintance, casual dating partner), and 2 indicated a close relationship (e.g., partner). A variable for assault recency (i.e., approximate date of the sexual assault relative to the first interview) was also calculated by subtracting the approximate date of the sexual assault from the date of the first interview. At the second, third, and fourth interviews, women were re-administered the SES-SFV to assess for revictimization since the previous interview. The presence of revictimization since the previous time point was scored as present (1) and absent (0).

Posttrauma appraisals. The Trauma Appraisal Questionnaire (TAQ; DePrince et al., 2010) was used to assess posttrauma appraisals related to the sexual assault at all four interviews. The TAQ is a 54-item self-report measure that assesses six different posttrauma appraisals of emotions, beliefs, and behaviors related to traumatic experiences, including betrayal, anger, fear, alienation, shame, and self-blame. In the current study, participants were asked to think about current thoughts and feelings in relation to the sexual assault, using a five-point scale from 1 (*strongly disagree*) to 5

(*strongly agree*). Average scores were calculated for each of the six posttrauma appraisals at each of the four interviews. For the current study, average Cronbach's alphas for each appraisal across the four interview time points were as follows: betrayal = .83; anger = .89; fear = .90; alienation = .92; shame = .89; self-blame = .91.

Physical health problems. The quantity of physical health problems experienced was assessed at the second, third, and fourth interviews using the SMU Health Questionnaire (SMU-HQ; Watson & Pennebaker, 1989). The SMU-HQ assesses for the presence of physical health problems since the previous interview (i.e., past three months). The 63-items include a broad range of health problems from symptoms and complaints (e.g., abdominal or stomach pain, sore throat, headaches) to minor illnesses (e.g., cold/flu, appendicitis) and more serious and chronic health problems (e.g., hypertension, diabetes, cancer). Participants were asked if they have experienced any of the listed physical health problems (even those physical health problems that they are controlling with medication and/or treatment) since the last interview using a yes/no response.

Relevant for the current study's research questions, mental health disorders (i.e., depression, anorexia nervosa, bulimia), chronic illnesses (i.e., breast cancer, skin cancer, other cancer, benign tumor, multiple sclerosis, diabetes), as well as health-related issues that would not be considered a health problem (i.e., pregnancy) originally included in the SMU-HQ were excluded. Additionally, symptoms and illnesses endorsed with very low frequency (i.e., none or only endorsed by one participant) across all three follow-up interviews (i.e., paralysis, appendicitis, mononucleosis, broken bones) were also excluded

in the final analyses, leaving 43 symptoms, complaints, and minor illnesses. Physical health problems were summed for each of the three time points.

Posttraumatic stress disorder. PTSD symptoms at the first interview were measured using the Posttraumatic Diagnostic Scale (PDS; Foa, Cashman, Jaycox, & Perry, 1997). The PDS is a brief self-report measure that assesses for symptoms of PTSD within the past month, using a four-point Likert scale (0 = *not at all or only one time* to 3 = *5 or more times a week or almost always*). The PDS also assesses for duration of symptoms (i.e., less than a month, 1 to 3 months, more than 3 months) and if the symptoms have caused impairment in any areas of functioning (e.g., relationships with family/friends, household chores and duties, work). The PDS yields both a dichotomous PTSD diagnostic rating based on DSM-IV criteria and a continuous measure of PTSD symptom severity. For the purpose of the current study's analyses, a dichotomous score was used: 1 indicated meeting DSM-IV diagnostic criteria for PTSD, and 0 indicated not meeting diagnostic criteria. To meet diagnostic criteria, participants had to endorse a rating of one or higher of at least one re-experiencing symptom, three avoidance symptoms, and two arousal symptoms; experienced symptoms for at least one month; and reported impairment in at least one area of functioning. In the current study, Cronbach's alpha for the PDS at the first interview was .87.

Perceived social support. The Interpersonal Support Evaluation List (ISEL; Cohen & Hoberman, 1983) was used to assess perceived social support at the first interview. The ISEL is comprised of 40-items that assess perceptions of the availability of potential social resources. The measure includes both positive statements of social relationships as well as negative statements. Participants were asked to answer how true

or false each statement is for them, using a 4-point scale: 0, definitely false; 1, probably false; 2, probably true; 3, definitely true. Certain items were reverse scored, and then items were summed to create a total score for social support. Higher scores equate to greater perceived social support. For the purpose of the current study's analyses, a dichotomous (high/low) variable was created by dividing participants into two groups using a median split: 1 indicated higher perceived social support (ISEL score of 33 or above) and 0 indicated lower perceived social support (ISEL score below 33). Cronbach's alpha for the ISEL was .86.

Data Analytic Approach

Two sets of bivariate correlations were performed using SPSS Statistics Software Version 24. The first set of bivariate correlations examined the cross-sectional relationship between posttrauma appraisals and physical health problems at Time 2, Time 3, and Time 4. The second set of bivariate correlations tested whether individual, sexual assault-related, psychopathological, and social factors were related to physical health problems. Listwise deletion was used for missing data for the bivariate correlations. A series of cross-lagged panel models with three waves were then employed to test the longitudinal relationship between posttrauma appraisals and physical health problems from Time 2 until Time 4. Time 1 variables were not included in the model as physical health was not measured at Time 1. Maximum likelihood (ML) estimation procedures were used to estimate the models. The study sample was restricted to only participants who provided data on the SMU-HQ at the second interview. Rates of missing data were low to moderate, with covariance coverage ranging from 67% to 99%. Goodness of fit of the models was assessed using a combination of the chi-square test of model fit, the root

mean square error of approximation (RMSEA), the comparative fit index (CFI), and the standardized root mean square residual (SRMR). Goodness of fit was indicated by a non-significant chi-square test, values greater than .90 for the CFI, less than .06 for the RMSEA, and less than .08 on the SRMR (Hu & Bentler, 1999; Kline, 2005).

After obtaining optimal model fit indices, the structural paths of each of the models were examined. Differences in chi-square indicators of model fit between unconstrained and constrained models were then observed to investigate whether structural paths varied by revictimization at Time 2, PTSD diagnosis at Time 1, and perceived social support at Time 1. For models in which the constrained and unconstrained were significantly different, specific paths of each model were scrutinized. All cross-lagged panel model analyses were performed using Mplus Version 5.0 (Muthén & Muthén, 2007).

CHAPTER THREE: RESULTS

Data Preparation

Prior to beginning analyses, variables in the dataset were examined to ensure that they had acceptable levels of skew and kurtosis. No violations were noted. Table 1 presents descriptive statistics, including means and standard deviations, for physical health problems and posttrauma appraisals by time point.

Table 1

Descriptive Statistics of Physical Health and Posttrauma Appraisals by Time Point

	Time 2	Time 3	Time 4
	M (SD)	*M (SD)*	*M (SD)*
Physical health problems	7.75 (5.70)	6.60 (5.12)	7.22 (6.11)
Betrayal	2.93 (0.99)	2.66 (1.07)	2.67 (1.09)
Anger	2.61 (1.13)	2.40 (1.00)	2.32 (0.95)
Fear	2.77 (0.82)	2.57 (0.93)	2.57 (0.92)
Alienation	3.16 (1.04)	2.97 (1.12)	2.93 (1.12)
Shame	2.91 (1.00)	2.65 (1.12)	2.57 (1.11)
Self-Blame	2.49 (1.02)	2.30 (1.04)	2.24 (1.05)

Sample Characteristics

Women were interviewed a median of 131 days (range: 5 – 457 days) following the sexual assault. The majority of women (79%) reported being raped. Just over a quarter (26%) of women reported that the perpetrator was someone who they felt close with, such as a dating partner, while 47% of women reported that they had some degree of association with the perpetrator (e.g., acquaintance), and 27% did not feel close to the

perpetrator (e.g., stranger). Thirty one percent of women reported experiencing another sexual assault between the first and second interview. Just over half of the sample (53%) endorsed symptoms meeting diagnostic criteria for PTSD at the first interview. Additionally, over half of the women in the sample (55%) reported having high levels of social support at the first interview.

Physical Health Problems

Women, on average, reported experiencing seven different physical health problems during the second, third, and fourth interviews (*SD* = 5.12 – 6.11). Figure 2 depicts physical health problems that were commonly endorsed by women at each of the three follow-up interviews. The most commonly endorsed physical health symptom across all three interviews was headaches (49.2% – 59.5%), followed by cold/flu (37.1% – 45.5%).

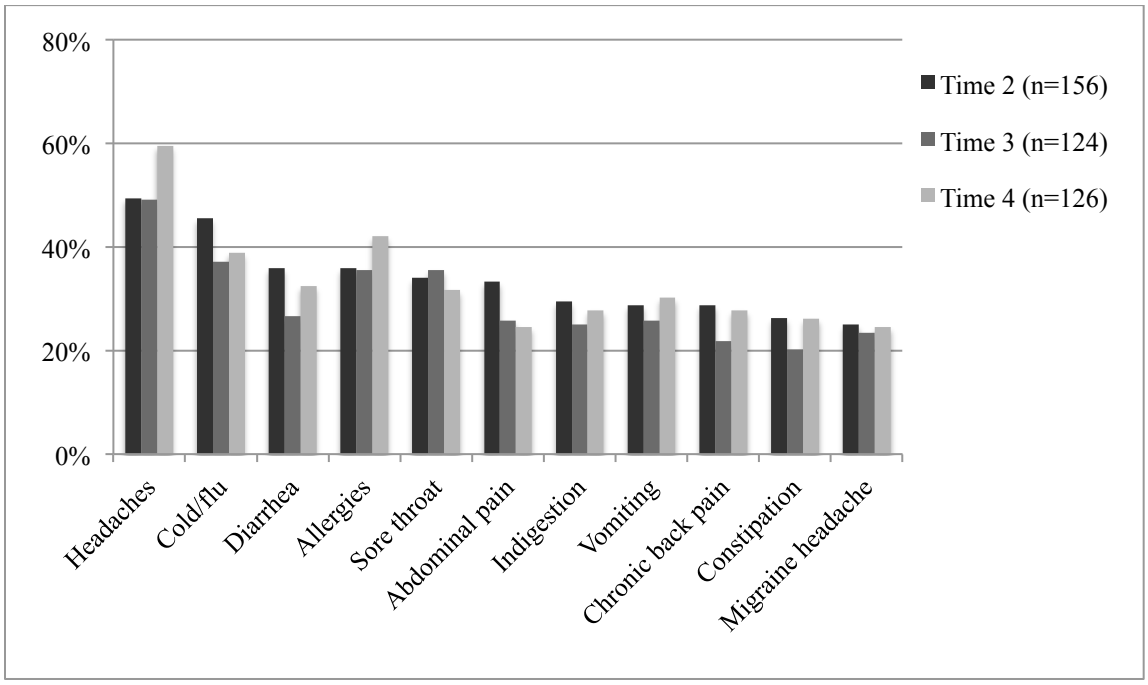

Figure 2. Frequency (%) of commonly endorsed physical health problems by time point.

