1-1-2012

Trauma in Transportation: Factors Contributing to Positive and Negative Outcomes of Involvement in Trauma for Railroad Workers

Jill Veronica Pinarowicz

University of Denver

Follow this and additional works at: https://digitalcommons.du.edu/etd

Part of the Counseling Psychology Commons, and the Experimental Analysis of Behavior Commons

Recommended Citation
Pinarowicz, Jill Veronica, "Trauma in Transportation: Factors Contributing to Positive and Negative Outcomes of Involvement in Trauma for Railroad Workers" (2012). Electronic Theses and Dissertations. 516.
https://digitalcommons.du.edu/etd/516

This Dissertation is brought to you for free and open access by the Graduate Studies at Digital Commons @ DU. It has been accepted for inclusion in Electronic Theses and Dissertations by an authorized administrator of Digital Commons @ DU. For more information, please contact jennifer.cox@du.edu,dig-commons@du.edu.
Trauma in Transportation: Factors Contributing to Positive and Negative Outcomes of Involvement in Trauma for Railroad Workers

Abstract
This study explored several predictors of Post Traumatic Stress Disorder (PTSD) and Post Traumatic Growth (PTG) in a sample of 136 train employees. The first objective was to examine the influence of number of work related traumas, number of life traumas, age, personality characteristic extroversion, personality characteristic openness, social support, positive cognitive coping, and negative cognitive coping in the prediction of PTSD. The second objective was to assess the influence of number of work related traumas, number of life traumas, age, personality characteristic extroversion, personality characteristic openness, social support, positive cognitive coping, and negative cognitive coping prediction of PTG.

Freight train employees from a major transportation company in the United States participated in the study. There has not been a thorough exploration of negative and positive outcomes of trauma in the literature with this population. The study attempted to gain further understanding of PTSD and PTG in train employees by using simple linear regression analyses to investigate number of traumas in predicting PTSD and PTG. The study then utilized hierarchical regression analyses to investigate how number of work related traumas, number of life traumas, age, personality characteristic extroversion, personality characteristic openness, social support, positive cognitive coping, and negative cognitive coping were related to PTSD and then in a separate regression using the same variables to predict PTG.

Results of this study indicated that number of work traumas predicted PTSD, although number of work traumas did not predict PTG. Also, factors in the hierarchical model that were significant predictors of PTSD were number of work traumas, number of life traumas, negative cognitive coping, and positive cognitive coping. In the model predicting PTG, social support, negative cognitive coping, and positive cognitive coping were statistically significant. The field of PTG is relatively young in comparison to the study of more pathological trauma, PTSD. Previous research has indicated personality factors, social support, and cognitive processing to have theoretical bases in the emergence of growth, and can also serve as protective factors for negative trauma reactions. This is the first study to look at PTG in train employees and to also apply personality characteristics, social support, and cognitive coping. The results of the study provide evidence that social support, negative cognitive coping, and positive cognitive coping are related to PTG. Further, results indicated that number of work traumas, number of life traumas, positive cognitive coping, and negative cognitive coping predicted PTSD.

Document Type
Dissertation

Degree Name
Ph.D.

Department
Counseling Psychology

First Advisor
Patrick Sherry, Ph.D.

Second Advisor
Cynthia McRae
Third Advisor
Kathy Green

Keywords
Cognitive coping, Post traumatic growth, Post traumatic stress disorder, Social support, Transportation, Trauma

Subject Categories
Counseling Psychology | Experimental Analysis of Behavior | Psychology

Publication Statement
Copyright is held by the author. User is responsible for all copyright compliance.
TRAUMA IN TRANSPORTATION: FACTORS CONTRIBUTING TO POSITIVE
AND NEGATIVE OUTCOMES OF INVOLVEMENT
IN TRAUMA FOR RAILROAD WORKERS

A Dissertation

Presented to

the Faculty of the Morgridge College of Education

In Partial Fulfillment

of the Requirements for the Degree

Doctor of Philosophy

by

Jill V. Pinarowicz, M.S.

August 2012

Advisor: Patrick Sherry, Ph.D.
Abstract

This study explored several predictors of Post Traumatic Stress Disorder (PTSD) and Post Traumatic Growth (PTG) in a sample of 136 train employees. The first objective was to examine the influence of number of work related traumas, number of life traumas, age, personality characteristic extroversion, personality characteristic openness, social support, positive cognitive coping, and negative cognitive coping in the prediction of PTSD. The second objective was to assess the influence of number of work related traumas, number of life traumas, age, personality characteristic extroversion, personality characteristic openness, social support, positive cognitive coping, and negative cognitive coping prediction of PTG.

Freight train employees from a major transportation company in the United States participated in the study. There has not been a thorough exploration of negative and positive outcomes of trauma in the literature with this population. The study attempted to gain further understanding of PTSD and PTG in train employees by using simple linear regression analyses to investigate number of traumas in predicting PTSD and PTG. The study then utilized hierarchical regression analyses to investigate how number of work related traumas, number of life traumas, age, personality characteristic extroversion, personality characteristic openness, social support, positive cognitive coping, and negative cognitive coping were related to PTSD and then in a separate regression using the same variables to predict PTG.
Results of this study indicated that number of work traumas predicted PTSD, although number of work traumas did not predict PTG. Also, factors in the hierarchical model that were significant predictors of PTSD were number of work traumas, number of life traumas, negative cognitive coping, and positive cognitive coping. In the model predicting PTG, social support, negative cognitive coping, and positive cognitive coping were statistically significant.

The field of PTG is relatively young in comparison to the study of more pathological trauma, PTSD. Previous research has indicated personality factors, social support, and cognitive processing to have theoretical bases in the emergence of growth, and can also serve as protective factors for negative trauma reactions. This is the first study to look at PTG in train employees and to also apply personality characteristics, social support, and cognitive coping. The results of the study provide evidence that social support, negative cognitive coping, and positive cognitive coping are related to PTG. Further, results indicated that number of work traumas, number of life traumas, positive cognitive coping, and negative cognitive coping predicted PTSD.
Acknowledgments

As I reflect back through this vigorous and exhausting journey, I feel gratitude to so many people for their unconditional love, support, and encouragement. My family, friends, and mentors have always been my biggest supporters. You all are my biggest heroes. I love you.

My parents have made many sacrifices for me over the years. Joan and Millard Pinarowicz, you made my dreams come true and I have the utmost gratitude to you. Your endless love and support are more than any child could have asked for.

My friends are my chosen family. For Pennsylvania: Shannon, for already spending an eternity supporting me; Dana, for being the brutally honest friend; and Jaime, for staying by my side since the age of 6. My Denver friends, who have not been around as long, but have my heart and soul. Lisa, you are so true and loyal. Valerie, Megan, Monica, Premilla, Crystal, Alex, Jessica, Cathy, and LJ; your laughter helps my light shine through. My DU counseling psychology peers: Kelly, Camille, Jen C., Amber, Robin, David, and Jen M. from SW. Thanks to my current AZ friends for supporting me during the most stressful year: Lou, Kaitlyn, Sarah, Aubs, Andy (partner in crime at ASU CS), and Todd (for entering life when needed most). Thanks for reminding me to breathe.

My mentors have included: Pennsylvania’s finest, Dr. Collins and Dr. Ratzin, who believed in my potential early on. My dissertation committee: Dr. Sherry for pushing me to my limits; Dr. McRae for your endless kind words; and Dr. Green for helping with statistics. ASU CS staff including: Dr’s. Hutchinson, Wasserbauer, and Schulte. Your ongoing advice, support, and encouragement were so much appreciated on this rigorous journey. Again, I thank you all from the bottom of my heart.
# Table of Contents

Chapter One: Introduction .....................................................................................................1  
  Background of the Problem ............................................................................................1  
  Statement of the Problem ..............................................................................................3  
  Purpose of Studying the Problem ...................................................................................4  
  Importance of Studying the Problem .............................................................................5  
  Overview of Hypotheses .................................................................................................6  
  Overview of Variables and Measures .............................................................................7  
  Limitations ......................................................................................................................8  
  Summary .........................................................................................................................9  

Chapter Two: Review of Selected Literature .......................................................................10  
  Introduction .....................................................................................................................10  
  Occupational Hazard of Trauma in Transportation .......................................................11  
  Trauma from Railroad Across Cultures .........................................................................12  
  Post Traumatic Stress Disorder (PTSD) .........................................................................15  
  Acute Stress Disorder (ASD) ..........................................................................................15  
  The Federal Employers’ Liability Act (FELA) ...............................................................17  
  Research of Other Occupational Trauma ....................................................................18  
  Symptoms of PTSD in Railway Studies .........................................................................21  
  Risk Factors for Severity of Symptoms .........................................................................23  
  Impact Trauma May Have on Work Performance .........................................................28  
  Difference Between Subway and Freight Train Incidents .............................................29  
  Differences in Ways Individuals are Hurt, Maimed, or Killed ......................................30  
  Procedure for Drivers When They Hit an Individual ....................................................34  
  Statistics about Jumpers/Accidents ...............................................................................35  
  Interventions ...................................................................................................................36  
  Cognitive Coping PTSD Literature ..............................................................................40  
  Mediating Factors ..........................................................................................................41  
  Introduction to Post Traumatic Growth (PTG) ..............................................................43  
  PTG Association with PTSD .........................................................................................47  
  Scales Measuring Growth ..............................................................................................50  
  Research Studies with PTG Results ...............................................................................52  
  Cognitive Coping Strategies .........................................................................................63  
  Janus Face of Self-Perceived Growth .............................................................................67  
  Personality Characteristics .............................................................................................68  
  Limitations ......................................................................................................................71  
  Treatment Possibilities with PTG ..................................................................................72  
  Summary .........................................................................................................................74  

Chapter Three: Methods ....................................................................................................76  
  Participants ......................................................................................................................76  
  Power and sample size .................................................................................................76  
  Demographics ...............................................................................................................77
List of Tables

Table 1. Summary of Findings from PTG Studies .................................................................59
Table 2. Descriptive Statistics for Measured Variables.......................................................90
Table 3. Overview of Demographic Characteristics ...........................................................93
Table 4. Overview of Work Traumatic Events ....................................................................95
Table 5. Overview of Lifetime Traumatic Events ...............................................................95
Table 6. Correlation Coefficients PTSD and PTG..............................................................97
Table 7. Hierarchical Regression of Posttraumatic Stress Disorder on Number of Work Traumas, Number of Life Traumas, Marital Status, Age, Extroversion, Openness, Social Support, Negative Cognitive Coping, and Positive Cognitive Processing (n=136) .................................................................103
Table 8. Hierarchical Regression of Posttraumatic Growth on Number of Work Traumas, Number of Life Traumas, Marital Status, Age, Extroversion, Openness, Social Support, Negative Cognitive Coping, and Positive Cognitive Processing (n =136) .................................................................................................................................106
List of Figures

Figure 1. A model of posttraumatic growth.................................................................48

Figure 2. Histogram of PTSD.....................................................................................90

Figure 3. Histogram of PTG .....................................................................................91

Figure 4. Histogram of Number of Work Traumas .....................................................91

Figure 5. Histogram of Number of Lifetime Traumas...............................................92
CHAPTER ONE
STUDY OVERVIEW

Introduction

Background of the Problem

Traumatic events occur unexpectedly in various ways. These events may have a life changing, profound impact on the individuals involved. Specific occupations have a higher propensity of exposing employees to traumatic events. Service workers, such as those providing emergency services, police officers, and firefighters are trained to respond to those who are in crisis as an expected responsibility in performing their jobs. These workers are expected to respond to others who encounter difficulties in their lives including medical crises, accidents, and fires, for example, and are exposed to more traumas from their careers than the average person experiences over their lifetime. Those who are employed in the transportation industry, specifically railroad engineers, also work in a profession where the probability of being involved in a critical incident, including derailments, collisions and near misses, and suicides on the tracks, is likely to occur (Weiss & Farrell, 2006). Railroad drivers are at a high risk of being exposed to a traumatic event sometime throughout their career. According to Napper, 1998, (as cited in Mishara, 2007), the average train driver will be involved in three fatal accidents during a 25 year career. According to the US Department of Transportation, (Federal Railroad Administration, 2006), in 2005 there were 13,969 rail accidents/incidents in the railroad
system in the United States resulting in 9,172 injuries and 888 fatalities (Biggs, 2007). These events can be traumatic to railroad workers involved; however, there is minimal research on the impact of these events. The outcome of being involved in these events can have varying impact with individuals’ symptoms ranging from mild discomfort to disabling symptoms. The most severe symptoms could include diagnosable disorders such as Post traumatic Stress Disorder (PTSD); however, every individual exposed to a traumatic event will not necessarily have an adverse reaction and will be impacted differently (Sherry & Philbrick, 2003).

The detrimental effects of being involved in a traumatic incident have been well researched and documented. More recently research has shifted from a pathology perspective to examining the positive effects of being involved in a traumatic event. Post Traumatic Growth (PTG) focuses on the positive outcomes and personal growth individual experiences from being involved in a traumatic event. There have been studies that have examined the concept of PTG in individuals with medical conditions such as chronic illness, heart attacks, breast cancer, bone marrow transplants, and HIV and AIDS. Furthermore, there has been research regarding the concept of PTG including individuals that have experienced rape and sexual assault, military combat, maritime disasters, plane crashes, tornadoes, and shootings. Studies have also focused on bereavement, injury, recovery from substance addiction, and parents of children with disabilities (Linley & Joseph, 2004). There have been previous studies that have addressed the negative outcomes of trauma from transportation; however there are no studies to date that have specifically examined the positive impacts of trauma of those who are employed in the commuter rail industry. Additionally, there is uncertainty regarding whether work-
related trauma that is not necessarily part of job roles for transportation workers, will have the same effects on those individuals who are trained to respond to trauma such as emergency service workers, police officers, and fire fighters. Further, there has been minimal research conducted to explore the concept of PTG in individuals in careers where they are trained to respond to trauma, with the majority of studies utilizing populations that have had a medical concern such as breast cancer. Overall, the process of growth may occur differently based on the type of trauma the individual has experienced. Research has yet to address and explain these possible differences.

Statement of the Problem

Workers that are employed in transportation, specifically railroad, are likely to encounter a work-related trauma in their career. Witnessing a traumatic event, such as a suicide on the tracks, can cause symptoms associated with PTSD and cause psychological impairment. Developing negative symptoms may have a profound impact on an employee’s job performance, daily functioning, and personal life. Understanding potential risk factors, as well as appropriate interventions to be implemented after a traumatic event, are essential to aid in the maintaining of psychological well being of these individuals. Railroad workers are responsible for safely transporting individuals and goods and hazardous materials all over the world. They also come in contact with all aspects of our society. Consequently, it is imperative that they be able to maintain a healthy and optimal ability to perform their jobs. Even momentary lapses of attention or errors in judgment can cause disastrous consequences. A case in point is the Exxon Valdez oil spill. National Transportation Safety Board (NTSB) investigators determined
that a simple mental error regarding the directionality of a course correction resulted in
the disastrous collision that produced the oil spill (Mauer, 1989).