Bivariate Correlations

Table 2 shows cross-sectional bivariate correlations between physical health problems and posttrauma appraisals for Time 2, Time 3, and Time 4 interviews separately. As shown in the table, all of the posttrauma appraisals, with the exception of alienation, were significantly, positively correlated with physical health problems at Time 2. At Time 3, all of the posttrauma appraisals were significantly, positively correlated with physical health problems. Only anger and shame were significantly, positively correlated with physical health problems at Time 4. For all time points, posttrauma appraisals were significantly, positively related to each other. Results of the bivariate correlations demonstrate that the relationship between posttrauma appraisals and physical health problems vary depending on the time point, and suggests that there is merit in testing the proposed cross-lagged panel models to examine this relationship over time.

Bivariate correlations were used to examine if other variables identified in past research were related to physical health problems, including individual/sociodemographic characteristics, sexual assault characteristics, revictimization, PTSD, and perceived social support. Table 3 displays results of bivariate correlations. As shown in the table, only the relationship to the offender, perceived social support measured at Time 1, and revictimization measured at Time 2 were significantly correlated with physical health problems measured at Time 2. Specifically, the relationship to the offender was significantly, negatively correlated with physical health problems, such that being sexually assaulted by an offender who was not close to the victim was related to greater physical health problems. Perceived social support was also significantly, negatively correlated with physical health problems, indicating that reporting greater social support

at Time 1 was associated with less physical health problems at Time 2. Additionally, revictimization was significantly, positively correlated with physical health problems, suggesting that experiencing another sexual assault between Time 1 and Time 2 was significantly related to greater physical health problems at Time 2. All other variables were not significantly correlated with physical health problems.

Table 2

Bivariate Correlations of Physical Health Problems and Posttrauma Appraisals by Time Point

	Physical health	Betrayal	Self-blame	Fear	Alienation	Anger
			Time 2 (n = 155)			
Physical health	--					
Betrayal	.23**	--				
Self-blame	.22**	.48**	--			
Fear	.20*	.64**	.64**	--		
Alienation	.13	.59**	.67**	.73**	--	
Anger	.20*	.55**	.42**	.61**	.53**	--
Shame	.23**	.65**	.70**	.77**	.74**	.56**
			Time 3 (n = 121)			
Physical health	--					
Betrayal	.29**	--				
Self-blame	.18**	.45**	--			
Fear	.21**	.63**	.65**	--		
Alienation	.22**	.62**	.68**	.81**	--	
Anger	.24**	.56**	.44**	.67**	.61**	--
Shame	.25**	.60**	.75**	.77**	.79**	.61**
			Time 4 (n = 118)			
Physical health	--					
Betrayal	.11	--				
Self-blame	.10	.42**	--			
Fear	.13	.57**	.61**	--		
Alienation	.16	.59**	.69**	.77**	--	
Anger	.21**	.53**	.51**	.68**	.65**	--
Shame	.18*	.56**	.75**	.77**	.77**	.66**

Note. *p < .05; **p < .01.

Table 3

Bivariate Correlations Between Physical Health Problems and Individual, Sexual Assault, Psychopathological, and Social Characteristics

Variable	1	2	3	4	5	6	7	8	9	10
1. Age	--									
2. Ethnic/racial minority status	.20*	--								
3. Perceived economic level	.38**	.26**	--							
4. Education	-.16*	-.24*	-.19*	--						
5. Timing of sexual assault	-.00	.13	.09	.06	--					
6. Relationship to the offender	.05	.09	.11	-.02	.04	--				
7. Rape	-.14	-.01	-.07	.12	.07	.08	--			
8. Perceived social support	-.12	-.12	-.23**	.25**	.02	-.05	-.05	--		
9. PTSD diagnosis	-.01	.03	.07	-.00	.29**	.16	.15	-.14	--	
10. Revictimization	.11	-.06	.13	-.18*	.18*	.08	.16	-.17	.21*	--
11. Physical health	.12	-.10	.13	-.08	-.03	.16*	.10	-.18*	.09	.27**

Note. Age, ethnic/racial minority status (0=no, 1=yes), economic level, education, timing of SA, relationship to the offender, rape (0=no, 1=yes), social support, and PTSD (0=no, 1=yes) were measured at Time 1. Revictimization (0=no, 1=yes) and physical health were measured at Time 2.
*$p < .05$; **$p < .01$.

Cross-lagged Panel Models

Cross-lagged panel models were created to examine the hypothesized reciprocal relationship between posttrauma appraisals and physical health problems. The initial models provided an adequate fit to the data, betrayal: X^2 (4) = 40.33, $p < .01$, CFI = 0.90, RMSEA = 0.24 (90% CI = 0.18 – 0.31), SRMR = 0.06; anger: X^2 (4) = 37.38, $p < .01$, CFI = 0.91, RMSEA = 0.23 (90% CI = 0.17 – 0.30), SRMR = 0.05; fear: X^2 (4) = 37.47, $p < .01$, CFI = 0.91, RMSEA = 0.23 (90% CI = 0.17 – 0.30), SRMR = 0.05; alienation: X^2 (4) = 43.78, $p < .01$, CFI = 0.89, RMSEA = 0.25 (90% CI = 0.19 – 0.32), SRMR = 0.07; shame: X^2 (4) = 40.89, $p < .01$, CFI = 0.90, RMSEA = 0.24 (90% CI = 0.18 – 0.31), SRMR = 0.06; and self-blame: X^2 (4) = 49.22, $p = .49$, CFI = 0.90, RMSEA = 0.27 (90% CI = 0.21 – 0.34), SRMR = 0.06. Two minor modifications were then made based on empirical considerations to account for correlating error variance between physical health problems at Time 2 and physical health problems at Time 4, as well as posttrauma appraisals at Time 2 and posttrauma appraisals at Time 4. The modified models represented a good fit to the data, betrayal: X^2 (2) = 0.06, $p = .97$, CFI = 1.00, RMSEA = 0.00 (90% CI = 0.00 – 0.00), SRMR = 0.00; anger: X^2 (2) = 0.36, $p = .83$, CFI = 1.00, RMSEA = 0.00 (90% CI = 0.00 – 0.09), SRMR = 0.01; fear: X^2 (2) = 0.46, $p = .79$, CFI = 1.00, RMSEA = 0.00 (90% CI = 0.00 – 0.10), SRMR = 0.01; alienation: X^2 (2) = 0.26, $p = .88$, CFI = 1.00, RMSEA = 0.00 (90% CI = 0.00 – 0.08), SRMR = 0.01; shame: X^2 (2) = 1.72, $p = .42$, CFI = 1.00, RMSEA = 0.00 (90% CI = 0.00 – 0.15), SRMR = 0.02; and self-blame: X^2 (2) = 1.41, $p = .49$, CFI = 1.00, RMSEA = 0.00 (90% CI = 0.00 – 0.14), SRMR = 0.01. Given the study's focus of understanding the temporal relationship

between physical health problems and posttrauma appraisals, no covariates were added to the models.

See Table 4 for unstandardized path estimates of each final cross-lagged panel model by appraisal, and see Figures 3-8 for all standardized path estimates of the full models of betrayal, anger, fear, alienation, shame, and self-blame, respectively. The cross-lagged panel models revealed that physical health problems at Time 2 were a significant predictor of appraisals of anger and alienation at Time 3. The positive cross-lagged regression coefficients indicated that greater physical health problems at the second interview were predictive of women perceiving their sexual assault with greater appraisals of anger and alienation at the third interview. Posttrauma appraisals of anger and alienation did not significantly reciprocally predict physical health problems, demonstrating a causal effect of physical health on appraisals of anger and alienation three months later. No other cross-lagged relationships between posttrauma appraisals and physical health problems were significant.

For all of the cross-lagged panel models, each of the posttrauma appraisals at Time 2 were significantly, positively correlated with physical health problems at Time 2. In the shame and physical health model, shame at Time 3 and physical health problems at Time 3 were significantly, positively correlated with each other. In the self-blame and physical health model, self-blame at Time 4 was significantly, negatively related to physical health problems. No other posttrauma appraisals were correlated with physical health problems at the third and fourth interviews.

Table 4

Cross-lagged Path Estimates by Posttrauma Appraisals

	Unstandardized Beta					
Path	Betrayal	Anger	Fear	Alienation	Shame	Self-Blame
T2 Appraisal → T3 Appraisal	0.79**	0.74**	0.85**	0.80**	0.74**	0.84**
T3 Appraisal → T4 Appraisal	0.64**	0.67**	0.66**	0.58**	0.62**	0.52**
T2 Health → T3 Health	0.57**	0.57**	0.59**	0.59**	0.59**	0.58**
T3 Health → T4 Health	0.36**	0.38**	0.36**	0.34**	0.34**	0.35**
T2 Appraisal → T3 Health	0.62	0.71^	0.14	-0.05	0.02	0.31
T3 Appraisal → T4 Health	0.68	0.55	0.36	0.25	0.53	0.62
T2 Health → T3 Appraisal	0.02	0.02*	0.01	0.03**	0.02	0.01
T3 Health → T4 Appraisal	-0.00	-0.00	0.00	0.01	-0.00	0.01
T2 Appraisals with T2 Health	1.29**	1.13*	0.93**	0.85^	1.32**	1.20**
T3 Appraisals with T3 Health	0.05	-0.17	0.03	0.36	0.55*	-0.09
T4 Appraisals with T4 Health	0.25	0.39	0.23	0.35	0.07	-0.81**
T2 Appraisals with T4 Appraisals	0.19*	0.13	0.09	0.27*	0.25*	0.34**
T2 Health with T4 Health	15.99**	15.62**	16.64**	17.05**	16.27**	16.94**

Note. See Figures 2-7 for standardized beta estimates. Health = physical health symptoms. Appraisal = posttrauma appraisal.

^ $p < .06$, * $p < .05$, ** $p < .01$

The cross-lagged panel models also demonstrated that all of the posttrauma appraisals were significant predictors of future posttrauma appraisals, such that each of the appraisals at Time 2 significantly predicted appraisals at Time 3, and appraisals at Time 3 significantly predicted appraisals at Time 4. A similar pattern was found for physical health problems across all models, in which physical health problems at Time 2 significantly predicted physical health problems at Time 3, and physical health problems at Time 3 predicted Time 4 symptoms. Correlations between posttrauma appraisals at Time 2 and Time 4 were significant (with the exception of appraisals of fear and anger), as well as correlations between physical health problems at Time 2 and Time 4.

Moderation Models

To test if revictimization, PTSD, and perceived social support moderated the relationship between posttrauma appraisals and physical health problems within the context of the larger cross-lagged panel models, multigroup analyses were conducted (see Table 5 for chi-square difference test results for each model). The chi-square difference tests for revictimization at Time 2 were significant at the .05 level for appraisals of betrayal, fear, alienation, and self-blame, and non-significant for appraisals of anger and shame. This indicated that the overall models for appraisals of betrayal, fear, alienation, and self-blame with physical health problems differed based on whether women experienced another sexual assault between the first and second interview. The chi-square difference tests for PTSD across all posttrauma appraisals were non-significant at the .05 level, indicating that the overall models for each posttrauma appraisal and physical health problems did not significantly differ based on PTSD diagnosis. The chi-square difference tests for social support were significant at the .05 level for appraisals of alienation and

self-blame, and non-significant for appraisals of betrayal, anger, fear, and shame. Results demonstrate that for appraisals of alienation and self-blame, the overall cross-lagged models with physical health problems significantly differed between women who reported higher perceived social support at Time 1 relative to women who reported lower perceived social support.

Table 5

Chi-square Difference Tests for Potential Moderators of Posttrauma Appraisals and Physical Health Problems

Model	X^2 difference test (df = 13)		
	Revictimization	PTSD Diagnosis	Perceived Social Support
Betrayal	22.62*	16.32	19.92
Anger	19.23	14.10	14.37
Fear	25.48*	19.49	16.82
Alienation	39.05*	21.57	23.31*
Shame	21.15	18.22	18.08
Self-blame	26.60*	14.40	29.41*

Note. PTSD diagnosis and perceived social support measured at Time 1. Revictimization measured at Time 2.
*$p < .05$.

For the models that were significant, individual paths were then examined to test whether paths differed based on either revictimization or perceived social support. Chi-square difference tests were conducted for individual paths within each model by comparing models with a single path constrained to a model with all paths freely estimated. For revictimization, two single paths emerged as significantly different for appraisals of alienation and one path for appraisals of fear. The path of physical health problems at Time 2 predicting appraisals of alienation at Time 3 was significantly different (X^2 (1) = 18.16, $p < .05$), such that there was a significant direct effect of

physical health problems at Time 2 on appraisals of alienation at Time 3 for women who were not revictimized at Time 2 (β = 0.09, p < .001), but no direct effect for women who were revictimized at Time 2 (β = -0.01, p = .38). The path of physical health problems at Time 3 predicting appraisals of alienation at Time 4 was also significantly different (X^2 (1) = 7.71, p < .05), such that for women who were revictimized at Time 2, physical health problems at Time 3 predicted appraisals of alienation at Time 4 (β = -0.04, p < .05). There was not, however, a significant direct effect for women who were not revictimized (β = 0.04, p = .07).

The path of physical health problems at Time 2 predicting appraisals of fear at Time 3 was significantly different, (X^2 (1) = 8.91, p < .05). Specifically, there was a significant direct effect of physical health problems at Time 2 on appraisals of fear at Time 3 for women who were not revictimized (β = 0.05, p < .001), but no significant direct effect for women who were revictimized (β = -0.02, p = .29). No other paths were moderated by revictimization. See Figures 9 and 10 for full cross-lagged panel models for appraisals of alienation and physical health problems and appraisals of fear and physical health problems, respectively, in which only paths that were significantly moderated by revictimization status were freely estimated and all other paths were constrained. Both final moderated models for appraisals of alienation and appraisals of fear with physical health problems represented a good fit of the data: X^2 (15) = 17.23, p = .31, CFI = 0.99, RMSEA = 0.05 (90% CI = 0.00 – 0.13), SRMR = 0.10; X^2 (16) = 16.78, p = .40, CFI = 0.99, RMSEA = 0.03 (90% CI = 0.00 – 0.12), SRMR = 0.10, respectively.

In regard to perceived social support, the path of physical health problems at Time 2 predicting appraisals of self-blame at Time 3 was significantly different (X^2 (1) = 4.73,

$p < .05$). Specifically, there was a significant direct effect of physical health problems at Time 2 on appraisals of self-blame at Time 3 for women who reported greater perceived social support ($\beta = 0.04$, $p < .01$). There was no significant direct effect for this path for women who reported less perceived social support ($\beta = -0.01$, $p = .68$). No other single paths were moderated by perceived social support. The final moderated model, however, represented a poor fit of the data, X^2 (16) = 31.10, $p = .01$, CFI = 0.97, RMSEA = 0.11 (90% CI = 0.49 – 0.17), SRMR = 0.11, and therefore, the above significant moderated path finding between physical health and appraisals of self-blame does not adequately represent the data in the context of the larger model.

CHAPTER FOUR: DISCUSSION

The present study examined physical health and posttrauma appraisals following recent sexual assault. Women reported an average of seven different kinds of physical health problems following sexual assault, persisting across three measurement periods (3, 6, and 9 months after the baseline interview). Physical health problems ranged from symptoms and minor illnesses to more severe health problems. Headaches were the most commonly endorsed physical health problem, which is consistent with previous research assessing physical health after sexual assault (Golding, 1999b). Women also commonly endorsed cold/flu, sore throat, diarrhea, abdominal pain, and allergies across the six-month time period. Combined with the existing literature on physical health following sexual assault, the current findings reinforce the importance of assessing for a broad range of physical health problems following sexual assault. The findings also highlight the importance of assessing for physical health problems over time following sexual assault, and not just immediately after the assault.

Longitudinal Relationship between Physical Health and Appraisals

Physical health symptoms at the second interview predicted greater anger and alienation at the third interview, but not other posttrauma appraisals (i.e., fear, shame, self-blame, betrayal). This pattern suggests that physical health problems have a unique, direct effect on anger and alienation. There may be several reasons that physical health

problems increase alienation and anger specifically. People who suffer from consistent physical health concerns and pain report experiences of isolation and alienation from others and their own bodies (Goldberg, 2012). Physical health problems may have an impact on women's quality of life and ability to engage in activities following sexual assault, which may contribute to feelings of isolation. Pain associated with physical health problems may also cause women to feel (or even desire to feel) disconnected from their own bodies; people who experience persistent pain often avoid and restrict awareness of their body (McCracken, Gauntlett-Gilbert, & Vowles, 2007). Anger has also been associated with physical health problems and pain (e.g., Karsikaya, Kavakci, Kugu, & Guler, 2013; Kerns, Rosenberg, & Jacobs, 1994). Greater physical health problems may reinforce the unfairness of the assault and its consequences, increasing anger. Women could also believe that they are not getting the necessary supports to manage their physical health following the assault, resulting in them feeling greater anger towards those who are not supporting them as well as isolation from others. Most of the literature connecting alienation and anger with physical health, however, frames appraisals and emotions as contributing to health outcomes, rather than physical health predicting appraisals as illustrated in the current findings. For example, general feelings of anger are thought to contribute to poorer health (Miller, Smith, Turner, Guijarro, & Hallet, 1996). Using a diathesis-stress model framework (e.g., Banks & Kerns, 1996), the pattern of the results suggest that the additive burden of physical health problems following sexual assault causes alterations in survivors' perceptions of anger and alienation related to the assault.

Cross-sectional analyses showed that women's sexual assault appraisals were significantly associated with physical health problems at each time point. All posttrauma appraisals were correlated with physical health problems at the second interview, indicating that women who perceive their assault with greater negative appraisals (i.e., betrayal, fear, anger, alienation, shame, self-blame) also report greater physical health concerns following recent sexual assault. Although posttrauma appraisals were not predictive of changes in physical health problems over time, there still appears to be same-time relationships between appraisals and physical health problems that should continue to be considered.

Shame and self-blame were also related to physical health problems at later interviews, suggesting that the relationship between different appraisals and physical health following sexual assault may vary across time. Women who reported greater shame also reported experiencing more physical health problems at the third interview. Shame and negative perception of the self have been associated with changes in physiological processes and health in the broader literature (Dickerson, Gruenewald, & Kemeny, 2004), although pathways by which shame and health are related are unknown. It could be that women who feel shame regarding their assault may be less likely to seek medical services due to embarrassment of the assault and, as a result, experience more physical health problems. Elevated feelings of shame may also be associated with women engaging in health risk behaviors (e.g., substance use) following sexual assault, which impacts their physical health.

Women who reported greater self-blame at the fourth interview also reported less physical health problems. This negative relationship between later self-blame and

physical health at the last interview is notable, and contradicts the existing literature postulating that self-blame is associated with poorer health (e.g., Dickerson et al., 2004). One possible explanation for the negative association between self-blame and physical health found in the current study is that survivors who carry a lot of self-blame for a longer period of time following sexual assault also feel a sense of responsibility to take care of themselves. In turn, survivors may engage in health promoting behaviors, improving physical health outcomes. Women who blame themselves for the sexual assault could also be less in tune with their bodies, and therefore, not acknowledge that they have physical health problems.