Besides understanding the negative impacts of trauma, there has recently been a
shift towards focusing on the positive impact of trauma, also known as PTG in the
literature. Due to the lack of research addressing negative and positive outcomes of
trauma in the railroad, it is imperative to gain an understanding of the incidents workers
in the transportation industry are exposed to. Finding out directly from the workers about
their experiences, specifically what was helpful for them after experiencing a traumatic
event, as well as what they believe could be changed and improved would be important to
study. Measures that would be beneficial based on these responses could be developed to
direct prevention and intervention protocols. Overall, a model that utilizes and recognizes
both negative and positive symptoms of traumatic events would be beneficial to
addressing the needs of railroad workers.

Purpose of Studying the Problem

Research has indicated that outcomes from trauma can have both negative and
positive effects. Traditionally, trauma was viewed from a pathological model. More
recently trauma has also been explored in terms of personal growth. There has been
research to suggest that PTSD and PTG can result from various traumatic events
including but not limited to medical illnesses, bereavement, natural and man-made
disasters, and sexual abuse. In regards to PTSD and PTG, there has not been agreement
on the underlying mechanisms that serve as protective or mediating factors or also
specific indicators that either of these outcomes will occur. Researchers have also
suggested that PTSD and PTG should not be considered as opposite ends of a spectrum,
but rather as two separate entities that co-exist. Currently, there is no research conducted in the transportation industry that explores these two concepts together. There is some indication that PTSD factors such as multiple traumatic events increase the likelihood of PTSD occurring, while the focuses of research for PTG factors include cognitive processing and personality variables. The overall purpose of this study is to gain a better understanding of the negative and positive effects of traumatic events on railroad workers. Research is needed to examine if the concept of PTG will apply to those in transportation, since this concept has not yet been tested with this population.

**Importance of Studying the Problem**

Millions of people depend on mass transportation for personal and professional reasons. It is extremely important that the general public is confident using transportation that will ensure they arrive at their location safely. There is societal benefit to ensuring that those who drive trains are mentally healthy and competent. Passengers want assurance in terms of their safety that measures are in place to address concerns with those who are employed in the transportation industry.

Individuals employed by railroad companies are at risk for witnessing a traumatic event while working. In particular, those who are driving a train and witness a suicide may experience PTSD and/or some other psychological impairment. These traumatic events may be viewed differently for each individual, have a varying amount of impact, and precipitate a variety of ways to cope. There are several factors to consider when studying this population. First, it is important to gain an understanding of what this experience is like for these workers before proceeding. During this process it might be helpful to assess if they have had current or past symptoms of PTSD or other
psychological impairment and if they have experienced multiple events. Another area to explore is what workers felt was helpful or not helpful and what could be done differently to help the worst affected people. Additionally, it would be beneficial to find interventions helpful in the prevention of psychological impairment of transportation workers and means of helping administrators make policy changes to improve the lives of these workers.

Research studies have also indicated the possibility of developing personal growth following a traumatic event; however there is no current research that addresses if PTG is applicable to transportation workers. If railroad workers indicate experiencing PTG, then interventions that are developed to address trauma can also include this concept. Instead of focusing on only the negative outcomes as most previous research has, positive outcomes can then also be incorporated into treatment. Examining variables that aid in growth including positive cognitive coping strategies, personality characteristics, and social support may all be helpful in understanding factors attributing to growth. Gaining a better understanding of how trauma impacts railroads workers in both negative and positive ways and the underlying mechanisms responsible for these changes can contribute to better protocols and interventions. Train drivers could be provided with training programs that attempt to assuage the impact of trauma on psychological well-being, as well as promoting growth.

**Overview of Hypotheses**

1. Number of work traumas will significantly predict PTSD symptoms in transportation workers.
2. Number of work traumas will significantly predict PTG symptoms in transportation workers.

3. Age, number of life traumas, number of work traumas, personality characteristics of extroversion and openness, social support, and positive and negative cognitive coping strategies will significantly predict PTSD in transportation workers.

4. Age, number of life traumas, number of work traumas, personality characteristics of extroversion and openness, social support, and positive and negative cognitive coping strategies will significantly predict PTG in transportation workers.

*Overview of Variables and Measures*

Four hypotheses were examined in this study. The dependent variable for the first hypothesis was PTSD, while the independent variable was number of work-related traumas. The dependent variable for the second hypothesis was PTG, while the independent variable was number of work-related trauma. The dependent variable for the third hypothesis was PTSD, while age, number of life traumas, number of work traumas, personality characteristics, social support, and cognitive coping strategies were the independent variables. Lastly, the fourth hypothesis dependent variable was PTSD, while age, number of life traumas, number of work traumas, personality characteristics, social support, and cognitive coping strategies were the independent variables.

A demographic questionnaire was used to collect background information as well as the occurrence of traumatic events including both personal and professional, which were used in statistical analyses. No identifying information was collected. PTSD was measured using the *Post Traumatic Stress Disorder Checklist – Specific (PCL-S)* developed by Weathers, Litz, Herman, Huska, & Keane (1993). The *Posttraumatic*
Growth Inventory (PTGI), developed by Tedeschi and Calhoun (1996), was used to measure PTG following a work related trauma. The Big Five Inventory Personality Test (BFI) (John, Donahue, and Kentle 1991) was used to measure personality characteristics. The Cognitive Processing of Trauma Scale (CPTS; Williams, Davis & Millsap, 2002) was used to measure positive and negative cognitive processing of trauma. House and Wells’ (1978) Measures of Social Support (as cited in House, 1981) was used to measure social support. It should be noted that each measure mentioned above is a self-report instrument. It is estimated that completion of all measures would take approximately 30 minutes.

**Limitations**

Several limitations should be discussed. First, the study tested the above hypotheses in a sample of freight train workers, thereby limiting the generalizability of the results to other transportation workers, those with careers exposed to trauma in the workplace, or trauma survivors, as a whole. Research conducted on train workers therefore may not be generalizable to other populations. Further, the sample does not provide an overall good gender representation, as males will be represented as the majority of the sample, although for the train industry majority male employees is the norm.

Second, there are several challenges with self-reported measures. Self-report measures may introduce bias due to participants not being retrospectively accurate. Also individuals may succumb to social desirability or may not be willing to admit that they are experiencing adverse symptoms due to the predominately male working class culture in which they work in.
Third, cross-sectional designs can make it difficult to understand the relationship between drivers’ former distressing events and current psychosomatic health problems. Recall bias is also a limitation as participants may have difficulty remembering past events. Longitudinal studies would be helpful in order to accurately study trauma and PTSD and PTG in railroad drivers (Yum et al., 2006).

Fourth, in a sample it is important to consider that non-responders (those who refuse to participate) may be most severely impacted (Andersen, Christensen, Petersen, 1991; Theorell, et al., 1994; Wei-saeth, 1984).

Summary

Chapter One provided the background of trauma in transportation including negative and positive outcomes in terms of PTSD and PTG. This chapter also included a statement of the problem, purpose of studying the problem, importance of studying the problem, hypotheses, overview of the variables and measures associated with the study, and limitations of the study. Please refer to Appendix A for a glossary of terms used in the study. Chapter Two will present a review of the literature relevant to this study as well as the theoretical basis of the hypotheses outlined above.
CHAPTER TWO

REVIEW OF SELECTED LITERATURE

Introduction

Trauma occurs unexpectedly and can result from involvement in sexual assault, accidents, serious illness, and natural disaster (Shakespeare-Finch, Smith, Gow, Embelton, & Baird, 2003). When an event occurs that outweighs an individual’s resources to cope, oftentimes emotional disease or distress will develop (Regehr, et al., 2007; Lazarus & Folkman, 1984). The impact of the traumatic event varies from one individual to another even when the same or similar incident has occurred (Hagstrom, 1995). Therefore, trauma and the result of trauma are a unique experience to each person.

When an individual is performing their work duties they can also experience a traumatic event that can occur without forewarning and without any control (Theorell, Leymann, Jodko, Konarski, & Norbeck, 1994). Those involved in rescue/recovery work may be exposed to physical and emotional trauma due to incidents that may arise specific to the job duties they perform (Perrin, DiGrande, Wheeler, Thorpe, Farfel, & Brackbill, 2007). Railroad drivers also experience traumatic events in their careers when trains strike or nearly miss other trains, other vehicles, and when individuals place themselves or jump onto tracks (Weiss & Farrell, 2006). Napper (1998) estimates that train drivers will be involved in three fatal accidents (suicides and accidents) in a 25 year career (Mishara, 2007). Work related distress, work related trauma, and occupational hazards are some of the names used to describe a traumatic event that occurs to an individual.
while performing their job duties. Drivers may have no possible way of preventing these accidents and may experience a wide range of feelings.

Service occupations including police officers, fire fighters, and emergency service workers are trained to respond to traumatic events of others. They are exposed at a much higher level of incidence than the general public. Other occupations also have a higher exposure to critical incidents, specifically when performing occupational duties. Those employed in the transportation industries that drive both freight and commuter trains are also exposed to critical incidents. These incidents can cause high costs to train drivers and bystanders by causing psychological distress, which can create secondary victims (Ratnayake, Links, & Eynan, 2007). It is crucial to maintain the psychological well being of these workers as they are responsible for transporting the lives of many individuals every day, making them vital members of society.

*The Occupational Hazard of Trauma in Transportation*

There are numerous reasons to study train related critical incidents and the subsequent impact to all involved. Train-related fatalities are the second most occurring transportation deaths after motor vehicles accidents (Lin & Gill, 2009). It is estimated that one out of 50 drivers will experience a critical incident in a year and some drivers may have the unfortunate experience of being involved in multiple traumas in a year (Farmer, Tranah, O’Donnell, & Catalan, 1992). Further, research from Tranah, et al. (1995) suggests that there is a 4% chance of a driver experiencing a traumatic event each year. Specifically, suicide by the use of railways is a problem that exists in almost every country where there is railway (O’Donnell & Famer, 1992). From 1991-2000, a total of 8653 fatal railway suicides (9510 suicide incidences) were recorded by the national
central registry in the German railway. Researchers estimate that approximately 17 suicides occurred per week on the tracks during this time (Baumert, Erazol, & Ladwig, 2005). The first official suicide was recorded in 1852 according to statistics from the Registrar General (Clarke, 1994). Suicide by the use of this method has increased over the years, due to mass expansion of the railroad system and the accessibility to use this means. During the period of 1852-1949 more than 10,000 suicides were recorded occurring on the railway in Germany. It should be noted that this has predominantly has been a preferred method with males. Females exceeded males in suicide by this means during only two years, while the rest of the years were dominated by males (Clarke, 1994).

Suicides and accidents cause delays to service, as well as impacting the individuals who witness these traumatic events (O’Donnell & Farmer, 1992). Drivers simply carrying out their duties at work can easily become involved in the plight of another individual taking their own lives. Collisions, near misses, and derailments may also cause psychological distress and are also experienced in most countries.

*Trauma from Railroad Across Cultures*

Railroad systems exist in most countries around the world and are responsible for transporting people and goods. It is estimated that 135 subway systems exist in metropolitan areas internationally (Light Rail Transit Association, as cited in Ratnayake, Links, & Eynan, 2007). Within the United States, the New York City Metropolitan Transit Authority (MTA) subways is the most utilized system transporting millions of people a day and approximately 1.5 billion yearly (Lin & Gill, 2009). With the mass
volume of traffic daily, individuals using subway trains as an instrument of death is likely to occur.

Medical examiner records were examined for the years 1990-2003 estimating 668 fatalities occurred in the New York City (NYC) subway. Out of these 668 fatalities, 343 were suggested to be the result of suicides from a 13 year span (Gershon, Pearson, Nandi, Vlahov, Bucciarelli-Prann, Tracy, Tardiff, & Galea, 2008). Researchers indicated that this is an estimation of the number of suicides in NYC transit and may underestimate the actual number of suicides that occur through this modality. This number accounts for fatalities and does not include unsuccessful suicide attempts. These individuals who attempted suicide and were not able to complete the act may have sustained injuries or no injuries and could still have a traumatic impact on the driver and others who witnessed. During Jan 1, 2003 and May 31, 2007 suicide research regarding the NYC subway indicated that there were 211 subway train-related fatalities (Lin & Gill, 2009).

Recently the federal government has ordered 10 states (Illinois, Alabama, California, Florida, Georgia, Indiana, Iowa, Louisiana, Ohio, and Texas) to develop plans to reduce the number of accidents at railroad crossings. Failure to comply with these mandates could result loss in funding for these railroads. Specifically in Illinois, there has been an estimated 588 grade-crossing accidents involving trains, vehicles, and/or pedestrians since 2006 resulting in 98 deaths according to the Federal Railroad Administration (FRA). Illinois has the second highest amount of rail-crossing accidents with Texas being in the lead. Nationwide, it has been estimated from federal data that there has been 7,077 crossing accidents from 2007-2009 resulting in 873 deaths (Hilkevitch, 2010).
Accidents and suicides occurring on railways have been researched in countries throughout the world. The Korea Railroad Cooperation’s statistics from 2004 indicated that 575 on the tracks incidents occurred and 1000 individuals were killed or injured with approximately 40% of victims accounting for person-under-train (PUT) accidents (Yum, Roh, Ryu, Won, Kim, Lee, & Kim, 2006). A study in Sydney, Australia, Austin and Drummond study found that in 562 train drivers, a third of them had experienced a train fatality (as cited in Mishara, 2007). In the London underground system, there are approximately 100 incidents a year with usually 90 involving the train driver witnessing the individual on the track (Farmer, et al., 1992). From 2000-2002, in Sweden there were 145 suicides involving train-person collisions (Mishara, 2007; Rådbo, Svedung, & Andersson, 2005), while in Turkey there were 326 railway suicides from 1997-2003 (Özdoğan, Cakar, Agalar, Eryilmaz, Aytac, & Aydinuraz, as cited in Mishara, 2007). Germany has a high percentage of individuals that commit suicide via railway systems. From 1997-2002, there were an estimated total of 5,731 suicides on the German central railway register. In Germany, suicide by railway accounts for 7% of all suicides with an average of 18 railway suicides occurring weekly. Railway suicide has indicated an increase from 1991-2000 with other methods of suicide decreasing during this same time span (Mishara, 2007; Baumert, Erazo, & Ladwig, 2005). In a research study in Sweden and Norway, a sample of 101 drivers that were involved in serious accidents were interviewed and about one third indicated experiencing acute stress symptoms (Weiss & Farrell, 2006; Mishara 2007). Overall, research indicates suicide and accidents occur internationally that can cause distressing effects on drivers of both subways and railroads.
Post Traumatic Stress Disorder (PTSD)

Psychiatric disorders may develop when railroad and subway drivers witness another individual being killed, seriously injured, or maimed by the train they are operating (Weiss & Farrell, 2006). Critical incidents at work can lead to acute stress disorder (ASD), post traumatic stress disorder (PTSD), and other conditions that can include anxiety depression, insomnia, and psychophysiological symptoms (Weiss & Farrell, 2006; Abbott, R., Young, S., & Grant, G., et al., 2003). They may initially develop psychological impairment such as ASD and this also could exacerbate into more severe symptomology including PTSD. Acute reactions following a traumatic incident should not be necessarily considered pathological as there is a gradual progression that may occur (Hagstrom, 1995). A variety of feelings may accompany subway engineers when they experience and witness a traumatic event, such as helplessness, fear, guilt, horror, anxiety, and dread. Further, individuals that develop post traumatic reactions can have increased substance use, decreased work performance, increased health risks, and disruption in social support and family (Regehr, et al., 2007).

Acute Stress Disorder (ASD)

ASD and PTSD share many of the same characteristics. According to the American Psychiatric Association (2000), the major difference between ASD and PTSD is the amount of time and individual experiences symptoms. ASD is considered a more immediate, short-term response to trauma that lasts between two days and four weeks. If ASD symptoms persist for more than a month, then PTSD may be diagnosed. The other notable difference between ASD and PTSD is that ASD is more associated with dissociative symptoms. Possible symptoms shared by these two diagnoses include
nightmares, sleep disturbances, tremors, restlessness, flashbacks, and intrusive thoughts regarding the events (American Psychiatric Association, 2000). Behaviors of individuals include avoid talking about the event, socially isolating themselves, worrying about having future accidents, and being retriggered when driving through the area where the accident happened. Again it should be noted that individuals respond differently to these events and symptoms will vary accordingly.

PTSD did not become a valid diagnosis until 1980 (Tranah & Farmer, 1994) with the prevalence for PTSD in the general population estimated to be 4% (Kessler, Chin, Demler, Merikangas, & Walters, as cited in Perrin, et al., 2007). According to the American Psychiatric Association *Diagnostic and Statistical Manual of Mental Disorders, 4th Edition, Text Revision* (DSM-IV-TR, American Psychiatric Association), there must be a direct threat of death or loss of physical integrity before ASD or PTSD can be assessed. According to the American Psychiatric Association *Diagnostic and Statistical Manual of Mental Disorders, 4th Edition, Text Revision* (DSM-IV-TR, American Psychiatric Association, 2000, p. 463),

an extreme traumatic stressor involves direct personal experience of an event that involves actual or threatened death or serious injury, or other threat to one’s physical integrity; or witnessing an event that involves death, injury, or a threat to the physical integrity of another person; or learning about unexpected or violent death, serious harm, or threat of death or injury experienced by a family member or other close associate.

Further criteria includes the individual’s response to the event must involve “intense fear, helplessness, or horror.” Posttraumatic stress disorder (PTSD) is a possible psychological outcome after trauma; however research has indicated a very small portion of the population will develop PTSD even after exposure to a traumatic event. According the
DSM-IV-TR (APA, 2000), symptoms of PTSD may include intrusive thoughts regarding
the event, nightmares, flashbacks, feelings of intense distress, and physiological
reactivity. Individuals may try to avoid activities, places, thoughts, or feelings that remind
them of the trauma, have an inability to remember important aspects of the trauma, have
a loss of interest in activities and life in general, may feel detached from others and
become emotionally numb, and have a sense of a limited future. PTSD symptoms of
increased arousal may include sleep disturbances in difficulty falling asleep and/or
staying asleep, irritability that can include outbursts of anger, difficulty concentrating,
hypervigilance, and being easily startled. Other common feelings may include guilt,
shame, or self-blame, depression and hopelessness, feeling alienated and isolated,
feelings of betrayal and mistrust, and physical symptoms including headaches, stomach
problems, and chest pains. From the description of these symptoms, it is evident that
psychological conditions can have serious repercussions for workers and their
productivity. Those who experience work related trauma, specifically those in the
transportation industry, would be vulnerable to developing psychological difficulties that
could interfere with their abilities to perform their jobs adequately.

The Federal Employers’ Liability Act (FELA)

The Federal Employers’ Liability Act (FELA) governs the way work related
injuries are handled, however it becomes more complicated to distribute benefits when
there is no direct physical impact on the worker (Weiss & Farrell, 2006). When an
individual is involved in a traumatic event at work and is physically injured, this is
handled differently than when they have psychological trauma. A physical injury is
much more readily given compensation versus a psychological injury due to being more
difficult to assess. An individual’s psychological trauma and compensation can be more challenging to determine in terms of services and time off needed from their job.

According the FELA, employers must provide mental health coverage to railroad drivers for those who have experienced work related trauma only in situations that included a threat of imminent direct physical impact. Therefore, a worker cannot just witness a traumatic event and receive compensation, despite that diagnostic criterion for PTSD is not limited to this occurrence. Keram argues that the employer’s financial interests may be responsible for this discrepancy (2006).

Individuals making claims under FELA must prove negligence of the employer, the employee was exposed to danger, and a causal nexus connects these (Weiss & Farrrell, 2006). Due to the significant size difference between trains and cars or persons, there is usually no physical injury to the employee. More often there are sensory, visceral, and cognitive impacts experienced by drivers (Weiss & Farrell, 2006), which cause complications again when discussing benefits in regards to FELA.

Research of Other Occupational Trauma

Numerous studies indicate that PTSD can develop as a result of being witness to a traumatic event. Nurses in Vietnam who witnessed the injuries of soldiers have been diagnosed with PTSD (Carson, Paulus, Lasko, 2000). A study that utilized police officers found that the most distressing events for them were the homicide of a fellow officer and working with victims of serious crimes (Violanti & Gehrke, 2004). PTSD has also occurred in emergency service workers in England (Bennett, Williams, & Page, 2004) Sweden (Jonsson, Segesten, & Mattson, 2003) and South Africa (Ward, Lombard, & Gwebusche, 2006). Further, PTSD has been found in physicians caring for trauma
survivors (Firth-Cozens, Midgley, & Burges, 1999; Mills, & Mills, 2005). PTSD has also been found in good Samaritans and recovery workers in which they were not personally at risk (Centers for Disease Control and Prevention, 2004; Tehrani, Walpole, & Berriman, 2001, as cited in Keram, 2006).

Rescue Workers

Perrin, DiGrande, Wheeler, Thorpe, Farfel, and Brackbill (2007) found that the overall prevalence of PTSD in rescue/recovery workers from the World Trade Center Disaster was 12.4% with the lowest being police officers at 6.2% and for unaffiliated volunteers at 21.2% (after adjustments were made highest risks were construction/engineering workers, sanitation workers, and unaffiliated volunteers). Findings indicated the earlier start date and longer amount of time spent at the disaster site were significant risk factors for PTSD including all occupations with the exception of police officers. Further, PTSD was also more prevalent for those who performed tasks that were not common to their usual occupation. Therefore, those who had the least amount of training or experience were at the greatest risk for developing PTSD.

Research was conducted regarding rescue workers from a major rail accident in Denmark in 1988. During the accident, eight individuals were killed and 73 injured. Results indicated intensity of symptoms increased over time and also workers had a tendency to somatize stress reactions with anxiety and insomnia being the most prevalent. Rescuers were not directly in the line of danger and only experienced some time pressure to free victims. Further, findings suggested that almost half of rescuers felt the rescue work had a positive impact on their lives after the event (Andersen, Christensen, Petersen, 1991).
Helpers


Community residents that are exposed to a train crash may also need to express anxiety, anger, sadness, despair, helplessness, and guilt (Chung, Werrett, Easthope, Farmer, & Chung, 2002). Residents may turn to using drugs, become socially withdrawn, lose interest in usual activities, or lose interest in social and work relationships; however this was not found in the study by Chung, et al. (2002). Overall they found that community residents experienced some intrusive thoughts and avoidance behavior. Further, anxiety seemed to be the major problem with community residents. In a study regarding the train disaster in Granville, Australia, Raphael (1977) reported feelings of shock and numbness among those who were bereaved. These individuals needed to discuss the accident in detail that accompanied feelings of anger and guilt. Survivors’ guilt was found in those who had survived the crash as well as free floating anxiety or dread (Hagstrom, 1995).

In a study of 66 passengers in Germany involved in a train accident, findings indicated those in the age group older than age 65 had the most difficulty coping with events. Women reported more preoccupied thoughts regarding the accident and also
reported more avoidant behavior. Some individuals reported difficulties in traveling by train and sought out other modes of transportation. In addition, results suggested that those with previous physical health problems also had more depressive symptoms following the incident. Those individuals who had a direct threat to their lives suffered more nightmares and intrusive thoughts and also showed more avoidant behaviors (Hagstrom, 1995).

*Symptoms of PTSD in Railway Studies*

The impact of posttraumatic stress reactions has been documented in numerous high risk occupations (Regehr, et al, 2007). Disorders can include and are not limited to PTSD, anxiety, and depression. Several studies conducted with train drivers have attempted to establish the impact of a traumatic work related incidents on individuals in regards to PTSD. Outcomes from these studies have varied in their results.

Research with Korean railroad drivers found that drivers that were exposed to more than one critical incident had acute and chronic PTSD. Specifically, researchers found that the more experiences of a person-under-train within one year the higher rate of PTSD (Yum, Roh, Ryu, Won, Kim, Lee, & Kim, 2006). Results for PTSD for Korean railroad drivers ranged from 9.6 to 13.2. In addition, drivers that had the experience of person-under-train accident had more adverse psychological and physical symptoms than those who did not experience a traumatic event. Researchers found that only the driver’s age had an association with the level of distress following the person-under-train accident. Findings from this study indicated that the younger the driver the more presence of PTSD than the older drivers. Individual and working environmental characteristics showed no impact on levels of intrusion and avoidance. Researchers noted that in this
study all drivers were male with the exception of one being female so this was a limitation to the study regarding gender (Yum, et al., 2006).

Trannah et al. (1995) interviewed three different drivers after they were exposed to a work related trauma in London. Results indicated varying responses ranging from PTSD diagnosis to few reported symptoms (Tranah, et al., 1995). Other studies regarding the London underground transportation system indicated that 16.3% of drivers developed PTSD and depression and phobic states were present in 39.5% of drivers after one month of an incident using the PTSD checklist (Farmer, et al., 1992). Results from this study of London Underground Railroad drivers, indicated that one-third of drivers suffered distress following persons injured by their trains including neurotic depression, PTSD, and phobic states. After six months, a significant decrease was found in symptoms (Tranah & Farmer, 1994).

In Sweden and Norway a sample of 101 drivers involved in serious accidents were interviewed. Approximately one third indicated experiencing acute stress symptoms. All the drivers in this study reported having intrusive thoughts regarding the accident. Additional symptoms included sleep disturbance, nightmares, restlessness, and tremors. Results also found that drivers who had previous similar trauma were more likely to be more distressed (Karlehagen, Malt, Hoff, et al., as cited in Weiss & Farrell, 2006). Cothereau et al. (2004) compared 202 and French train drivers who experienced a PUT event with 186 French train drivers who had not been exposed to a PUT. Findings from their study indicated that drivers’ immediate reactions included somatic symptoms, anxiety, sleep disturbance, and problems with psychosocial functioning including 4% with posttraumatic stress.
Risk Factors for Severity of Symptoms

Multiple Traumas

Some drivers experience several incidents throughout their career (Farmer, et al., 1992). Not all drivers will be impacted by the event; however symptoms reported can be incapacitating (Farmer, et al., 1992). Stressful events that have not been dealt with properly may make it even more difficult to deal with new problems that arise (Regehr, et al., 2007). Research has suggested that cumulative trauma increases an individual’s predisposition to developing PTSD. Those who are employed as railroad drivers have a continual threat for repeated traumatic experiences to occur which can cause an aggravation of PTSD (Weiss & Farrell, 2006). Those who experience multiple traumas at work or prior non-work related trauma and those earlier in their careers are at risk for having more severe psychological symptoms associated with the trauma. Results of a study by Regehr, et al. (2007) suggested that previous trauma did not impact biological indicators of distress, although previous trauma and reduced social supports were related to continuing psychological distress. These results may suggest that cumulative effects of traumatic events may impact an individual’s psychological well-being, especially in those professions in which traumatic exposure is more likely. In addition, researchers Irish, Ostrowski, Fallon, Spoonster, VanDulmen, Sledjeski, and Delahanty (2008) indicated that prior traumatic experiences accounted for some variance in PTSD symptoms. Researchers suggested that further exploration of the impacts of previous traumatic experiences may be beneficial to examine. Overall, it appears that cumulative stressors have a significant impact on an individual and make PTSD symptoms more probable to occur.
Other studies also have provided evidence to support that multiple accidents increase the likelihood of adverse symptoms. A study conducted in Sweden and Norway indicated that drivers that experienced two or more accidents experienced feelings of vulnerability and acute responses (Malt, Karlehagen, Hoff, Herrstromer, Hildingson, Tibell, & Leymann, as cited in Yum, et al., 2006). Factors that increased vulnerability to acute stress included lower levels social support, previous traumatic experiences, and preexisting symptoms of traumatic stress. It was found that these factors became more pertinent over time following the event. Results also supported that cumulative negative effects of traumatic exposure can be detrimental to workers (Regehr, et al., 2007).

In Sweden and Norway a sample of 101 drivers that were involved in serious accidents were interviewed and about one third indicated experiencing acute stress symptoms. All the drivers in this study reported having intrusive thoughts regarding the accident. Other symptoms included sleep disturbance, nightmares, restlessness, and tremors. Researchers also found that drivers who had previous similar trauma were more likely to be more distressed. Also younger drivers had more severe symptoms (Karlehagen, Malt, Hoff, et al., as cited in Weiss & Farrell, 2006). Karlehagen, et al. found that those individuals that had two or more previous accidents and were worried about having more accidents had highest levels of distress at one month and one year later (as cited in Mishara, 2007).

In a study with French train drivers by Cothereau, et al. (2004), results indicated that risk factors for drivers for PTSD included those who were alone after the incident and those who had experienced previous trauma. Also research has indicated that those
who initially had stress reactions were more likely to have increased stress reaction; however having immediate help reduced stress (Mishara, 2007).

Reactivation of posttraumatic stress can be precipitated by a new traumatic event. These low grade triggers would most likely under normal conditions would not have an impact; however when previous unresolved trauma is prevalent then this reactivated by the new trauma. Boe, Holgersen, and Holen (2010) conducted a 27-year follow-up study with survivors from the Norwegian North Sea oilrig disaster. Results indicated that the number of residual intrusion and avoidance symptoms may predict future PTSD. Sleep related intrusions specifically were the most consistent predictor. These residual symptoms can serve as vulnerability markers to reactivated PTSD.

*Injuries*

Certain studies suggest that the severity regarding injuries may impact workers differently. Theorell, Leymann, Jodko, Konarskia, and Norbeck (1994) found that drivers that witnessed seriously injured victims had more days absent from work than those drivers who had witnessed mildly injured or dead victims. Studies from Norway have found that there are risk factors from disasters for traumatic distress that include perceived threat to life, confinedness, observing others die, and witnessing mutilated bodies (Hagstrom, 1995; Holen, 1990, 1991; Weisaeth, 1984, 1989a). In a study of Norwegian locomotive engineers by Vatshelle and Moen (1997), results indicated that engineers who had not had a traumatic event had better physical health. Furthermore, correlations have been found between reported health problems and psychological distress (Sherry & Philbrick, 2003).
Perrin, et al. (2007), found that the strongest risk factor for PTSD for those individuals involved in rescue/recovery efforts was those that sustained an injury for all occupations in the study. Sustaining an injury is a personal life threat, so this result is understandable as a serious risk factor. Additionally, Stephens, Long, and Miller found in a study with police officers that the degree of symptoms they experience is related to the severity and proximity of trauma exposure (as cited in Regehr, et al., 2007).

Abbott, et al., (2003) found that stress was exasperated by drivers’ waiting alone following a critical incident oftentimes in the dark for help to arrive and lack of support from police officers. This can be particularly distressing when a worker has no one else to help them during a critical incident and must wait for assistance to arrive, especially when an individual is in need of immediate help. Alternatively, stress was found to be mitigated by acknowledgement by the victims’ family and reassurance from the employer that the driver was not at fault for the accident (Weiss & Farrell, 2006).