Other Factors Related to Physical Health and Appraisals

Trauma-related and social factors were also associated with physical health and posttrauma appraisals. Experiencing another sexual assault was related to physical health, such that women who reported being revictimized also reported greater physical health problems at the second interview. Differences in the relationship between physical health problems and posttrauma appraisals were also found based on whether women were revictimized. Physical health problems at the second interview predicted greater alienation and fear at the third interview for women who were not revictimized, but not for women who were revictimized. One possible explanation for physical health problems not predicting changes in appraisals of fear and alienation for women who have recently been revictimized is that the cumulative impact of multiple sexual assaults soon after each other may more strongly predict changes in posttrauma appraisals. Experiencing more than one trauma has been linked with worse physical (e.g., Golding et al., 1997; Stein et al., 2000) and psychological (e.g., Balsam, Lehavot, & Beadnell, 2011)

outcomes. Sexual revictimization is also linked with factors that may better account for changes in posttrauma appraisals compared to physical health. Women who have been revictimized, for example, endorse greater dissociation relative to their singly assaulted counterparts (DePrince, 2005; DePrince, Gagnon, Srinivas, & Wright, 2018), and dissociation is related to appraisals (DePrince et al., 2011). Physical health problems may, therefore, not account for unique variance in changes of posttrauma appraisals for women who have experienced another sexual assault soon after the initial assault. Interestingly, for the sample of women who were not revictimized, physical health predicted appraisals of fear; a pattern that was not found in the models including the full sample. For these women, experiencing physical health problems soon after sexual assault may cause them to feel more vulnerable and, therefore, afraid that they may be assaulted again. Women may also attribute their ongoing physical health challenges to the sexual assault, causing them to experience greater fear related to the assault.

Revictimization also moderated the relationship between physical health and appraisals of alienation at later time points. Physical health problems at the third interview predicted lower appraisals of alienation at the fourth interview for women who were revictimized between the first and second interview, but not for women who were not revictimized. It could be that women who experience another sexual assault and endure more physical health problems three months afterwards are likely to seek medical services and support, resulting in them feeling less isolated. The pattern of the results also suggests that revictimization impacts the relationship between posttrauma appraisals and physical health problems differently over time. For example, being revictimized only influenced the relationship between physical health problems and alienation at the third

and fourth interviews, whereas being revictimized did not impact the relationship between physical health problems and alienation at the second and third interviews. Revictimization did not moderate any other relationships between posttrauma appraisals and physical health problems, suggesting that revictimization may only influence the relationship between physical health problems and changes in alienation and fear.

Social support was also related to physical health. Women with high levels of social support at the first interview reported experiencing less physical health problems at the second interview. A strong support network can minimize the stress related to sexual assault, increase engagement in health promoting behaviors, and help survivors access the needed services to mitigate negative changes to health (Wallston, Alagna, DeVellis, & DeVellis, 1983). Additionally, level of social support impacted the relationship between physical health and later posttrauma appraisals. For women with high levels of social support, physical health problems at the second interview predicted more self-blame at the third interview, but not for women with low levels of social support. Despite having a high level of social support, survivors who experience greater physical health problems following sexual assault may elicit negative reactions from their support network, causing survivors to blame themselves for the sexual assault. The literature on social reactions to disclosures of sexual assault indicates that negative reactions from informal supports (e.g., family, friends) reinforce feelings of self-blame (Aherns, 2006). Unfortunately, the full model of physical health problems and appraisals of self-blame was not a good fit of the data, and so the above conclusions should be interpreted with caution. Social support did not moderate any other relationships between physical health

and posttrauma appraisals. PTSD diagnosis did not account for any differences among the relationship between physical health and posttrauma appraisals.

The victim-offender relationship was also related to physical health. Women reported greater health problems at the second interview when the offender was someone not relationally close to them. One possible explanation for this finding is that sexual assaults by non-close perpetrators are oftentimes more sudden and violent, causing women to experience greater fear of impending harm and hypervigilance to danger (Ellis, 1983). Greater fear and hypervigilance may then be related to worse physical health outcomes. Indeed, greater fear has been linked with stranger assaults relative to assaults perpetrated by known others (Ullman & Siegel, 1993), and fear has been linked to physical health problems (Pavert, Sunderland, Luijten, Slade, & Teesson, 2017). Interestingly, the betrayal trauma literature shows a different pattern between the victim-offender relationship and physical health, such that traumas perpetrated by a close other are related to worse physical health outcomes compared to trauma perpetrated by someone not close or trauma of a non-interpersonal nature (e.g., natural disaster; Freyd et al., 2005; Goldsmith et al., 2012). Differences in findings may be due in part to the samples studied as well as the type of traumas assessed. The betrayal trauma literature has looked at the victim-offender relationship and health within a broad range of traumatic experiences (e.g., interpersonal violence, natural disasters, motor vehicle accident) in both community and undergraduate samples with and without trauma histories, whereas the current study focused on a community sample of women whom all experienced sexual assault. Among survivors of sexual assault, the relationship between the victim-offender relationship and physical health trajectories may be influenced by

assault-related factors (e.g., type of sexual assault). Additional research is needed to further explore the relationship between the victim-offender relationship and physical health in the context of sexual assault.

Limitations

Limitations of the current study should be considered. This study tested a model examining the cross-lagged relationship between six different posttrauma appraisals and physical health problems following sexual assault. To answer the novel questions of the current study, multiple statistical tests were employed to examine the relationship between physical health and each posttrauma appraisal separately, which may raise concern for type I error. As this was the first study to explore a reciprocal longitudinal relationship between physical health and posttrauma appraisals following sexual assault, the intention of the current study was to determine the next steps of research. Adjustments to the *p*-values were not made in an attempt to reduce the risk of type II error. With that in mind, findings reported above could be false positives, and further research is needed to replicate the patterns found between physical health and posttrauma appraisals.

The aim of the larger study from which these data were drawn was to examine social reactions upon disclosure of sexual assault to formal supports, including law enforcement, medical personnel, and mental health professionals, as well as informal supports (e.g., family, friends). As physical health was not a primary aim of the larger project, physical health problems were not measured until the second interview. The current study, therefore, lacks information about women's physical health prior to and immediately following sexual assault. The longitudinal nature of the study does,

however, allow us to capture change in physical health problems over time. By using a cross-lagged panel model approach, information regarding how much variation in posttrauma appraisals, for example, is able to predict change in physical health problems between Time 2 and Time 3 is provided. Additionally, physical health was measured over three time points, with approximately three months in between each measurement. An assumption of cross-lagged panel models is that there is the appropriate amount of time between each measurement (not too short or not too long) to capture the effect between variables (Kearney, in press). The three-month interval between each time point may not have been the appropriate amount of time to capture a significant effect, especially in regard to physical health problems.

Additionally, the models showed sizable autoregressive coefficients for posttrauma appraisals between all three-time points, as well as for physical health problems between the second and third interviews. Autoregressive coefficients indicate the amount of stability of a construct over time, and larger autoregressive coefficients suggest more stability and little variance over time (Kearney, in press). The stability of the constructs over time may have impacted the ability to detect a relationship between posttrauma appraisals and physical health problems, as was detected in the initial analyses. For example, if physical health problems at Time 2 account for a significant portion of the variance for physical health problems at Time 3, then there is little unique variance left over to be accounted for by posttrauma appraisals. Measuring physical health prior to and soon after the sexual assault, as well as measuring both physical health and posttrauma appraisals over a longer duration may predict different effects across time and is an important area of further investigation.

The current study used a subjective measure of physical health to initially examine the temporal relationship of physical health and posttrauma appraisals following sexual assault. The SMU-HQ provides a general screening measure of a wide range of physical health problems; however, the measure is limited in capturing women's objective health. Women in the current study endorsed a multitude of physical health problems following sexual assault, highlighting the importance of assessing a wide variety of physical health problems in survivors of sexual assault. It may also be interesting for future researchers to explore if certain posttrauma appraisals are linked with specific physiological responses and changes. Objective indicators of physical health may be helpful to answer future research questions specific to physiological processes, posttrauma appraisals, and sexual assault. For example, gastrointestinal problems could be associated with certain appraisals following sexual assault, while gynecological problems are related to other appraisals.

The limitations of the social support variable should also be considered. Social support did not moderate the relationship between physical health at Time 2 and appraisals of self-blame at Time 3; however, the full model was not a good fit of the data. Social support was also not a significant moderator for any other posttrauma appraisals and physical health. The lack of significant findings may have been an artifact of the way social support was measured in the current study. Unfortunately, the scoring for the ISEL does not have an established method for dichotomization, and so a median split was used in order to examine whether the level of perceived social support moderated the relationship between posttrauma appraisals and physical health problems. Dichotomization of the ISEL score using a median split may have resulted in loss of

reliability, loss of power, and/or misclassification of some individuals (MacCallum, Zhang, Preacher, & Rucker, 2002). Future studies are needed to assess the role of social support in the association between posttrauma appraisals and physical health problems in the context of sexual assault.

The larger study included a diverse sample of survivors of recent sexual assault; however, the sample is limited to only women who disclosed their sexual assault to service providers. Many women do not disclose their sexual assault or desire to talk about their experiences, particularly with service providers (Belknap, 2010; Tillman, Bryan-Davis, Smith, & Marks, 2010), and therefore, the findings of the current study may not generalize to the broader population of sexual assault survivors. Furthermore, the sample only comprised adults who identify as women. How the results of the current study extend to male and gender non-conforming adults is unknown. There may be different patterns of posttrauma appraisals and physical health problems among survivors who do not identify as women. Future research is needed to further understand the relationship between physical health and posttrauma appraisals among a broader population of sexual assault survivors. The current study did not measure previous experiences of victimization, including childhood history of trauma. Early childhood trauma has been associated with adverse physical health outcomes in adulthood (Felitti et al., 1998; Walker et al., 1999). Future studies should consider survivors' histories of victimization and how that may impact the course of physical health problems and posttrauma appraisals following recent sexual assault.

Implications and Future Directions

Despite these considerations, the results of the current study have meaningful implications for informing future research. Firstly, the findings of the current study confirm links between sexual assault and a broad range of physical health problems. Women endorsed a wide range of physical health problems across the six months of the study. Studies focused on understanding the consequences of sexual assault should consider assessing for a broad range of physical health problems, in addition to mental health problems, to more fully understand the extensive impact of sexual assault on survivors' well-being. The current study only tracked physical health over a span of six months. Future research examining health outcomes of sexual assault may benefit from longitudinal designs that examine physical health outcomes over a longer span of time.

The pattern of the findings also extends the existing literature on sexual assault outcomes by demonstrating that physical health is related to the women's perceptions of their sexual assault. The association between physical health and appraisals also appears to vary over time. Further longitudinal exploration is needed to better understand the relationship between physical health and posttrauma appraisals and confirm the patterns found in the current analyses. The current study also examined the relationship between physical health and each posttrauma appraisal separately. Future research may explore the cumulative impact of posttrauma appraisals on physical health. It could be that the cumulative impact of posttrauma appraisals, rather than the specific categories of appraisals, may better explain physical health outcomes.