Lack of access to services to address mental health needs may account for an increased risk among sanitation workers, construction/engineering workers, and unaffiliated workers that were involved in the World Trade Center disaster (Perrin, et al., 2007). A lack of recognition by others including supervisors, co-workers, and family may also increase psychological distress. Further, those individuals who are employed by railroad companies may be less likely to seek out mental health services than other occupations due to lack of understanding regarding the development of psychological symptoms from distressing events. Also their occupational role as railroad driver does not always solicit an understanding from others of the distress they may experience by being involved in traumatic events.
Valerie, Kennedy and Debra found that a driver’s distress may be impacted by a poor working environment (Elizarov and Sin’kov, as cited in Yum, et.al, 2006). When workers do not feel supported by their employers this can increase their overall level of distress, especially following a critical incident. Ongoing support from supervisors and co-workers may help to mitigate symptoms. Also it should be noted that initially a worker may receive support, but may not get needed ongoing support following the incident.

*Lack of Training*

Some research suggests that lack of training can impact an individual’s vulnerability to developing PTSD symptoms. A study that focused on workers and volunteers who were involved in the world trade center disaster (Perrin, et al., 2007) indicated that those who had the least amount of disaster training or experience were at greatest risk of developing PTSD, as were those who spent the most time at the disaster site. These results suggest that the appropriate prior preparedness training and shorter duration of service at a disaster site may serve as buffers in reducing the number of those who develop PTSD. Also findings indicated that prevalence for PTSD for rescue/recovery workers was 12.4%, 6.2% to 21.2% for police officers, and 21.2% for unaffiliated volunteers (Perrin, et al., 2007). These results suggest that the highest prevalence for PTSD was found in those untrained in emergency response services. Those who are employed in the railroad industry are often ill-prepared for managing traumatic incidents they encounter. Training for these workers may be beneficial for reducing the likelihood of developing psychological symptoms that negatively impact them personally and professionally.
Impact Trauma May Have on Work Performance

Individuals’ responses will vary in the way that these situations impact their mental health and psychological wellness. According to Weiss and Farrell (2006), stress was exacerbated for drivers who had to wait alone in the dark and did not feel supported by police. Drivers who feel isolated may have a worse response to stressors. Further, when experiencing events such as a person under the train and not feeling supported, engineers may need to take long-term sick leave. Mishara (2007) found that the best predictors of sick leave were high depression scores and high plasma cortisol levels. According to Sherry and Philbrick (2003), those involved in a PUT had more sick leave compared to other drivers. In addition, driver absences were greater when they witnessed a severe injury or fatality in comparison to a minor injury. Traumatic events at work can impact an individual’s ability to perform their job duties effectively. Further, reassurance from the victim’s family and from the employer that the driver was not at fault helps to serve as a buffer from stress (Weiss and Farrell, 2006). Drivers may feel more supported when they do not feel blamed, nor fear losing their jobs.

Some research has suggested that even minor reductions in the severity of PTSD can be helpful to individuals involved in a traumatic incident. Smith, Schnurr, & Rosenheck (2005) found that even slight reductions in PTSD symptoms may lead to employment gains, even if the overall level remains severe. Vietnam veterans that had severe or very severe PTSD at the Department of Veteran Affairs were studied to examine the correlation between employment outcomes and PTSD symptom severity. Those with severe symptoms were more likely to work part time or not at all. These findings support that even a slight reduction in symptoms may lead to employment gains
Smith, Schnurr, & Rosenheck, 2005). It may be beneficial for employers to address workers who have PTSD symptoms in order to have a more efficient work force. Kessler, et al. (2005) reported that individuals with the diagnosis of PTSD had the highest utilization of services with the highest per capitol cost of any psychological disorder (as cited in Sherry & Philbrick, 2003).

Theorell, et al. (1994) found that subway drivers in Stockholm, Sweden, that witnessed a PUT event had a significant amount more sick days than those workers who did not. This stayed true for looking at intervals of time including event to three weeks, event to three months, and event to one year after the PUT. Researchers found that those in the PUT group suffered sleep disturbance at three weeks after the event. Further, they found that those drivers with seriously injured victims had more days of absenteeism than those drivers with mildly injured or dead victims. Further, Miller reported that individuals exposed to trauma have a greater desire to avoid work, greater absenteeism, and have an increase used of the health care system (as cited in Sherry & Philbrick, 2003).

**Difference Between Subway and Freight Train Incidents**

Arrays of transportation venues exist for an individual to commit suicide. Metro trains and railway are two types of transportation that utilize trains. Words used synonymously in the literature are subway, railway, metro, underground, and tubes (Ratnayake, et al., 2007). Urban rail that are found in populated areas encompasses the use of metro, underground, or subway (Mishara, 2007). Metro suicides occur in more urban settings, while railways are typically in rural settings. Metro trains or subways often operate at high rates of speed, capacity, and frequency and are located in urban centers that are separated from other forms of motorized traffic (Ratnayake, et al., 2007;
Metro systems are more frequently environments that have more control due to access and are usually limited to passengers.

Railway most commonly refers to long distance travel between cities and used as freight for the delivery of goods. Physical barriers do not often control railway access to tracks and railway passenger trains may enter stations at a slower speed than metro trains (Mishara, 2007). Oftentimes there will be miles of exposed track that cars, vehicles, and individuals can be seriously hurt or killed on. There may be some physical barriers and crossing signals to help forewarn individuals crossing the tracks. Systems that are above ground also deal with road crossings, whereas train-car and train-pedestrian accidents occur (Lin & Gill, 2009). It is not always easy to differentiate in the literature the differences between incidents occurring in these systems. Further complication can arise due to that some passenger railways have protected access to their tracks, while some metro systems may extend beyond protected tracks (Mishara, 2007).

**Differences in Ways Individuals are Hurt, Maimed, or Killed**

**Suicide**

Trauma can be caused by person-under-train by accident or suicide attempt, cars or other vehicles being hit at road junctions, derailments, and train collisions (Yum, Roh, Ryu, Won, Kim, Lee, & Kim, 2006; Vatshelle, 1997). In railway transportation, suicide can occur by the individual placing their vehicle on the track or laying on the track in order to be run over and killed (also known as trespassing fatalities). In suicides that occur in metro transportation, the individual typically jumps in front of the train, while it is pulling into the station or lays down on the tracks in order to be run over by the train pulling into the station. In these situations, the train can kill or maim the individual. An
individual can also be electrocuted from touching the high voltage rails, although this occurs infrequently (Mishara, 2007; Gershon, et al., 2008). Metro and railway suicides can occur on open tracks as well as stations.

Suicide is an encompassing overall societal public health challenge, as well as having a profound impact on all individuals involved. According to the Center for Disease Control (CDC), in the year 2005 there were an estimated 32,637, or 11 per 100,000 deaths from all types of suicide including firearm, suffocation, and poisoning suicides. Although there is information available regarding overall suicide rates, there is minimal data available on suicides involving mass transportation systems. Defining deaths as suicides that occur in mass transportation can be challenging. Police officers are not always able to determine if the incident was an accident or suicide so it is then recorded as unknown cause of death (Thornton, 2008). There is even ambiguity in determining if an incident was a suicide even with witnesses present. In addition, transportation systems are not uniform in the way they keep records and use of criteria making it even more challenging to understand rates of suicide in the transportation industry (Mishara, 2007). The numbers reported appear to be much lower than what they may actually be. With approximately 135 subway systems that exist in more densely populated areas of countries around the world, suicide by the use of these systems is a major societal concern as well as the implications it can have for those who are employed in this industry (Ratnayake, Links, & Eynan, 2007).

Survival rates of suicide attempt are also complicated to determine due to tracking systems. There are a variety of factors that can contribute to an individual’s survival. The first factor to take into consideration is the speed of the train, specifically if pulling into a
station. If a train is pulling into a station it may have enough time to slow down and possibly stop. This may be different for freight trains where individuals may lay down on the tracks and hit by high impact. Survival rates for suicide attempts may vary greatly depending on the country in which the attempt occurred and how the transportation is orchestrated. Most studies have indicated that attempting suicide by jumping in front of a train is not always necessarily lethal. O’Donnell & Farmer (1992) estimated that fatality rates across international systems are rarely to be lethal more than 60% of the time (Ratnayake, et al., 2007). Mishara found in a review of Montreal coroner’s records during 1986-1996 that less than 30% of the 323 subway suicide attempts were fatal (as cited in Gershon, et al., 2008). “Suicide pits” used for drainage (also known as drainage pits) are also designed so the train safely passes over an individual that is lying on the tracks is the area between rails that if is deep enough can increase an individual’s chance for survival (Mishara, 2007; O’Donnell & Famer, 1992). These deep areas between rails may partially be responsible for the suicide attempter’s survival. Individuals jumping in front of trains and landing in “suicide pits” are often more associated with metro transportation. Completed suicides and attempts can have a profound impact on individuals who witness these events, specifically those operating the trains.

**Accidental or Unintentional Deaths**

Accidental or unintentional deaths can occur when a person is walking along the tracks, accidentally falls on the tracks, or leans to look for the train and is struck upside the head. Other unintentional deaths result from passengers retrieving personal items such as cell phones, purses, or wallets (Gershon, et al., 2008). Individuals may also experience a medical emergency including a fainting spell or becoming unconscious. They may also
suffer a stroke or heart attack which can cause them to fall onto the tracks. Further, unsupervised children and youth may also end up on the tracks. Rarely a passenger will fall off between cars. Operator fatigue can also contribute to accidents (Lin & Gill, 2009; Pelletier, 1997). Individuals may also look for adventure by “train surfing” which is riding on top of the train and “skylarking” which is hanging on the outside of the doors (Gershon, et al., 2008; Mass Transit Association, & New York City Transit; Lin & Gill, 2009). Either of these thrill seeking endeavors can result in fatal injuries (Lin & Gill, 2009); however in a study in NYC subway suicides, only three deaths were due to “train surfing,” which demonstrates that death from these activities is a rare occurrence. Furthermore, it should be noted that sometimes it is the difficulty of climbing back onto the platform that can cause the fatal injury from all of these events (four to five feet climb back to platform) (Gershon, et al., 2008; Beller, 2006; Independent Online, 2004; Lee, 2007). Death may also occur when the train catches an individual’s backpack, purse, briefcase, or handbag as it pulls out of the station (Gershon et al., 2008; Mass Transit Association & New York City Transit; Perez-Pena, 1995).

**Homicide**

Homicide is an extremely rare event occurring in railroad systems (Lin & Gill, 2009; Thornton, 2008). Several documented cases have included individuals with untreated mental illness who have pushed an individual unknown to them onto the tracks. Martell and Morrison found in a study of violent offenders who had pushed individual onto tracks in the NYC subways, that all 52 of the victims were strangers to the perpetrators (as cited in Gershon, et al., 2008). Researchers further found the majority of individuals involved in subway crime to have mental illness, being homeless, and having
a long history of prior hospitalizations and arrests (Martell & Morrison, as cited in Gershon et al., 2008). In addition, there have also been cases of domestic violence in which this method was used for murder (Thornton, 2008). Overall, homicide is a rare occasion in transportation.

Worker Deaths

Recently the MTA released a report revealing that 238 NYC subway workers have been killed in work accidents since 1946. The majority of the time a worker was killed was the result of being hit by a train while working, although some were electrocuted by the third rail and numerous others died from falls (Thornton, 2008). Some workers were also killed in train collisions and robberies. The majority of workers deaths occurred between 1940 and 1950 indicating safety has steadily improved through the decades. It is estimated that nine workers have been killed this decade from MTA (Thornton, 2008). Further research regarding the NYC subway indicated that out of 211 subway train-related fatalities during Jan 1, 2003 and May 31, 2007, five were subway employees that were included in the fatalities (Lin & Gill, 2009).

Procedure for Drivers When They Hit an Individual

When an individual commits suicide, the train operator who is seated in the first car and operating the train will have the most detailed eyewitness account of the event (Lin & Gill, 2009). Drivers are trained to apply the emergency brakes as part of safety protocol when an individual or vehicle is on the tracks; however it is a rare occurrence that the train will stop before striking the person or vehicle on the tracks (Tranah, et al., 1995). Individuals may strike in front of the cab or the cab may run over the body in which the driver may witness this disturbing and distressing event. The individual
involved in the accident may be instantly killed, the body may be mutilated or maimed, or the body could be intact with them surviving. Following the incident, the driver may be responsible for finding the body and may also come in contact and talk to the victim before other rescue help arrives (Tranah & Farmer, 1994). Following an incident, the driver often times observes and assists emergency teams in recovering the body or injured individual (Farmer, et al., 1992). In reference to vehicles on the tracks, the vehicle may be dislodged due to the massive size and speed of the train. If an individual is in the vehicle they may be killed or also may be seriously injured.

*Statistics about Jumpers/Accidents*

Research findings indicate that across the board individuals committing suicide may have similar characteristics. According to Mishara (2007), individuals that completed suicide have had inpatient treatment for depression and/or schizophrenia, had previously expressed a desire to die, and chose the closest metro station to their residence or institution in which they resided. Research has also suggested these individuals have had previous contact with mental health services prior to the suicidal behavior (Ratnayake, et al., 2007). Also findings indicated that the majority of jumpers are male, between the ages of 20-30, single or unmarried at the time of incident, living alone, and had at least one previous attempt (which may have involved the subway).

Data was gathered from 23 metro systems from around the world to gain a better understanding of railway suicide (Europe, Canada, US, and South America). Most victims were less than 40 years old and male, fatality was less than 60%, no seasonal variation, peak time of day was 1000-1200, closeness to psychiatric centers was a possible risk factor, as well as busiest stations (Lin & Gill, 2009). In a study in NYC
subway suicides, results indicated that antidepressants were detected more often in
suicides, while cocaine and ethanol were more often detected in accidents. Also
researchers found the male to female ratio was five to one with the majority of fatalities
categorized according to ethnicity with Caucasian 32%, African-American 28%,
Hispanic 28%, and Asian 11%. Most accident and suicides occur in middle-aged men
(Lin & Gill, 2009). Identifying individuals who suffer specific mental health concerns
related to suicide may help in prevention strategies. Decreasing the number of individuals
attempting suicide by means of trains would be proactive in also helping to reduce the
number of individuals who witness these events and are subsequently traumatized.

Interventions

Individual

Prevention may be the best intervention for train drivers in reducing the number
of critical incidents, specifically when discussing suicide in railroad. Gate keeping
programs have been recommended and may prove to be effective in the prevention of
individuals committing suicide by means of trains. Employees can often be the last point
of contact with those who attempt suicide and can be trained to identify those individuals
and manage the situation until help arrives. Gaylor and Lester (1994) found in a Hong
Kong subway system that there may be specific clues to who will commit suicide. Some
of these suspicious behaviors may include removal of shoes, sudden droppings of
belongings as the train approaches, having sentimental items, avoiding eye contact with
others, and over-deliberate actions. Through heightened measures within the station with
security officers and television observation, Berman (1991) and Gershon, et al. (2005)
reported that this may decrease the likelihood that an attempter could follow through with
the act in a subway station. According to O’Donnell and Farmer (1992) these measures together could help to facilitate a protocol that includes a liaison system of identifying an attempter and then for example having an electronic signal to forewarn the driver (Ratnayake, et al., 2007).

Oftentimes, it may difficult for a driver to receive proper and adequate mental health care unless protocols are built into the employers systems’ policies (Weiss & Farrell, 2006). Mental health services should be provided immediately following the event that may include counseling and drug treatment (Chung, et al., 2002). When railroads do not intervene, this can be considered negligent due to the extensive forms of literature and clinical experience available to railroad employers (Weiss & Farrell, 2006). Williams, et al., (1994) proposed a protocol for British train drivers that were impacted by a traumatic event which included four meetings of debriefing during a year-long of psychological care (Weiss & Farrell, 2006). Further, Denmark railroads had policy in place that include psychotherapy within 24 hours of the incident, preparations including introducing psychotherapy to young drivers, introduction to crisis intervention for instructors and others who intervene, and information available regarding railway suicides inside and outside of the company (Weiss & Farrell, 2006; Mishara, 2007; Tang, 1994).

Crisis intervention, peer response teams, debriefing, cognitive behavioral therapy (CBT), eye movement desensitization reprocessing (EMDR), and pharmacotherapy have been identified as possible effective treatments for companies to provide employees to help manage a traumatic event. In crisis intervention, the main emphasis is to intervene immediately, stabilize the individual through social support and resources, develop an
understanding of what has occurred, focus on problem solving, and encourage self-reliance (Sherry & Philbrick, 2003; Everly & Mitchell, 1999; Flannery, 1998; Rauch, Hembree, & Foa, 2001; Wollman, 1993).

In peer response teams, individuals are trained in order to deal with trauma of their co-workers. Peer response teams may have a better understanding of what the individual has experienced, and have better empathy and credibility (Sherry & Philbrick, 2003). Those who participate in peer response teams may have had similar experiences and co-workers may be more willing to discuss the traumatic event that occurred.

Debriefing is another approach that has been considered controversial and more research is needed in order to determine the effectiveness. In debriefing, individuals who have experienced a trauma are approached and asked to talk about the trauma they witnessed. However, there may be certain situations in which debriefing is contraindicated (Philbrick & Sherry, 2003). Further research is needed to determine which factors may contribute to this approach not being beneficial.

Cognitive Behavioral Therapy (CBT) may be helpful through the use of desensitization in order to help the individual process the trauma. CBT is considered an empirically supported treatment for PTSD with numerous research studies to show the benefits of using this approach (APA Presidential Task Force on Evidence-Based Practice, 2006). CBT may be a helpful therapeutic approach for drivers involved in a traumatic incident in the transportation industry.

Eye Movement Desensitization and Reprocessing (EMDR) may be helpful for those experiencing PTSD from work-based trauma. In a study in Stockholm, Sweden, public transportation workers were recruited that had a person-under-the-train accident or
who had been assaulted at work. Results indicated that treatment with EMDR had a 67% success rate, in that workers no longer expressed symptoms of PTSD. Further research is needed to validate this treatment approach in larger samples with transportation workers exposed to occupational trauma (Hogberg, Pagani, Sundin, Soares, Aberg-Wistedt, Tarnell, & Hallstrom, 2007).

Pharmacotherapy may be another beneficial avenue to pursue to treat those with PTSD. An individual may need medication to help manage symptoms related to the trauma such as anxiety and depression. They may also need medication in order to help with sleeping problems incurred from the traumatic experience. Most pharmacotherapy to treat PTSD utilizes antidepressant and anxiolytic drugs, rather than targeting putative neurobiologic mechanisms responsible for the PTSD symptoms (Sherry & Philbrick, 2003).

Different companies provide a variety of ways of handling incidents on the tracks and individuals take a variety of approaches to manage the trauma they have experienced. Further research is needed in order to determine which approaches are most beneficial to decreasing the likelihood of an individual developing PTSD and also the best interventions to manage an individual’s symptoms.

*Structural*

According to Gershon, et al (2008), it may be difficult to implement individual level interventions and structural interventions may be more beneficial. Prevention strategies that focus on structural controls may help to improve safety of subway systems. Specifically for railroad trains, structural changes include installing protective gates at crossings to keep vehicles off tracks, building overpasses and tunnels specific for trains,
and putting up fences near pedestrian area near tracks to deter individuals from trespassing on tracks (Hilkevitch, 2010). Although limiting access to the tracks seems like a plausible solution, this would be quite expensive considering how much land the railroad system encompasses. Within subway systems, one suggestion includes making more “suicide pits” so the survival rate is better when an individual lies or lands on the tracks (Ratnayake, et al., 2007). Additionally, the installation of video cameras may also be helpful in identifying possible jumpers before they attempt. All of these structural measures may be financially untenable though (Mishara, 2007).

If there is a mental institution near tracks or a station, taking extra measures to prevent those that are severely mentally ill from taking their lives has also been suggested. Public awareness about suicide and the reality that most jumpers survive might also be considered; although there is some concern that publicizing information about suicide may lead to higher rates of suicide (Mishara, 2007).

Cognitive Coping PTSD Literature

Some possible factors to consider with interpretation of trauma include the way in which earlier trauma was coped with, the situation in which the incident occurred including who was there, the situation itself, and how the individual cognitively processed the event (Regehr, et al., 2007). Also an individual’s coping style may also determine how they will respond to a traumatic event (Sherry & Philbrick, 2003). There are a variety of ways that an individual may try to cope with the trauma that has occurred unexpectedly. Specifically individuals can try to manage the trauma they have experienced through emotion-focused coping and problem focused coping (Sherry & Philbrick, 2003). Emotion focused coping involves the individual having an emotional
response to the trauma and the desire to gain emotional regulation. Problem focused coping is when an individual attempts to manage the difficulties with the person-environment (Hagstrom, 1995). Problem focused coping looks at the trauma as problematic and individuals seek out ways to make changes. Avoidant coping strategies may be beneficial in the interim; however long term adjustment is better without the use of this style (Sherry & Philbrick, 2003).

Mediating Factors

Social Support

When a traumatic incident occurs at work, it may have a profound impact on the driver. Drivers that have to handle the consequence of the accident can be traumatized as well as others who witness the event. Early interventions to help these individuals may prove to be cost effective. Specifically, research has suggested that early interventions may reduce number of days for sick leave and also long-term disabilities (Mishara, 2007). Social support may serve as a buffer against developing adverse symptoms including ASD, PTSD, anxiety, and depression. Further, certain protective factors may help to decrease the amount of stress a driver experiences. For example, stress was found to be mitigated by acknowledgement by the victims’ family and reassurance from the employer that the driver was not at fault for the accident (Weiss & Farrell, 2006; Abbott, et al., 2003). Further, social support from an individual’s personal network and within his/her organization, specifically from supervisors, may be helpful in mediating traumatic stress (Regehr, et al., 2007; Leffler & Dembert, 1998; Regehr, Hill, & Glancy, 2000; Weiss, Marmar, & Metzler, 1995). Providing ongoing and good-quality supervision in which an employee is encouraged to discuss their difficulties and anxiety may also be
helpful (Lev-Wiesel, Goldblatt, Eisikovits, Admi, 2009). Co-workers of drivers that have experienced a traumatic event may not receive adequate support from their peers after several months have passed from the event. This can be particularly challenging when it may take several months for the individual to begin to face the reality of the trauma they have experienced. This may indicate the necessity of sustained peer support. Further, peers that have had similar experiences may be able to offer unique support to their co-workers by having a special understanding and may serve as role models of post-traumatic growth (Pardess, 2005).

Previous research has suggested that social support has numerous benefits. Individuals that have had experienced a traumatic event and have strong social support networks adapt better than those who do not (Sherry & Philbrick, 2003). In a study by Margiotta with the Long Island Rail Road in New York, found that a driver experienced lower levels of stress when they had someone to talk to after the PUT that provided social support (as cited in Mishara, 2007). Perception regarding social support is also important. An individual may have support from others including friends, family, and co-workers; however if they do not perceive that they have this support then they are still likely to feel distressed (Sherry & Philbrick, 2003; Cohen & Wills, 1985).

Training

Numerous studies have indicated the value and necessity of training as a way of coping with distress (Hagstrom, 1995; Dunning, 1990; Hytten, 1989; Richards, 1994; Weisaeth, 1989).

Perrin et al., (2007) found that those rescue/recovery workers at the World Trade Center that were in occupations that were less prepared for the disaster work, were more likely to
develop PTSD. Research has indicated that prior training or experience may protect against psychological distress that may be accompanied with disaster work (Perrrin, et al., 2007; Epstein, Fullerton, & Ursano, 1998; Ozen, & Aytekin, 2004; Guo, Chen, Lu, Tan, Lee, & Wang, 2004; North, Tivis, McMillen, Pfefferbaum, Spitznagel, Cox, Nixon, Bunch, & Smith, 2002). Further, Theorell, et al. (1994) reported that drivers’ victims who were seriously injured were the most impacted and it may be helpful for them to receive updates regarding their condition (Theorell, et al., 1994). Other recommendations regarding training include role-play simulations of interventions for emergency events (Lev-Wiesel, et al., 2009; Somer, et al., 2004). Researchers have recommended educating employees on understanding the impact of trauma-related work on professionals, developing coping skills for managing personal distress while helping others in distressed states, and applying strategies for detecting their own personal meaning that are positive in nature in order to become empowered in traumatic situations and enable personal growth (Lev-Wiesel, et al., 2009). Further in accordance with Saakvitne, railroad workers should be encouraged to maintain a balance between work, rest, receiving emotional support of others, and engaging in activities including exercise in order to ensure a good mental balance (as cited in Lev-Wiesel, et al., 2009).

**Introduction to Post Traumatic Growth (PTG)**

Positive traumatic growth has its roots in positive psychology. PTG was highlighted during Martin E. P. Seligman’s Presidential Address to the American Psychological Association’s Annual Convention on August 21, 1999 (Joseph & Linley, 2008). Seligman disputed that psychologists needed to refocus on a more strength based model of care instead of emphasizing psychopathology. Even though focus of models of
care for psychology have been related to the medical model, positive results of trauma have been found all throughout history. Positive change that was initiated by suffering and distress can be noted in the writings of ancient Hebrews, Greeks, Buddhists, and early Christians (Tedeschi & Calhoun, 1995).

Until more recent times, most research studies have focused on the negative outcomes an individual may experience from traumatic experience. Negative impact more specifically can include the development of symptoms of psychological distress such as PTSD; however only recently has there been an insurgent of research on the concept of PTG following a traumatic life event. Positive psychologists and philosophers have indicated that individuals who undergo traumatic experiences and suffering cannot only recover, but may also surpass their previous level of functioning prior to the traumatic event (Hefferon, Grealy, & Mutrie, 2009).

Zoellner and Maercker (2006) define PTG as “the subjective experience of positive psychological change reported by an individual as result of struggle with trauma.” Calhoun and Tedeschi (1998) proposed in their PTG model the importance of initial distress, personality characteristics, type of trauma, and the context of social support. Tedeschi and Calhoun (2004) then revised the model to include a more functional description. They suggested that the traumatic event must be greatly impactful with shaking or destroying an individual’s important goals and worldviews. Further, the trauma must bring about a challenge to higher-order goals and beliefs and the ability to manage emotional distress.
**Rumination**

Rumination is a result of the emotional distress and the individual attempts to engage in behavior in order to reduce distress. Rumination initially is an automatic response then as time passes it becomes more deliberate. Tedeschi and Calhoun (2004) suggest that rumination is the cognitive process and necessary entity that leads to the outcome of personal growth. PTG encompasses changes in beliefs, goals, behaviors, and identity and may also include the development of life narrative and wisdom (Zoellner & Maercker, 2006; Martin & Tesser, 1989). Bower, Kemeny, Taylor, and Fahey (1998) found that men who engaged in active or deliberate thinking about the loss they experienced of death of a loved one also experienced positive shifts in values or priorities in response to the death.

An essential question when discussing the concept of PTG is how do some individuals thrive and grow from a traumatic event and achieve a higher level of functioning and what factors contribute to this growth (Linley, & Joseph, 2003). Calhoun & Tedeschi (1999) have found that between 30 to 90 percent of individuals that have experienced a traumatic event will experience some positive change (Linley, & Joseph, 2003). Further, Tedeschi and Calhoun (2004) have found that growth from trauma far outnumbers reports of psychiatric disorders (Quarantelli, 1985; Tedeschi, 1999). Tedeschi and Calhoun (2004) found positive changes that included greater appreciation of life and changed life priorities, a greater sense of personal strength, more intimate relationships with others, recognition of new possibilities for one’s life, and spiritual development.

Tedeschi and Calhoun (2004) also explain the improvement of relationships by looking at
preadversity family functioning, changed behavior on the part of the family members other than the adversity survivor in question, the degree to which communication is increased among family members following the adversity, the degree to which proximity is increased among family members, and recognition of these change in others by the adversity survivor (McMillen, 2004).

Other positive changes may include more positive social relationships, being more altruistic, greater feelings of personal strength, being grateful for each day, more awareness and acceptance of their own shortcomings, and focus on social and/or political advocacy (Linley, & Joseph, 2003). McMillen (2004) also suggests other potential growth areas that include:

- increased compassion, increased ability to help others, increased faith in other people, decreased naiveté that can serve as a protective factor against future trauma, material or financial gain, increased knowledge about oneself, desisting harmful alcohol and drug use, increased community closeness and cooperation among neighbors, and increased organizational preparedness for future adversities.

Aspects of personality, environment, and coping processes may have different relations in regards to growth.

Linley and Joseph (2004) reviewed 40 empirical studies and found that there are various names for the positive changes or adversarial growth that can accompany a traumatic event that include posttraumatic growth, stress-related growth, perceived benefits, thriving, blessings, positive-by-products, positive adjustment, and positive adaptation. In addition, Garnefski, Kraaij, Schroeters, and Somsen (2008) have identified terms including PTG, stress-related growth, or benefit finding. The terminology related to PTG is used in a variety ways and is not clearly defined in the literature. Some view PTG as a cognition, attitude, or belief, while others view it as a coping mechanism that challenges the negative impact of trauma or the positive results of struggles with a major
life event (Pat-Horenczyk, & Brom, 2007; Calhoun, Cann, Tedeschi, & McMillan, 2000). Others view PTG in terms of meaning making and also there is debate in regards to adaptive significance. By using various names for growth and not agreeing on the underlying constructs, this contributes to the inconsistency in this area of research. This makes the concept more difficult to study and to build upon findings.

PTG Association with PTSD

Research by Cadell, Regehr, and Hemsworth (2003) advise that continuing personal distress and growth can often co-exist. Just as most individuals will not develop severe pathology from a trauma; it should also not be assumed that they will experience PTG as a result of a trauma (Tedeschi & Calhoun, 2004). Further, growth emerges from struggle with coping and not from the trauma itself and PTG is not universal nor inevitable (Calhoun & Tedeschi, 2004). According to the ‘Janus’ two-faced model (Maerker & Zoellner, 2004), individuals are able to find benefit from their traumatic event, while also being able to acknowledge the distressing side as well. Zoellner and Maercker (2006) suggest that it is important to consider PTG and PTSD as two distinct separate entities representing separate continuous dimensions. PTG should not be considered as an increase in well-being and a decrease in distress (Tedeschi & Calhoun, 2004). Therefore, growth and emotional distress can exist at the same time for some individuals.
Figure 1: A model of posttraumatic growth.