Notably, the current findings revealed that physical health problems predicted changes in women's appraisals, rather than appraisals predicting changes in physical health. A large portion of studies examining the link between cognitive processes and

health has focused on how cognition impacts health. The pattern of the current study provides evidence for further research looking at how physical health may impact cognitive processes following sexual assault. The significant associations between physical health, posttrauma appraisals, trauma-related characteristics, and social factors also provide further evidence for using integrated frameworks, such as the biopsychosocial model that integrates biological, psychological, and social factors to disease outcomes (Engel, 1980), when understanding health sequelae of sexual assault. Not all survivors experience health problems following sexual assault, and it appears that there are many potential pathways by which sexual assault can impact cognitive and physiological processes.

The current study pointed to other factors that are important to consider when understanding the relationship between posttrauma appraisals and physical health following sexual assault. In particular, the findings emphasized the importance of acknowledging trauma-related factors, including revictimization and the victim-offender relationship, as well as social support when understanding physical health following sexual assault. There is also the possibility that unexamined variables that are associated with sexual assault may account for the relationship between physical health and posttrauma appraisals over time. The current study only examined PTSD as a potential moderator; however, depression is commonly experienced by survivors of sexual assault (Shalev et al, 1998) and has been linked with negative health outcomes (Goldsmith et al., 2012; Kendall-Tackett, 2002). Substance use may also be an important factor to consider, as survivors are likely to engage in substance use following sexual assault (Kilpatrick, Acierno, Resnick, Saunders, & Best, 1997), and substance use can impact physical health

(National Institute on Drug Abuse, 2017). Future researchers should consider examining the link between depression, substance use, posttrauma appraisals, and physical health problems in the context of sexual assault. Additionally, researchers may want to consider help-seeking behaviors and whether survivors who access medical care experience a different pattern between posttrauma appraisals and physical health compared to survivors who do not seek care to better inform medical service provision.

Conclusion

In summary, the current study advances our understanding of the link between sexual assault, physical health, and posttrauma appraisals and supports a relationship between physical health and posttrauma appraisals. A reciprocal model between posttrauma appraisals and physical health was, however, not supported in the current study. Instead, a causal effect of physical health on appraisals of alienation and anger was found. Additionally, physical health was found to predict certain appraisals when considering trauma-related and social factors. As the current study is the first (of which we are aware) to examine the longitudinal relationship between posttrauma appraisals and physical health soon after sexual assault, additional research is needed to further explore the dynamic relationship and address the questions raised from the current findings. Future research can help us understand other mechanisms that may be involved in the trajectory of physical health and posttrauma appraisals following sexual assault in order to more effectively facilitate service provision. The findings from the current study support the importance of assessing for a broad range of physical health concerns soon after assault. Assessment and subsequent treatment of physical health concerns can help

to alter women's appraisals of their assault and potentially mitigate the likelihood of women experiencing longer term health concerns following sexual assault.

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APPENDIX A:
CROSS-LAGGED PANEL MODELS

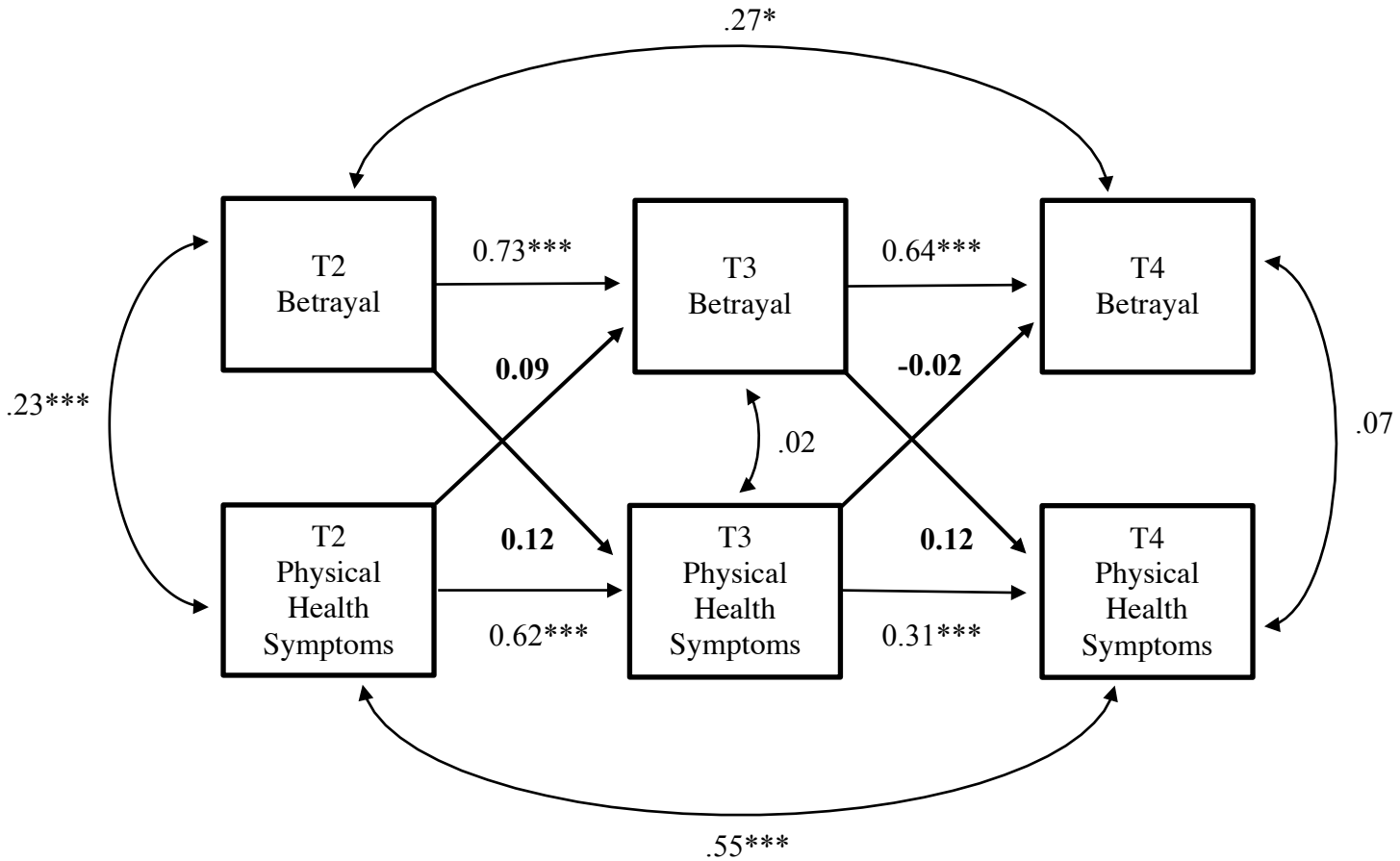

Figure 3. Cross-lagged panel model of betrayal and physical health symptoms. X^2 (2) = 0.06, p = .97, CFI = 1.00, RMSEA = 0.00 (90% CI = 0.00 – 0.00), SRMR = 0.00. Cross-lagged paths and coefficients are in boldface for clarity. * $p < .05$, ** $p < .01$, *** $p < .001$.

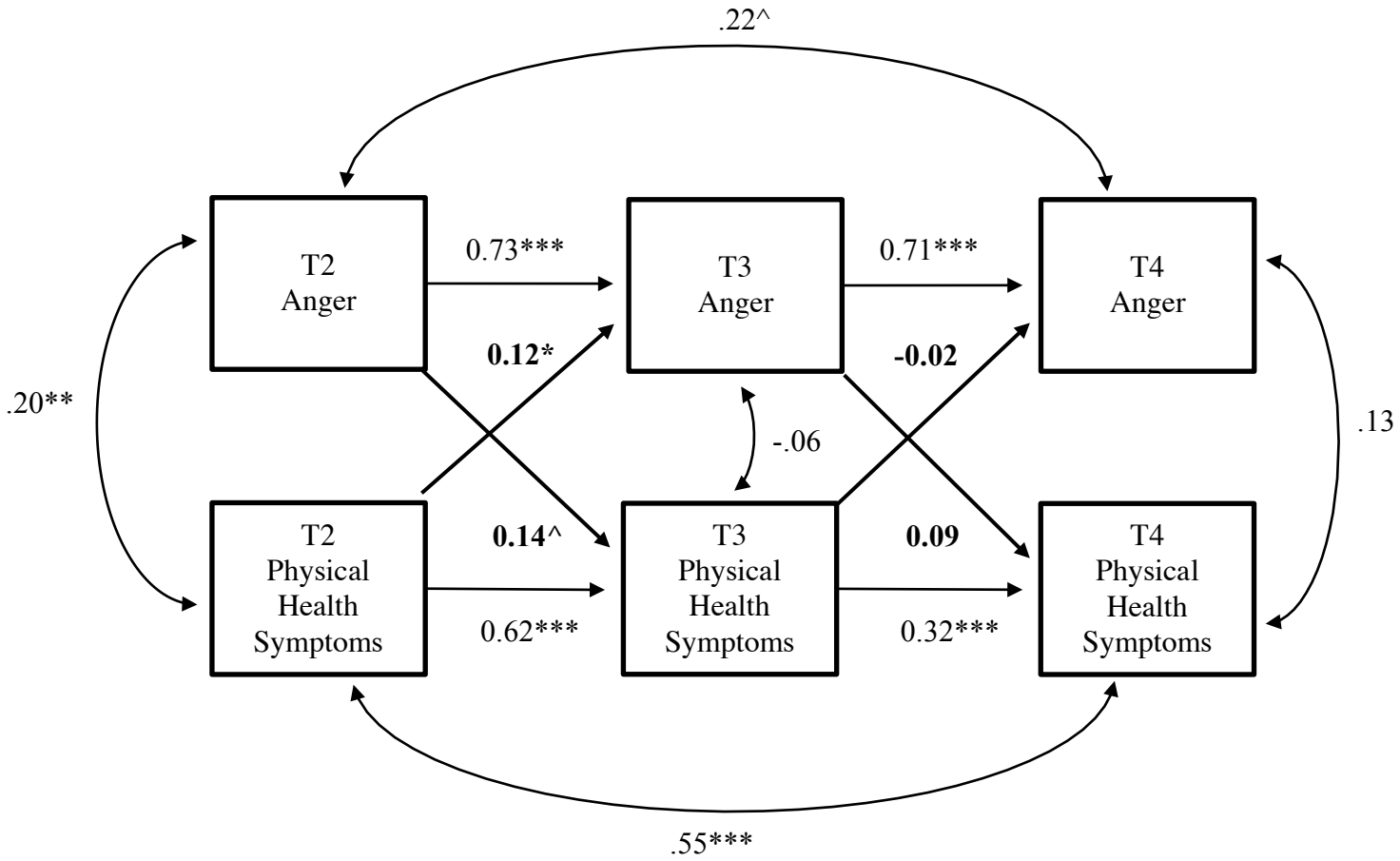

Figure 4. Cross-lagged panel model of anger and physical health symptoms. X^2 (2) = 0.36, p =.83, CFI = 1.00, RMSEA = 0.00 (90% CI = 0.00 – 0.09), SRMR = 0.01. Cross-lagged paths and coefficients are in boldface for clarity. ^ $p < .06$, * $p < .05$, ** $p < .01$, *** $p < .001$.

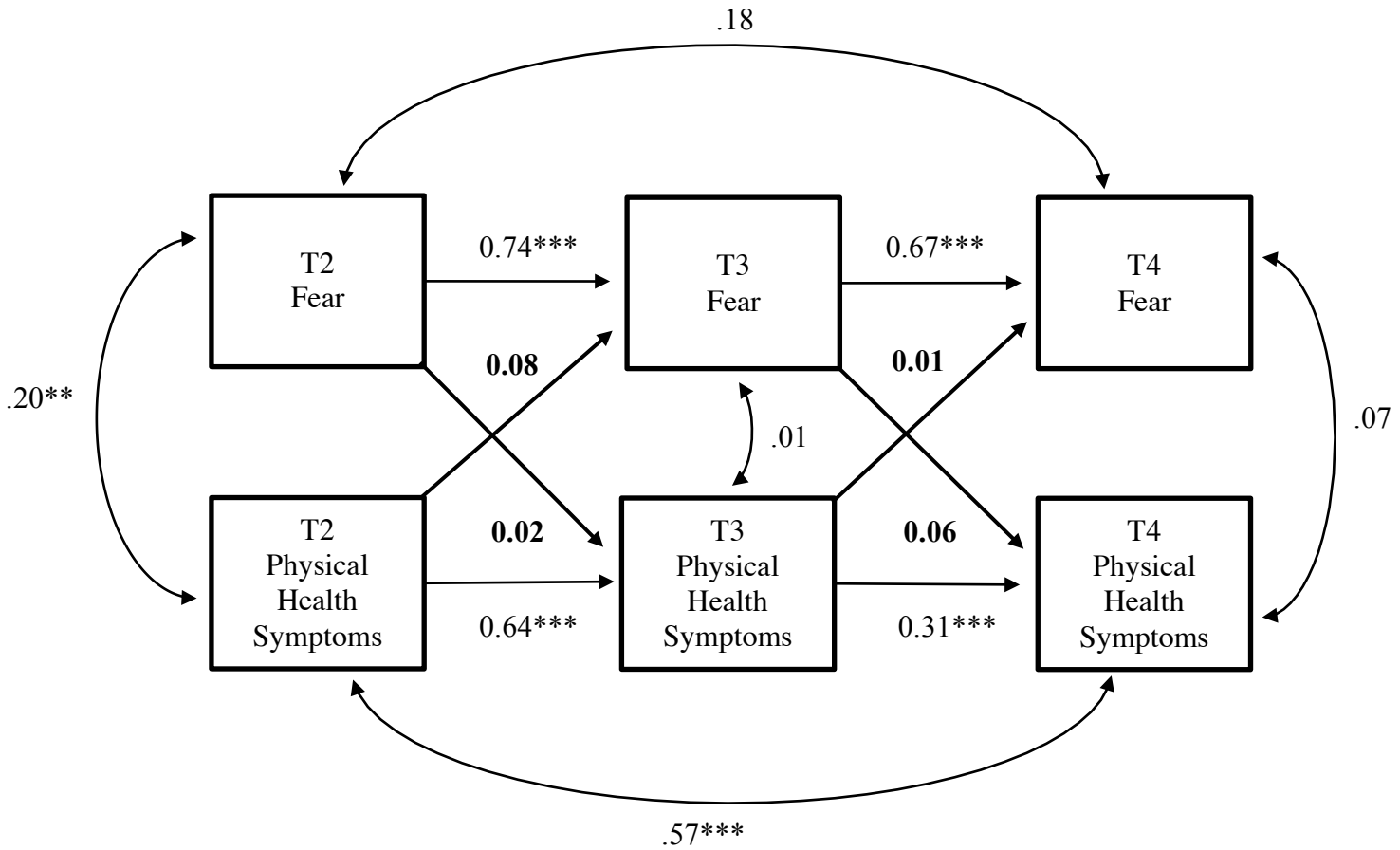

Figure 5. Cross-lagged panel model of fear and physical health symptoms. X^2 (2) = 0.47, p = .79, CFI = 1.00, RMSEA = 0.00 (90% CI = 0.00 – 0.10), SRMR = 0.01. Cross-lagged paths and coefficients are in boldface for clarity. * $p < .05$, ** $p < .01$, *** $p < .001$.

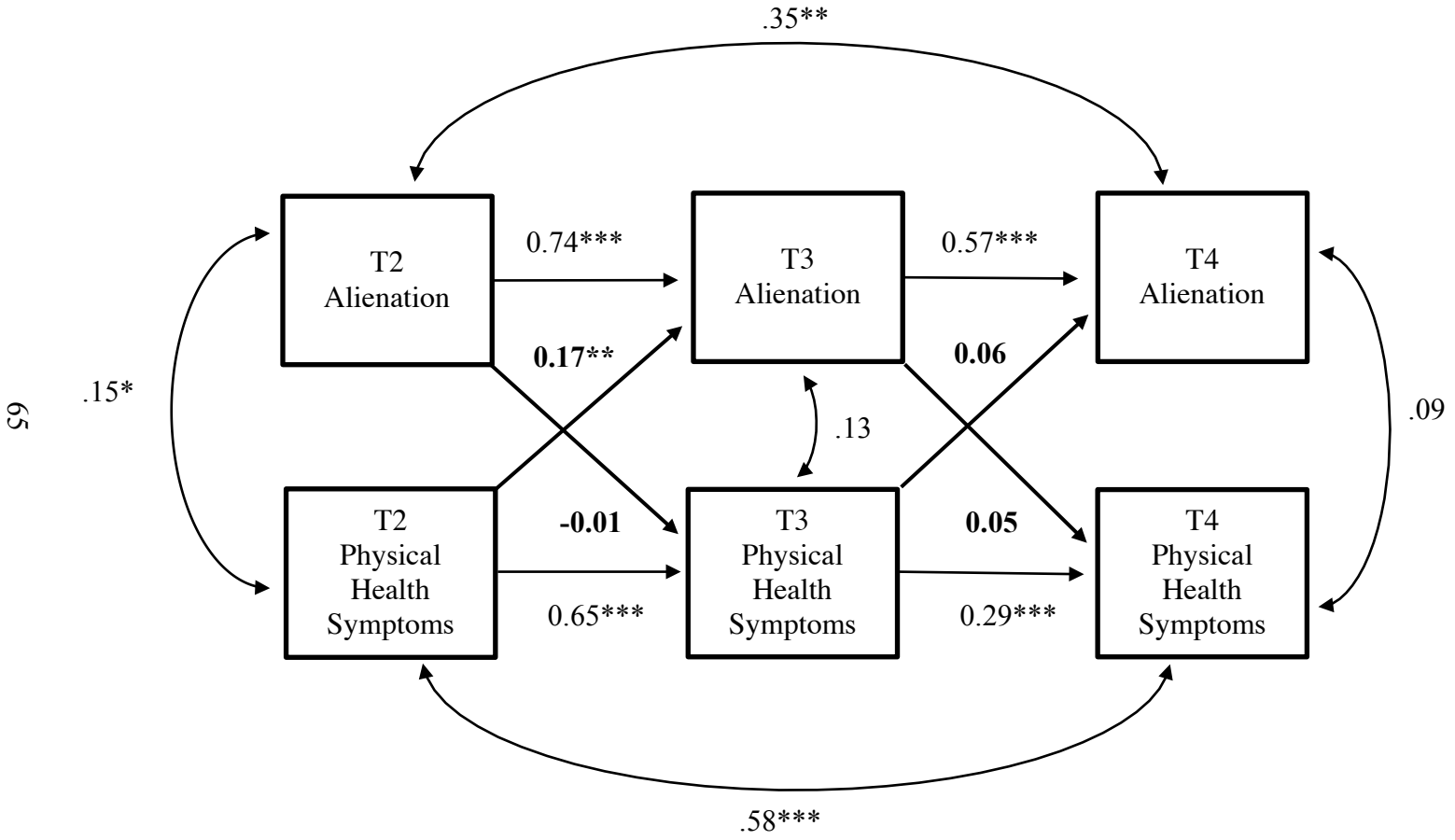

Figure 6. Cross-lagged panel model of alienation and physical health symptoms. X^2 (2) = 0.26, p =.88, CFI = 1.00, RMSEA = 0.00 (90% CI = 0.00 – 0.08), SRMR = 0.01. Cross-lagged paths and coefficients are in boldface for clarity. * $p < .05$, ** $p < .01$, *** $p < .001$.