In regards to those diagnosed with PTSD, some studies have found negative symptoms associated with positive life changes, some have found positive associations with stress-related growth, and others have found no association (Pat-Horenczyk, & Brom, 2007). Results of examining studies indicated “greater levels of perceived threat and harm are associated with higher levels of adversarial growth, while not a consistent linear association between degree of trauma and growth (Linley & Joseph, 2004).” Further Linley and Joseph (2004) found that lower depression scores and higher positive well-being had more PTG; however Tedeschi and Calhoun (2004) found that distress and growth to be unrelated (Garnefski, et al., 2008). Further, Snape (2010) found that PTG was not correlated with anxiety and depression, but was significantly correlated with intrusion and avoidance scores. In a study by Morrill, Brewer, O’Neill, Lillie, Dees, Carey, and Rimer (2008) results indicated that PTG moderated relationships between post-traumatic stress symptoms (PTSS) and both depression and quality of life (QOL) in breast cancer survivors. Results suggest that PTG may serve as a protective buffer and could possibly serve as deflecting long term occurrence of depressive symptoms and impaired QOL.

Zoellner and Maercker (2006) suggest that most cross sectional studies indicate that there is no relationship between PTSD and PTG and there is also no relationship between PTG and depressive symptoms. Also studies looking at relationships between PTG and anxiety, anger, and hopelessness were also inconclusive. Sociodemographic variables (gender, age, education, and income) and psychological distress variables (depression, anxiety, PTSD) have shown to have had inconsistent associations with adversarial growth. Depression and anxiety were not found to be predictors of PTG and
individuals with significant depression or anxiety were less likely to report growth (Linley & Joseph, 2004).

Park et al (1996) found six significant predictors of stress-related growth: positive reinterpretation, intervening positive life events, acceptance coping, intrinsic religiousness, initial stressfulness of the event, and social support satisfaction (Linley & Joseph, 2004). Difficulty lies in making definitive conclusions regarding Park et al’s findings; however it appears that

the greater traumatic experience, dealt with means of positive reinterpretation and acceptance coping, in people who are optimistic, intrinsically religious, and experience more positive effect, are likely to lead to reports of greater adversarial growth (Linley & Joseph, 2004).

These findings are important to consider as facilitating growth may be important in helping to lessen distress, which would be an important change of focus in treatment for those who have experienced a traumatic event. Further, cognitive changes may not be enough and behavioral changes may need to accompany. PTG needs to further scientific inquiry in order for it to morph into a more stable, scientific concept (Pat-Horenczyk & Brom, 2007).

Scales Measuring Growth

According to Linley and Joseph (2004), seven instruments have been published that measure PTG. The Post-traumatic Growth Inventory (PTGI) was developed by Tedeschi and Calhoun (PTGI; 1995, 1996) and is the most common scale used to measure growth in research. The PTGI consists of 21 items and five subscales that assess growth in the following dimensions: relating to others, new possibilities, personal strength, spiritual change, and appreciation of life. These five subscales can be
categorized into 3 more broad categories of perceived changes in self, a changed sense of relationships with others, and a changed philosophy of life. Subscales specifically measure how individuals that have lived through a traumatic event may enable an individual to recognize their ability to be self-reliant and competent in difficult situations. In regards to changed relationships with others, they may reevaluate relationships that include realizing the importance of their relationships and how quickly they can be lost. Further, the acknowledgment of one’s vulnerability can lead to more emotional expressiveness and seeking out more social support than had been previously overlooked.

In terms of changed philosophy of life, research from Joseph, Williams, and Yule reported that survivors of the sinking ship Jupiter no longer took life for granted and 71% reported living their lives to the fullest (as cited in Tedeschi & Calhoun, 1996). PTGI has acceptable construct validity, internal consistency (.90), and test-retest reliability over a two month interval (.71).

Tedeschi and Calhoun (1995) reported that in terms of gender outcomes, women typically tend to experience more benefits than men. Also individuals that have experienced traumatic event will more likely experience growth than those who have not. Further, the PTGI scale is modestly related to the variables optimism and extraversion.

Other scales used to measure growth include the Stress-Related Growth Scale (ARGS; Park et al., 1996) which is a 50 item measure. The Revised Stress-Related Growth Scale (RSRGS; Armeli et al., 2001) contains 43 items and eight subscales that include examining factors of affect regulation, religiousness, treatment of others, self-understanding, belongingness, personal strength, optimism, and life satisfaction. The Changes in Outlook Questionnaire (CiOQ; Joesph et al., 1993) is composed of 26 items.
and is a measure of positive and negative changes. The Thriving Scale (TS; Abraido-Lanza et al., 1998) is made of 20 items that utilizes 15 items from the SRGS and 3 items from the PTGI and 2 items by the authors. The Illness Cognition Questionnaire (ICQ; Evers et al., 2001) has three 6-item subscales (first scale Perceived Benefits relevant to this area of study). Lastly, the Perceived Benefit Scales (PBS; McMillen & Fisher, 1998) is composed of 30 positive change items and 8 subscales: enhanced self-efficacy, increased community closeness, increased spirituality, increased compassion, increased faith in people, lifestyle changes, enhanced family closeness, and material gain and 8 negative change items (Joseph & Linley, 2004).

Joseph, Linley, and Harris (2005) examined several instruments that are used to measure growth following a traumatic event. Researchers sample consisted of 176 adults who had experienced a range of distressing life events including the death of a loved one, illness of self, illness of others, relationship problems, family problems, divorce, job-related problems, and other events. Individuals completed the Perceived Benefit Scales, the Thriving Scale, and the Posttraumatic Growth Inventory. Results suggested that all subscales loaded highly on a single component, therefore indicating a unitary phenomenon. Further, results suggested the possibility of three second-order components including interpersonal relationships, self-perception, and life philosophy.

*Research Studies with PTG Results*

*General Medical*

Numerous research has been conducted regarding the concept of PTG with those with medical concerns including cancer, spinal cord injuries, multiple sclerosis, and rheumatic diseases (Garnefski, et al., 2008; Helgeson, Reynolds, & Tomich, 2006).
Further, PTG studies have included HIV infection, bone marrow transplantation, heart attacks, coping with medical problems of children, bereavement, transportation accidents, house fires, sexual assault and sexual abuse, combat, refugee experiences, and being taken hostage (Tedeschi & Calhoun, 2004a; Tedeschi & Calhoun, 2004b). With regard to medical illnesses and PTG, cancer has been the most research area with breast cancer having the most studies conducted. These studies have strongly supported that PTG can result from various life stressors of traumatic events; however there should be some consideration in that the type of trauma may impact personal growth differently. For example, growth from trauma resulting from medical illness versus growth from trauma due to a natural disaster would not necessarily mimic the same process of growth (Hefferon, et al., 2009). Specifically, the difference that occurs with a medical illness is the process of physical connection with the body and having to cope with these changes. Further, Tedeschi, Park, and Calhoun (1998) suggested that after large-scale disasters, social support is usually decreased so therefore growth will not necessarily be as high as it is in individuals with medical concerns such as the diagnosis of cancer. Social support is considered an essential component necessary for growth as it affects rumination and coping behaviors and certain traumatic events may not elicit this as much as others.

Research from Hefferon et al. (2009) regarding illness indicates that recovering and thriving from an illness may create new awareness and an increased importance of the body. Further, results indicated that survivors took an increased interest in maintaining their health, listened to their bodies, improved health behaviors, visited their physicians for routine check-ups, decreased risky behaviors, and had an overall new positive identification with their body.
**Cancer**

Research from studies regarding PTG and breast cancer have found that PTG was not related to distress or well-being, but was positively associated with perceived life threat, prior talking about breast cancer, income, and time since diagnosis (Cordova, Cunningham, Carlson, & Andrykowski, 2001). Schulz and Mohamed (2004) reported that those individuals who underwent tumor surgery found that social support was the strongest indicator of positive changes after a stressful surgery, both directly and indirectly regarding social comparison. Weiss (2010) also looked at breast cancer in women and also included their husbands to see if both partners would experience PTG. Results indicated that 40 wives (98%) experienced positive changes in their life, as well as 36 husbands (88%) also reported significant, positive changes in their lives after this medical event. In addition, a study by Gotay, Ransom, and Pagano (2007) found that those survivors of multiple cancers experienced modest, but lasting decrements in overall quality of life. Results from this study may have implications for PTG in that those with multiple cancers are not as likely to experience growth due to these medical events.

**Brain Injury**

In a small scale study with those with acquired brain injury, McGrath and Linley (2006) found that PTG is also applicable to this population. Individuals reported a significant amount of PTG from the PTGI measure. Further, there was some indication that a significant amount of time may need to pass in order for PTG to develop. A study by Powell, Ekin-Wood, and Collin (2007) also supported this finding in that the measures from the PTGI including relating to others, personal strength, new possibilities, and
appreciation of life and spirituality appeared to increase over time after an individual has experienced a head injury.

*Studies of Children*

Michel, Taylor, Absolom, and Eiser (2009) found that survivors of childhood cancer that reported benefit finding was associated with optimism, but not with pessimism. Findings indicated children that reported their illness still impacts their life today also reported more benefit finding. Also children that were diagnosed with leukemia reported more benefit finding than those survivors of solid tumors. These results may suggest that illnesses that are longer in duration may overall result in more benefit finding. There was no indication of an association between child benefit finding and parent PTG.

In addition to children and research with PTG, Salter and Stallard (2004) found that 67 (42%) of child survivors of road trauma reported some aspects of PTG, specifically within the realm of philosophy of life. Results indicated that 25 (37%) were experiencing PTSD. These latter results support the concept that PTG and PTSD are not mutually exclusive. Results of this study could not delineate if possible adverse reactions prevented or ameliorated positive attributions (Salter & Stallard, 2004).

*Childhood Abuse*

When considering childhood abuse, researchers Woodward and Joseph (2003) found through personal experience narratives, that individuals experienced positive change and personal growth. Further, researchers Lev-Wiesel, Amir, and Besser (2005) found that those who had survived interfamilial sexual abuse had higher levels of PTSD as well as higher levels of PTG than those who were not abused by a family member.
Bereavement

Calhoun and Tedeschi (1990) interviewed 52 individuals who had lost a spouse or parent. Results indicated individuals having an increased appreciation of social support, feeling more independent and more accepting of mortality, great self-efficacy and strength, stronger religious commitment, and being able to more readily express emotions (Cadell, Regehr, & Hemsworth, 2003). Further, a study was conducted by Cadell, Regehr, and Hemsworth (2003) with bereaved HIV/AIDS caregivers to explore factors related to PTG. Results indicated that those with strong connections to spirituality, had greatest amount of social support from family and friends, and those individuals who experienced the highest level of distress were more likely to experience higher levels of growth. Further, Cadell (2003) found that out of 176 bereaved HIV/AIDS carers in Canada, 86.4% of them exhibited PTSD symptoms as well as 81.8% had scores indicative of PTG. These results concur with the notion that PTSD and PTG can co-occur.

Researchers (Jenewein, Moergeli, Fauchere, Bucher, Kraemer, Wittman, Schnyder, & Buchi, 2008) have found that in the long term, bereaved and non-bereaved parents cope reasonably well with an extremely preterm birth of a child with PTG being found in mothers positively related to bereavement. Specifically in the PTGI subscales, “relating to others” showed significantly higher scores. These results were also found by Polatinsky and Esprey (2000) that parents bereaved experienced a perceived benefit from their loss. Results also indicated a potential association of greater benefit and bereaved through illness. The greater amount time elapsed since the bereavement also seemed to be an indicator for greater benefit finding. Also it appeared that younger individuals and
those married also had higher PTGI scores. Further, researchers have indicated that with bereavement it may be important to focus on assumptive world changes in the aftermath of crisis (Gerrish, Dyck, & Marsh, 2009). Additionally, in studies regarding PTSD and bereavement, it is important to acknowledge that the major difference with these individuals who have experienced a loss is that they would change this event of losing a loved one if they could.

**Life’s Most Traumatic Event**

Park, Mills-Baxter, and Fenster (2005) asked elders about the most traumatic event that they had experienced in their lifetime and examined the lasting impact of PTG. Some of the life experiences reported as most stressful included death of a loved one (especially child or spouse), family illness, participants’ own illness or disability, combat experiences or war, family issues, work issues, divorce, and other experiences. PTG was found to be positively associated with several coping strategies including self-distraction, emotional support, venting, positive reframing, planning, use of humor, and religious coping.

**Natural Disaster**

Kraemer, Wittman, Jenewein, and Schnyder (2009) conducted research on Swiss tourists that were involved in the 2004 Tsunami and assessed them for PTSD, anxiety, depression, and PTG. Results indicated that 16.8% endorsed criteria for PTSD, 17.8% for anxiety, and 8.0% for depressive disorder. Results indicated that those tourists that had been directly affected had more intense PTSD, anxiety, depression, and PTG, than tourists who were not directly affected or unaffected. This study further purports the need for psychological intervention to help those who have experienced a traumatic event such
as from a natural disaster including addressing PTSD concerns and helping with the recognition and development of PTG.

A study by Karanci and Acartuk (2005) found PTG as an outcome in volunteers from the Marmara Earthquake in Turkey. Researchers examined aspects of being a volunteer looking at pre-disaster, within disaster, and post disaster. Significant predictors related to growth included using problem solving/optimistic and fatalistic coping, and being a disaster preparedness volunteer. Prior to examining predictive value of the three stages of disaster, PTG was significantly correlated with perceived severity of impact, perceived life threat, perceived social support, problem focused coping, fatalistic coping, and helpless coping. Researchers from this study indicated that measuring coping strategies is not enough in studying PTG and it would be beneficial to look at personality characteristics of volunteers. Further, researchers indicated that being a member in a preparedness group may enhance growth.

*Rescue Workers*

Melerski (2006) conducted a qualitative dissertation that examined trauma, coping, and functioning in rescue workers that were involved in the terrorist attacks that occurred on September 11, 2001. Workers were examined 34 to 39 months after the incident. Results indicated a 13% probable rate of PTSD, as well as 87% of participants reported a positive outcome due to being involved in this traumatic event with 53% expressing experiencing multiple positives. Experiences described included appreciation of/importance of life, personal growth, camaraderie, helping others/contributing, focus on others/relationships closer, recognition of work, professional growth/better prepared, spirituality, and more perspective Melerski, 2006).
Recently there have been several studies to examine if PTG occurs with different life traumas including medical concerns, child sexual abuse, bereavement, and natural and manmade disasters as discussed thus far. Currently, there has been no research to address if PTG will occur in those workers in transportation. There has been no research conducted on PTG and those who witness trauma as an occupational hazard in the railroad industry. Specifically when addressing transportation trauma, the incident the workers witness does not usually threaten their own life, but often will threaten the physical integrity of another. The phenomenon of PTG applying to those in transportation railway accidents has not yet been examined.