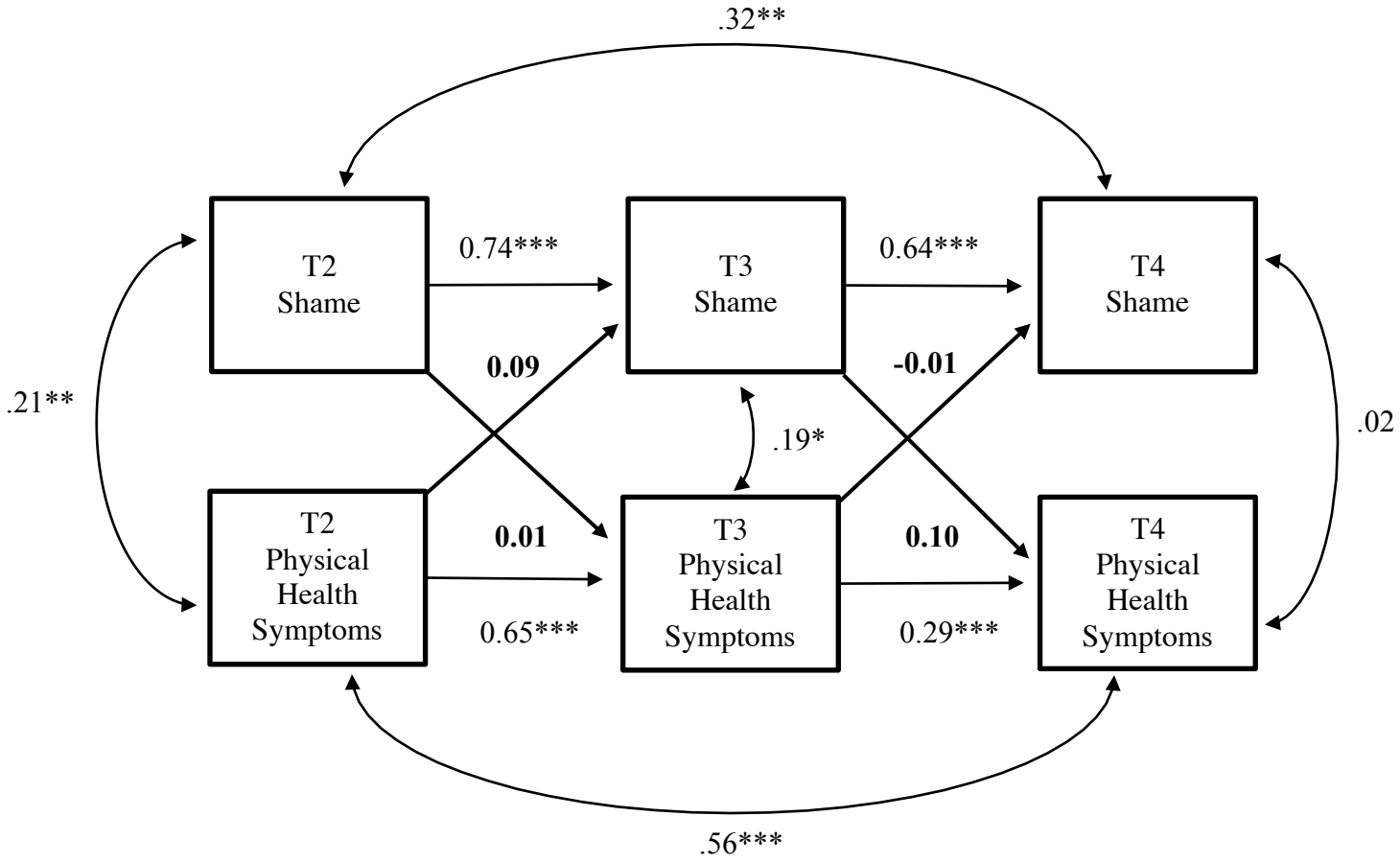

Figure 7. Cross-lagged panel model of shame and physical health symptoms. X^2 (2) = 1.72, p = .42, CFI = 1.00, RMSEA = 0.00 (90% CI = 0.00 – 0.15), SRMR = 0.02. Cross-lagged paths and coefficients are in boldface for clarity. * $p < .05$, ** $p < .01$, *** $p < .001$.

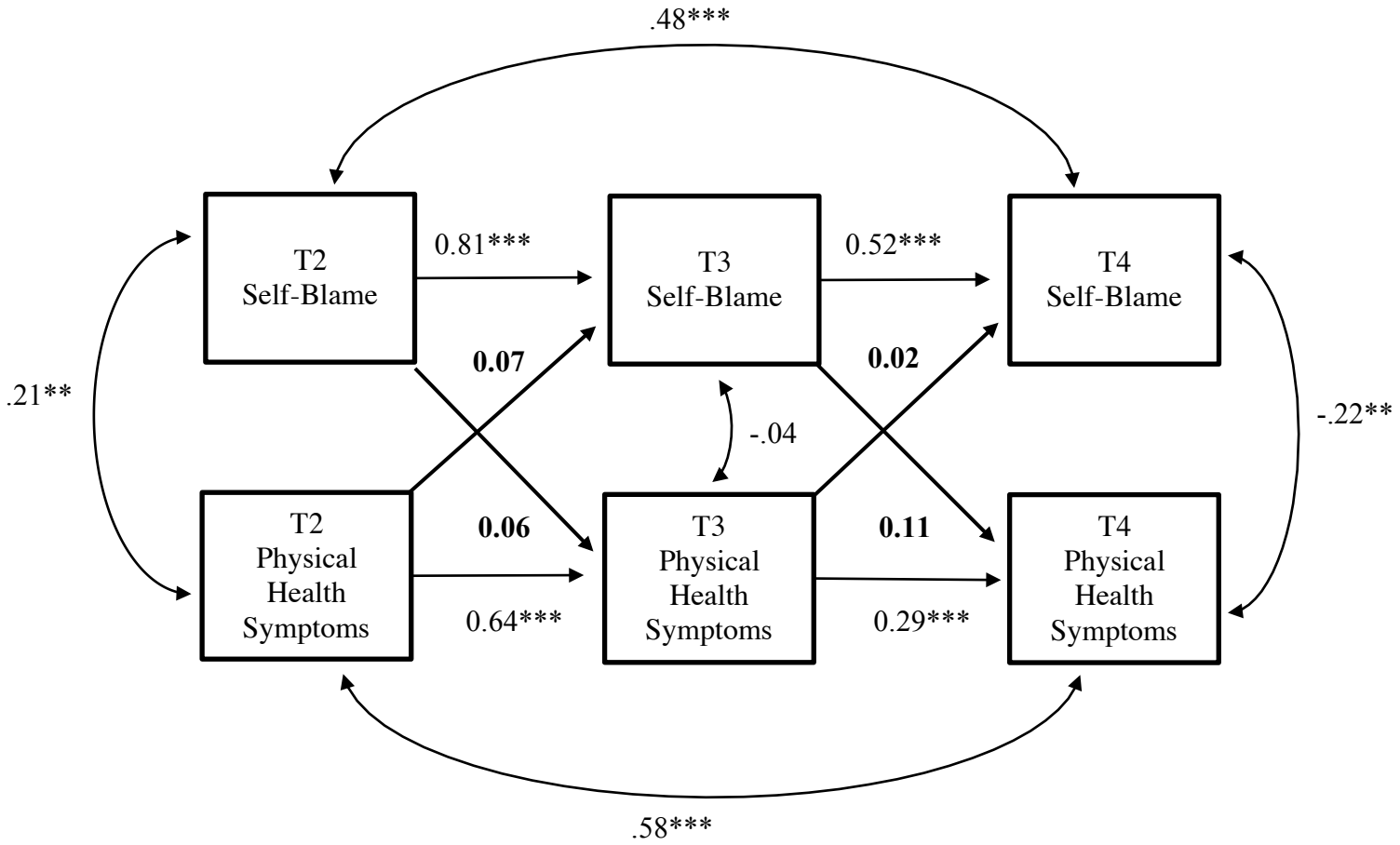

Figure 8. Cross-lagged panel model of self-blame and physical health symptoms. X^2 (2) = 1.41, p = .49, CFI = 1.00, RMSEA = 0.00 (90% CI = 0.00 – 0.14), SRMR = 0.01. Cross-lagged paths and coefficients are in boldface for clarity.