Table 1: Summary of Findings from PTG Studies

<table>
<thead>
<tr>
<th>Authors</th>
<th>Population</th>
<th>Measures</th>
<th>Factors</th>
<th>Outcomes</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td>Emotional support</td>
<td>Duke – UNC Functional Social Support Questionnaire (DUKE-SSQ)</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Ryffs Well-Being Scales</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>• Growth</td>
<td>• Growth</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>• Purpose in Life</td>
<td>• Self-efficacy</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>• Self-Acceptance</td>
<td>• Social support</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>• Coping</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Social support retained a direct effect on benefit finding.</td>
</tr>
<tr>
<td>Authors</td>
<td>Population</td>
<td>Measures</td>
<td>Factors</td>
<td>Outcomes</td>
</tr>
<tr>
<td>-------------------------------</td>
<td>-----------------------------------</td>
<td>--------------------------------------------------------------------------</td>
<td>--------------------------------</td>
<td>---------------------------------------------------------------------------</td>
</tr>
<tr>
<td>Gotay, Ransom and Pagano (2007)</td>
<td>Cancer survivors</td>
<td>• Global Quality of Life (QOL) • Life Orientation Test (LOT) • PTGI • QOL-LOT-optimism</td>
<td>• Optimism • Growth</td>
<td>Survivors of multiple primary cancer diagnoses had significantly lower global QOL.</td>
</tr>
<tr>
<td>McGrath and Linley (2006)</td>
<td>Brain injury</td>
<td>PTGI</td>
<td>Growth</td>
<td>Participants showed evidence of substantial positive psychological change.</td>
</tr>
<tr>
<td>Michel, Taylor, Absolom and Eiser (2009)</td>
<td>Survivors of childhood cancer</td>
<td>• Children: Benefit Finding Scale for Children (BFSC) and QOL • Parents: PTGI and QOL</td>
<td>Growth</td>
<td>Diagnosis of leukemia, greater optimism and reports that the illness still affects their life today were associated with higher scores on the BFSC among survivors themselves. For parents, perceptions of how much the illness still affects them emotionally was associated with PTG.</td>
</tr>
<tr>
<td>Salter and Stallard (2004)</td>
<td>Child survivors of road trauma</td>
<td>Qualitative categorized responses by the three categories from Tedeschi and Calhoun</td>
<td>• Perception of Self • Interpersonal Relationships • Philosophy of Life</td>
<td>Children can experience a degree of posttraumatic growth after being involved in an RTA.</td>
</tr>
<tr>
<td>Woodward and Joseph (2003)</td>
<td>Childhood Abuse</td>
<td>Qualitative (thematic analysis)</td>
<td>Inner drive toward growth, vehicles of change and psychological changes</td>
<td>Experienced PTG.</td>
</tr>
<tr>
<td>Lev-Wiesel, Amir and Besser (2005)</td>
<td>Childhood sexual abuse</td>
<td>PTGI</td>
<td>Growth</td>
<td>Posttraumatic growth was higher among survivors who were sexually abused by a</td>
</tr>
<tr>
<td>Authors</td>
<td>Population</td>
<td>Measures</td>
<td>Factors</td>
<td>Outcomes</td>
</tr>
<tr>
<td>------------------------------</td>
<td>-----------------------------------------</td>
<td>-------------------</td>
<td>---------</td>
<td>---------------------------------------------------</td>
</tr>
<tr>
<td>Calhoun and Tedeschi (1990)</td>
<td>Individuals who had lost a spouse or parent</td>
<td>Bereavement, Interviewed</td>
<td>Growth</td>
<td>More mature, more independent, better able to face other crises.</td>
</tr>
<tr>
<td>Cadell (2003)</td>
<td>Bereaved HIV/AIDS careers</td>
<td>PTGI</td>
<td>Growth</td>
<td>81.8% had scores indicative of PTG.</td>
</tr>
<tr>
<td>Polantinsky and Esprey (2000)</td>
<td>Bereaved parents</td>
<td>PTGI</td>
<td>Growth</td>
<td>Results also indicated a potential relation between greater perception of benefit and those bereaved through illness, and more perception of benefit for the longer the time elapsed since the bereavement. Lastly, there was a tendency for younger individuals and married respondents to obtain higher scores in the PTGI.</td>
</tr>
<tr>
<td>Park, Mills-Baxter and Fenster (2005)</td>
<td>Life’s Most Traumatic Event</td>
<td>Stress-Related Growth Scale</td>
<td>Growth</td>
<td>PTG was found to be positively associated with several coping strategies including self-distraction, emotional support, venting, positive reframing, planning, use of humor and religious coping.</td>
</tr>
<tr>
<td>Kraemer, Wittman, Jenewein and Schnyder (2009)</td>
<td>Swiss tourists that were involved in the 2004 Tsunami</td>
<td>PTGI</td>
<td>Growth</td>
<td>Tourists that had been directly affected had more intense PTSD and PTG.</td>
</tr>
<tr>
<td>Karanci and Volunteers from Stress Related Growth and Growth</td>
<td>PTG was significantly</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Authors</td>
<td>Population</td>
<td>Measures</td>
<td>Factors</td>
<td>Outcomes</td>
</tr>
<tr>
<td>-------------------------</td>
<td>-------------------------------------</td>
<td>---------------------------------</td>
<td>--------------------------</td>
<td>-------------------------------------------------------------------------------------------------------------------------------------------</td>
</tr>
<tr>
<td>Acartuk (2005)</td>
<td>the Marmara Earthquake</td>
<td>Scale</td>
<td>• Coping</td>
<td>correlated with perceived severity of impact, perceived life threat, perceived social support, problem focused coping, fatalistic coping and helpless coping.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Ways of Coping Questionnaire</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Melerski (2006)</td>
<td>Rescue workers</td>
<td>Narrative</td>
<td>Growth</td>
<td>87% of participants reported a positive outcome due to being involved in this traumatic event with 53% expressing experiencing multiple positives, appreciation of/importance of life, personal growth, camaraderie, helping other/contributing, focus on others/relationships closer, recognition of work, professional growth/better prepared, spirituality and more perspective.</td>
</tr>
<tr>
<td>Calhoun, Cann, Tedeschi and McMillan (2000)</td>
<td>Individuals that had a traumatic event</td>
<td>• Quest Scale</td>
<td>• Religion</td>
<td>More rumination after the event and greater openness to religious change were related to PTG.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• PTGI</td>
<td>• Growth</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Items from several instruments</td>
<td>• Rumination</td>
<td></td>
</tr>
<tr>
<td>Authors</td>
<td>Population</td>
<td>Measures</td>
<td>Factors</td>
<td>Outcomes</td>
</tr>
<tr>
<td>-------------------------</td>
<td>--------------------------</td>
<td>---------------------------------------------------------------------------</td>
<td>--------------------------------</td>
<td>---------------------------------------------------------------------------</td>
</tr>
<tr>
<td>Garnefski, et al (2008)</td>
<td>Myocardial Infarction (MI)</td>
<td>• Neuroticism Extraversion • Openness-Five Factor Inventory (NEO-FRI) • Personal Growth Scale (PGS) • Cognitive Emotion Regulation Questionnaire (CERQ)</td>
<td>• Personality • Growth • Cognitive Coping</td>
<td>Cognitive coping strategies of putting into perspective, positive refocusing and positive reappraisal were associated with PTG, while acceptance, planning, rumination, self-blame and other blame were not found to be significant, 18% of variance of PTG could be explained by neuroticism, extraversion and conscientiousness, 8% of variance of PTG individuals with a myocardial infarction was explained by psychological health.</td>
</tr>
<tr>
<td>Dorfel, Rabe and Karl (2008)</td>
<td>Motor vehicle accident survivors</td>
<td>Eysenck Personality Inventory (EPI)</td>
<td>Personality</td>
<td>Trait of extroversion may serve as a protective factor against PTSD.</td>
</tr>
</tbody>
</table>

**Cognitive Coping Strategies**

According to Tedeschi and Calhoun (2004),

much like earthquakes can impact the physical environment, traumatic circumstances, characterized by their unusual, uncontrollable, potentially irreversible and threatening qualities, can produce an upheaval in trauma survivors’ major assumptions about the world, their place in it and how they make sense of their daily lives.

An individual may need to reformulate goals and schemas in order to be able to acknowledge how their worldviews have changed.

Tedeschi and Calhoun’s model is composed of a major life event that challenges an individual’s primary schemas and beliefs about self and world and also cognitive processing in regard to the meaning of the event. PTG is when an individual experiences
a struggle with a life crisis and experiences a positive change due to this life crisis. The event must be severe enough that it disturbs previously held assumptions. The event may completely upset the individual’s worldviews and perspectives and they may need to reorganize their thought processes. The traumatic event may result in shattered assumptions and inflict important losses. Cognitive processing is important part of an individual’s attempt to recompose worldviews and adjust to the trauma (Calhoun, Cann, Tedeschi, & McMillan, 2000; Tedeschi & Calhoun, 1995).

Each individual who experiences a traumatic will have different responses due to danger, disaster, loss, and shock. The responses to the traumatic event are viewed as coping strategies. Cognitive coping strategies are oftentimes looked at as mechanisms that are subject to potential influence and change (Garnefski, et al., 2008). PTG is associated with adaptive coping (Linley & Joseph, 2004; Park & Helgeson, 2006) with a higher level of cognitive processing (Garnefski, et al., 2008; Tedeschi & Calhoun, 2004). Memories are integrated through a process of remembering and avoiding, meaning making, and returning to a balance of functioning; therefore an individual demonstrating resilience (Pat-Horenczyk, & Brom, 2007) and then also surpassing functioning before the traumatic event to gain growth.

*Cognitive Appraisal Variables*

Cognitive appraisal variables that have been associated with positive growth include (coping social support, and religion) problem-focused coping, acceptance, positive reinterpretation coping, and positive religious coping. Emotion-focused coping including emotional social support has been found to be positively associated with growth; social support in general terms also appears to be related to growth. Further,
cognitive processing, rumination, intrusions, and avoidance were also positively associated with growth. These variables are considered necessary “for the rebuilding of shattered world views following trauma (Linley & Joseph, 2004; Calhoun & Tedeschi, 1998; Janoff-Bulman, 1992).”

Cognitive processing has been considered to be key elements in the formation of PTG. Key elements of cognitive processing include rumination, schema change, and life narrative development. Further, theories regarding PTG emphasize the importance of schema reconstruction (Tedeschi, 1999). Tedeschi and Calhoun (2004) explain social relationship as their influence in PTG is abilities to promote rumination and therefore the revision of schemas (McMillen, 2004). Researchers Calhoun, Cann, Tedeschi, and McMillan (2000) found that in a study with 54 students that experienced a traumatic event that the more rumination, the greater degree of PTG. Further, Tedeschi, Park, and Calhoun (1998) found that there is a significant relationship between acceptance coping, positive reinterpretation, and perceived growth.

There should be some consideration when explaining the concept of rumination. Rumination that is negative can have an adverse impact on an individual, while event related rumination that is not solely negative can lead to PTG (Calhoun, Cann, Tedeschi, & McMillan, 2000; Nolen-Hoeksema, McBride, & Larson, 1997). An individual needs to spend some time thinking about the event in order to experience growth, although there is uncertainty regarding the specifics of the predicted relationship. In order to gain a better understanding of this concept, further consideration with cognitive processing should include if the thoughts are considered intrusive, the duration and the timing of the thoughts, the content of the thoughts, (problem solving, reminiscence, meaning making),
and whether the cognitive processing is deliberate or automatic for the individual (Tedeschi and Calhoun, 1995).

There have been a limited number of studies examining concepts related to rumination. Calhoun, Cann, Tedeschi, and McMillan (2000) examined event related rumination, quest orientation to religion beliefs, and religious involvement and relationship to PTG. Results indicated that the more rumination after the event and greater openness to religious change were related to PTG. There is some evidence to suggest that individuals experiencing PTG seek out religious experiences or their religious affiliation helps them move towards spiritual growth (Calhoun, Cann, Tedeschi, & McMillan, 2000; Tedeschi & Calhoun, 1996). Researchers Calhoun et al. (2000) found that general religion did not predict PTG, however quest orientation to religious belief did. When an individual’s cognitive processing includes meaning making and significance, then more likely to experience PTG (Calhoun, Cann, Tedeschi, & McMillan, 2000; Tedeschi & Calhoun, 1995). In addition, a study by Karanci and Acarturk (2005) indicated that using problem solving/optimistic and fatalistic coping and being a disaster preparedness volunteer are significant predictors of PTG.

Results from a study by Garnefski, et al. (2008) found that the majority of variance (25%) was explained by cognitive coping strategies regarding PTG for a population that had a myocardial infarction (MI). Specifically the cognitive coping strategies of putting into perspective, positive refocusing, and positive reappraisal were associated with PTG, while acceptance, planning, rumination, self-blame, and other blame were not found to be significant in the MI sample. These results can be potentially influential for treatment as coping strategies appear to be changeable unlike personality
(Garnefski, et al., 2008). Further, these ‘adaptive’ strategies of helping individuals put events into perspective, learning to refocus on positive issues, and reappraising the situation may be helpful to increase job performance and job satisfaction.

A commentary by McMillen (2004) questions the model’s reliance of cognitive processing being responsible for PTG. Even Tedeschi and Calhoun (2004) suggest that the “phenomenon is complex, and cannot be easily reduced to simply a coping mechanism, a cognitive distortion, psychological adjustment or well-being, or a host of apparently similar constructs (McMillen, 2004).” McMillen (2004) noted that the role of supportive others needs to be further explored, as well as role of culture in terms of promotion of PTG, while also exploring cognitive processing concepts.

*Janus Face of Self-Perceived Growth*

Maercker and Zoellner (2004) suggest a two-component model (the Janus face model) to help explain the phenomenon of PTG. PTG has a constructive, transcending side that is explained by Calhoun and Tedeschi, although does not necessarily address the self-deceptive, illusionary side. Maercker and Zoellner (2004) suggest that the constructive side can be based on cognitive restructuring, while the self-deceptive side may be based on denial, avoidance, wishful thinking, self-consolidation, or palliation. Recently researchers (Taylor, 1983; Taylor & Amor, 1996; Taylor, Kemeny, Reed, Bower, & Gruenewald, 2000) have broached the topic of positive illusions. Through Taylor and associates research, they revealed that when individuals are faced with a traumatic event that they can often respond with distorted positive perceptions of themselves, an inflated sense of personal control, and unrealistic optimism. Taylor (1983) who coined the term positive illusion, suggests that themes including a search for
meaning, an effort to regain sense of mastery, and an attempt to restore positive sense of
sense may all be themes in which transformation may occur (Maercker and Zoellner,
2004).

Zoellner and Maercker (2003) suggested a change in the two component model in
that the illusionary part does not necessarily lend to denial and maladjustment.
Individuals may create illusions as an active coping mechanism against the trauma. The
illusion may serve as a short-term palliative function, with neither bad nor good long-
term consequences. Therefore, when an individual is confronted with a traumatic event,
the illusion may serve as self-enhancement cognition. However if the illusion becomes
associated with avoidant coping behaviors including wishful thinking, denial, and
repression, then it may in turn have a negative impact on adjustment. Therefore, the two
face model functions can be adaptive as well as maladaptive (Maercker and Zoellner,
2004).