APPENDIX B:
CROSS-LAGGED PANEL MODERATION MODELS

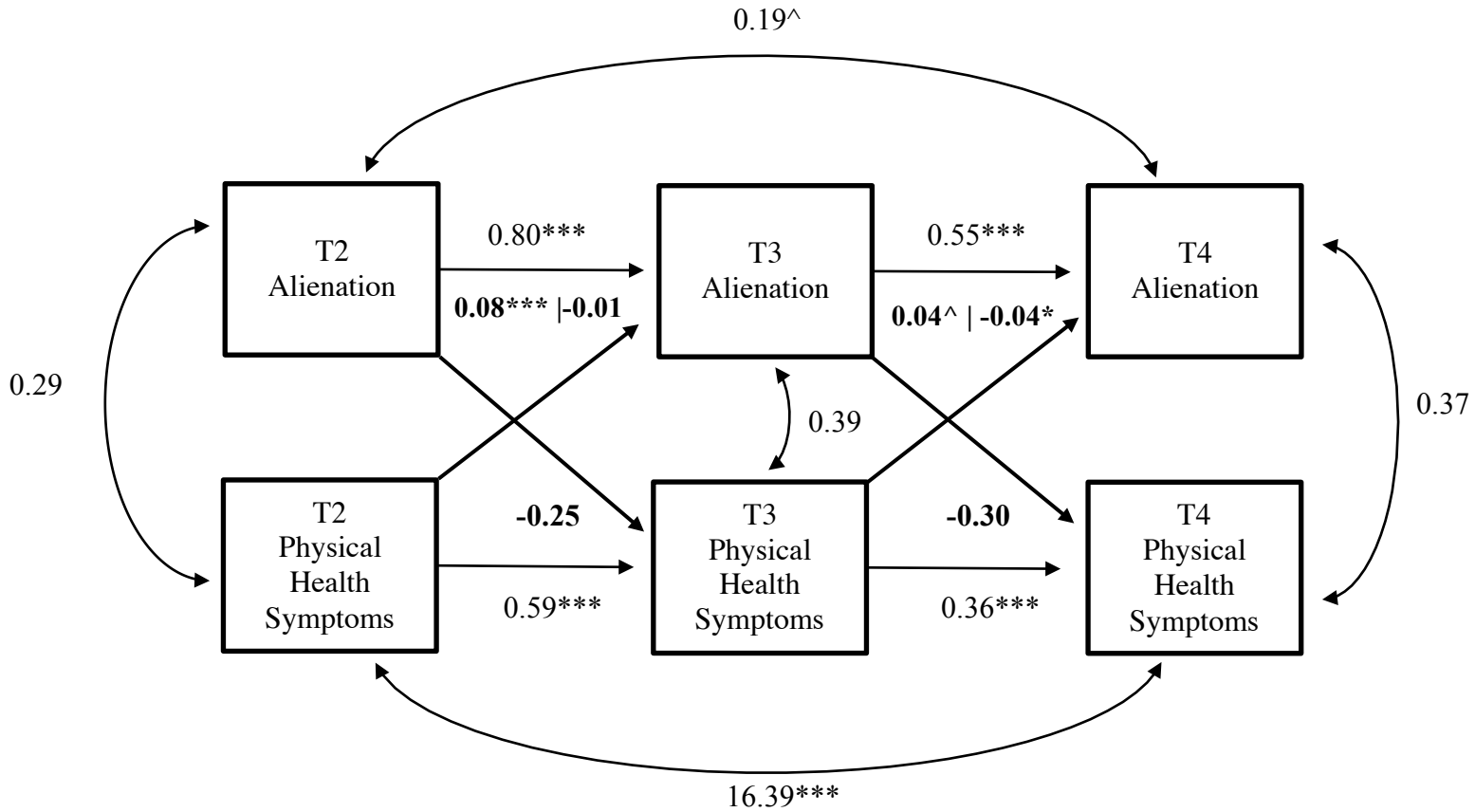

Figure 9. Cross-lagged panel model of alienation and physical health symptoms moderated by revictimization at time 2. X^2 (15) = 17.23, p = .31, CFI = 0.99, RMSEA = 0.05 (90% CI = 0.00 – 0.13), SRMR = 0.10. Unstandardized beta estimates reported. The coefficients correspond to **No Revictimization at Time 2 | Revictimization at Time 2**.
^ $p < .10$, * $p < .05$, ** $p < .01$, *** $p < .001$.

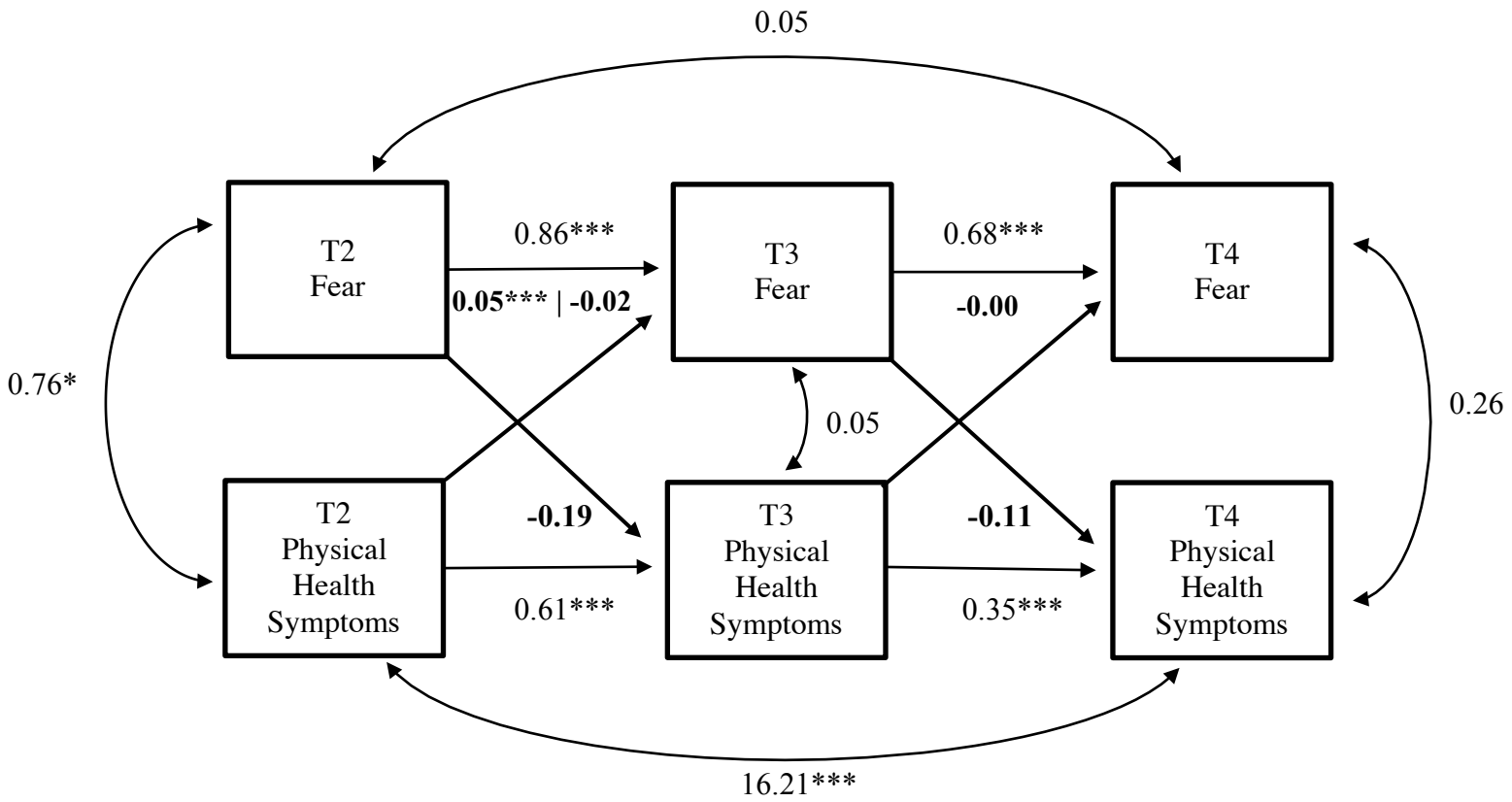

Figure 10. Cross-lagged panel model of fear and physical health symptoms by revictimization at time 2. X^2 (16) = 16.78, p = .40, CFI = 1.00, RMSEA = 0.03 (90% CI = 0.00 – 0.12), SRMR = 0.10. Unstandardized beta estimates reported. The coefficients correspond to **No Revictimization at Time 2 | Revictimization at Time 2.**
* $p < .05$, ** $p < .01$, *** $p < .001$.

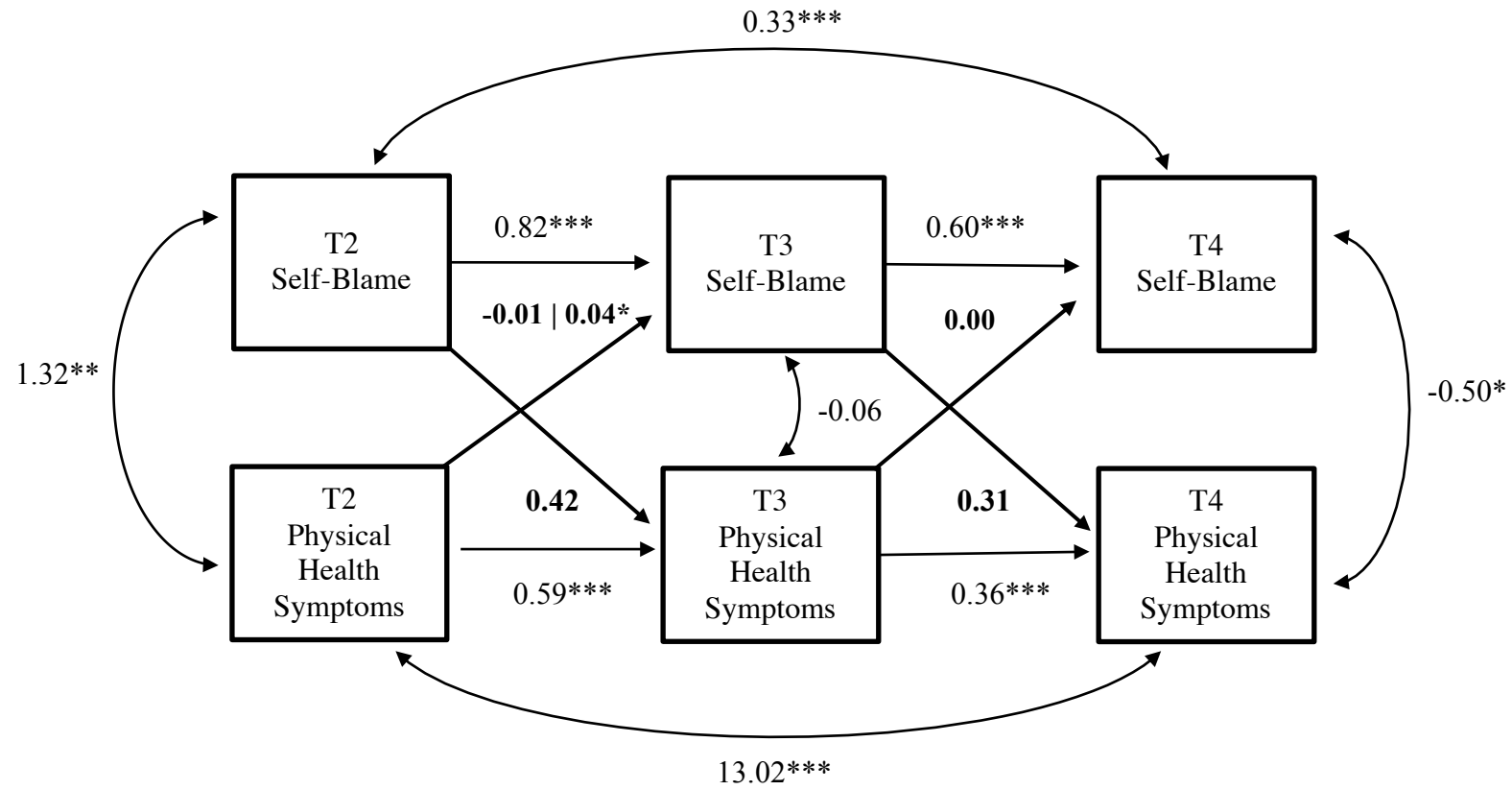

Figure 11. Cross-lagged panel model of self-blame and physical health symptoms moderated by social support at time 1. X^2 (16) = 31.10, p = .01, CFI = 0.97, RMSEA = 0.11 (90% CI = 0.05 – 0.17), SRMR = 0.11. Unstandardized beta estimates reported. The coefficients correspond to **low levels of social support | high levels of social support.**
* $p < .05$, ** $p < .01$, *** $p < .001$.