**Personality Characteristics**

Personality variables are factors that appear to contribute to whether an individual
experiences PTG. Extraversion, openness to experience, agreeableness, and
conscientiousness were variables found to have a positive correlation with PTG, while
neuroticism has had a negative association (Linley & Joseph, 2004). Results from
Garnefski, et al. (2004) regarding those with myocardial infarction indicated that 18% of
variance of PTG could be explained by neuroticism, extraversion, and conscientiousness.
With regards to extraversion, this trait was the most consistent and significant predictor
of growth as found in previous studies (Sheikh, 2004). Certain studies have suggested
that the trait of extroversion may serve as a protective factor against PTSD (Dorfel, Rabe,
& Karl, 2008; Kuhne, Orr, & Barraga, 1993; Nightingale & Williams, 2000). Dorfel, Rabe, and Karl (2008) also found this to be true in motor vehicle accident survivors. Eysenck (1964) has argued that the reason for these findings is that extraverts can afford more arousal than introverts (Dorfel, et al., 2008).

Openness to new experiences, which is correlated with extraversion, is found in those who are imaginative, emotionally responsive, and intellectually curious. Tedeschi and Calhoun (1996) found that in a sample of college students that this was correlated with PTG (Zoellner and Maercker, 2006).

Garnefski et al. (2004) suggests interplay between the three variables of neuroticism, extraversion, and conscientiousness; however other studies have not had these same findings. The findings of Tedeschi and Calhoun (1996) contradicts when including personality characteristic of neuroticism, although supports findings from Evers, Kraaimaat, van Lankveld, Jongem Jacobs, & Bijlsma (2001) (Garnefski, et al., 2004). To make findings more complicated, Garnefski et al. (2008) also found that 8% of variance of PTG in individuals with a myocardial infarction was explained by psychological health which includes positive well being and low level of depressive symptoms. With a low level of variance explained by this variable, Tedeschi and Calhoun (2004) emphasize that PTG should not be looked at similarly as increase in well-being and a decrease in distress (Garnefski, et al., 2008).

Optimism

Results from studies also have indicated that those with higher levels of self esteem and were more optimistic were more likely to report higher levels of growth. Also personality variables self-efficacy and hardiness were associated with growth, while
personality variable coherence was not (Linley & Joseph, 2004). Individuals that are optimistic typically demonstrate more flexibility in their ability to cope and tend to be more adaptive in regards to when problems arise. They are more apt to utilize problem focused coping in controllable situations and use reframing and acceptance coping in uncontrollable situations (Zoellner and Maercker, 2006; Scheier, Carver, & Bridge, 2001). Further, studies have found that optimists are more likely than pessimists to utilize adaptive coping skills (Wagner, Knaevelsrud, & Maercker, 2007; Weintraub, Carver, & Scheier, 1986). Research also has indicated that when an individual experiences a traumatic event, for example cancer, optimism can impact their behavioral choices (Wagner, Knaevelsrud, & Maercker, 2007; Allison, Guichard, Fung, & Gilain, 2000). Alternatively, results of treatment for those experiencing complicated grief found PTG in treatment group; however no treatment effect for optimism. One possibility for this outcome is that optimism may not have changed due to being a relatively stable personality trait (Wagner, Knaevelsrud, & Maercker, 2007; Scheier & Carver, 1985). Further, Zoellner and Maercker (2006) may explain these differences by considering personality traits as habitual cognitive processing styles. Personality traits are generally stable, so therefore directly impact the way an individual processes the traumatic event.

Trait Self-Enhancement

Gupta and Bonanno (2010) examined potentially traumatic events (PTEs) in college students over a four year period. The most commonly reported events included personal illness or injury, hospitalization of someone close or important, and illness or injury to someone close or important. Results indicated that individuals with greater exposure to PTEs had higher levels of distress, although individuals that were high in the
personality trait self-enhancement were relatively not impacted by the PTE exposure. It appears that the trait self-enhancement may serve as a buffer against the negative impact of trauma. Further, Paulhus (1998) supported these findings in those individuals with trait self-enhancement had a positive adjustment following PTEs. Self enhancers are often extremely positive and should be taken with caution as they can also be possibly unrealistic filled with self illusions. Self enhancers though may be well suited for individuals managing a traumatic event. In addition, researchers examined included the personality variables of optimism and neuroticism and found that neuroticism was correlated with first and fourth year distress and optimism was meaningfully inversely correlated with fourth year distress (Gupta & Bonanno, 2010).

Limitations

McMillen (2004) suggests that it would be difficult to conclude that Tedeschi and Calhoun (1996) were able to thoroughly identify all domains of growth through one sample that consisted of college undergraduate students. The list is not exhaustive, although appears to cover the most prevalent themes. Culture may be relevant to survivors’ pretrauma fundamental schemas, beliefs and goals, the types of trauma people typically endure, the management of emotional distress of adversity, ongoing life narrative development, the degree to which survivors use different aspects of rumination to cope with adversity, and the degree and types of social support received following adversity (McMillen, 2004).

Pals and McAdams (2004) also urge that there are other factors to consider that were not fully addressed in Tedeschi and Calhoun’s PTG model. They argue the need for more research and consideration regarding the role of narrative building within PTG as well as culture. They advise that building PTG is an identity-making and narrative based
practice. Essential components of the practice include how individuals apprehend and work through the traumatic event. Further, there should also be consideration to the extent they construct a positive and reasoned ending to the story through seeing the self as transformed in a positive way. Neimeyer (2004) also argues that self-narratives are the very essence that is disrupted through trauma and loss that need to undergo a transition of repair and transcendence. Lastly, the way the individual proceeds to tell their story of trauma and adversity can be shaped by the culture in which they are entrenched which can include coloring from economic, political, religious, ideological, and historical factors (Pal & McAdams, 2004). All of these factors should be considered in further research in PTG.

Treatment Possibilities with PTG

PTG has been developed out of positive psychology and can be used effectively to therapeutically help those individuals whom have experienced a traumatic event (Linley & Joseph, 2003). Just as it is essential to provide information to clients regarding the distressing effects of trauma, it is also important to educate them about the possibility of growth. Therefore, PTG may have implications in the way that therapy is conducted. Clinical interventions that are sensitive and appropriate can be utilized to promote growth after a traumatic event by taking advantage of the trauma induced disruption that occurred in the individual’s life (Lechner & Antoni, 2004). There may be challenges developing manualized treatment such as cognitive behavioral therapy and other modalities such as client-centered, experiential, and existential psychotherapies may be more helpful in encouraging PTG in those who have experienced a major unsettling life event (Linley, & Joseph, 2003).
When provided therapy to a client that has experienced a traumatic event and is distressed, it may be beneficial to first allow them to regain the ability to cognitively engage. Clinicians must feel comfortable with helping their clients to process existential and spiritual matters. Most of the time listening to the client without trying to solve problems will help them process trauma into growth (Calhoun & Tedeschi, 1999). When considering clients telling their stories in a narrative form, the creative therapeutic alliance can be helpful in fostering its development (Neimeyer, 2004). Therapeutic journals may be helping for individuals in finding meaning and positive emotion by being able to write deeply and consistently about the painful events in their lives. Through this process they may reap mental health benefits (Neimeyer, 2004; Pennebaker, 1997). In addition to this strategy, the use of narrative methods including biographical techniques, loss characterizations, metaphoric stories, and life chapters’ exercises may be helpful in promoting meaning reconstruction following loss (Neimeyer, 2004; Neimeyer, in press).

It is recommended that clinicians relate to their clients their own personal change as a result of listening to the trauma. Although a clinician cannot bring about PTG in their clients, they can pay close attention to when their clients discover it by noting, labeling, and reinforcing (Weiss, 2002). Further recommendations from Hutchinson and Lema (2009) include being careful with labeling and diagnoses as these invariably are negative pathological (example suffering from PTSD); noticing resistance and use this to empower the client; inviting fun and laughter and other positive emotions into the therapeutic session can help to build resilience; listening to the client and paying close attention to strengths and acts of coping; and also giving adequate attention to client’s theory of change. Further, it is important to continually listen to our clients, focusing in on their
strengths, understanding their resistance, acknowledging their competence, and to also pay attention to the part of their lives that are not saturated by trauma. Interventions used to develop PTG are best addressed after a sufficient amount of time has passed so that the individual has been able to begin to process the trauma (Tedeschi & Calhoun, 2004).

**Summary**

Psychotraumatology has emphasized the detrimental effects of trauma and has therefore confined the research of trauma to a deficit oriented model (Zoellner & Maercker, 2006). There have been numerous research studies that have examined the impact of being involved in a traumatic event. Specifically, there have been studies that have addressed the experience of a train driver being involved in a critical incident while working and the impact of this event. Recently a growing body of literature has examined PTG in the aftermath of trauma. While numerous studies have been conducted investigating PTG among those who have experienced trauma, no studies to date specifically address PTG as a concept applicable to those in the railroad industry exposed to work related trauma. Further, there is not a clear and concise understanding of the concept of PTG, specifically in regards to underlying mechanisms including cognitive coping and personality variables. The studies that were selected for review provide findings that suggest that positive cognitive processing, along with personality variables extraversion and openness to new experiences, and social support have the potential to influence the emergence of PTG.

Certain personality characteristics may help to predict who will develop PTSD and PTG. By identifying those factors that contribute as risk factors, this may help to
provide services to employees that are more vulnerable to developing negative trauma responses and be more psychologically healthy.

Social support and the relationship to work related trauma responses is important to understand. Social support may serve as a buffer against certain stress responses. It is important to study this relationship as by increasing a workers social support, may help to decrease a negative trauma response. Further, research suggests that social support may also increase the likelihood of developing a positive trauma response such as PTG.

There is evidence to suggest that the way an individual cognitively processes a traumatic event can make a difference in their ability to cope with the event. Cognitive behavioral therapy is an empirically supported treatment for trauma responses. If work related trauma in transportation workers predict PTSD, then there would be reason to implement cognitive based strategy programs to properly address traumatic events. The same could be applicable to PTG. If work related traumas predict PTG, then also emphasizing certain cognitive strategies would be helpful in developing growth. It is essential to gain a better understanding of the relationship between work traumas and cognitive coping strategies to provide best training to have psychologically healthy train engineers. It is an absolutely necessary and extremely logical next step to study personality factors, social support, and cognitive coping in order to understand the effects of trauma.
CHAPTER THREE

METHOD

Participants

Participants were employed as locomotive engineers or train drivers in the transportation industry. The sample was a convenience sample. The organization that agreed to participate in the study allowed the survey to be completed during paid work hours. The goal was to recruit 80-100 participants in the study.

For participation in the study, it was required that participants be at least 18 years of age, be employees of the organization, and be employed as train drivers or locomotive engineers. Participants completed a demographic section of the questionnaire for the purpose of gathering relevant data about the participant sample and to identify any potential participants who did not meet the criteria for the study so that they could be eliminated from the sample of qualified participants.

Power and Sample Size

Statistical power analysis to determine appropriate sample size was examined through the computer software *G*Power 3.1. The analysis was run for the statistical test “Linear Multiple Regression” and was computed with three possible effect sizes (small = 0.02, medium = 0.15, large = 0.35, Cohen, 1988) and 8 predictor variables for regression models with an alpha of .05 and power of .80. The power analysis indicated that to achieve statistical power with a small effect size, 755 participants would be needed, with
a medium effect size, 108 participants would be needed, and with a large effect size, 52 participants would be needed. A medium effect size was targeted for the study. Based on previous studies this seemed an appropriate estimate of effect size.

**Demographics**

The survey contained a demographic information section (see Appendix C), with self-reported responses to variables. This information was used for descriptive and analytic purposes. Seven ethnic categories defined by the federal government were used: African American, American Indian/Alaskan Native, Asian/Pacific Islander, Caucasian, Hispanic/Latino/a, Multi-racial, and Other.

**Measures**

*PTSD Checklist – Specific (PCL –S)*

*PTSD Checklist – Specific (PCL –S)* is a 17-item self-report measure of the 17 DSM-IV symptoms of PTSD (Weathers, et al, 1993) that uses a Likert response scale (ranging from 1 = not at all to 5 = extremely). The PCL has a variety of purposes, including: screening individuals for PTSD, diagnosing PTSD, and monitoring symptom change during and after treatment. The PCL-S (specific) asks about symptoms in relation to an identified "stressful experience." The PCL-S is valuable because the symptoms endorsed are linked to a specified event. Participants may be instructed to complete the PCL-S in reference to a specific type of event. The PCL scales are useful as continuous measures of PTSD symptom distress but can also aid in making a categorical diagnosis of PTSD by summing items across the three DSM-IV symptom clusters of the disorder. Test-retest reliability has been estimated at .96, and internal consistency has been found to be high (alpha = .93). Convergent validity is supported by high correlations with the
Mississippi scale for PTSD ($r = .93$), the Impact of Event Scales (IES) ($r = .90$), the MMPI PTSD subscale ($r = .77$), and the Combat Exposure Scale ($r = .46$). The items used in this measure can be found in Appendix D.

**Posttraumatic Growth Inventory (PTGI)**

The Posttraumatic Growth Inventory (PTGI; Tedeschi & Calhoun, 1996) is a 21-item self-report measure scored on a 6-point rating scale (ranging from $0 = I$ did not experience this change as a result of my crisis to $5 = I$ experienced this change to a very great degree as a result of my crisis). Scores can range from zero to 105, with the higher the score the more indication that positive growth occurred. In the present study, the PTGI was used to measure the extent to which train workers perceived personal benefits, including changes in perceptions of self, relationships with others, and philosophy of life, due to being involved in a traumatic incident while performing job duties. Examples of items are: “I have a greater appreciation for the value of my own life” and “I know better that I can handle difficulties.” The scale has been utilized by researchers for a variety of trauma. The primary purpose of utilizing the scale is to measure positive outcomes (growth) after traumatic events have occurred in an individual’s life.

Conceptually, the scale has five factors: Relating to others, new possibilities, personal strength, spiritual change, and appreciation of life. These components were initially developed from research conducted with 604 undergraduate students. Tedeschi and Calhoun (1996) reported the internal consistency of the PTGI as $\alpha = .90$. Research has indicated that all items contribute relatively equally to the consistency of the scale. The internal consistency of each factor is as follows: new possibilities ($\alpha = .84$); relating to others ($\alpha = .85$); personal strength ($\alpha = .72$); spiritual change ($\alpha = .85$); and
appreciation of life ($\alpha = .67$). The correlations among the factors ranged from .27 to .52, and the correlations of the factors with the PTGI total score ranged from .62 to .83, which indicates some separate contributions by these factors (Tedeschi & Calhoun). Overall, test-retest reliability over a two-month period, with 28 participants, was acceptable at $r = .71$ (Tedeschi & Calhoun, 1996). Construct validity indicates that scores of the PTGI are not a function of positivity bias that operates in many areas (Fiske & Taylor, 1999). No other validity information exists. Overall, researchers have found that the PTGI has sound internal consistency, acceptable test-retest reliability, and that among people reporting a variety of life difficulties, scores on the scale are approximately normally distributed (Tedeschi & Calhoun, 1996). The items used in this measure can be found in Appendix E.

The Big Five Inventory Personality Test (BFI)

The Big Five Inventory Personality Test (BFI) consists of 44 items that measure the five factor model (FFM); (John, Donahue, & Kentle 1991). The five subscales include Extraversion (8 items), Agreeableness (9 items), Conscientiousness (9 items), Neuroticism (8 items), and Openness (10 items). Items consist of short phrases and are rated using a 5 point Likert scale (1 = disagree strongly, 5 = agree strongly). Subscale scores are developed by reverse scoring specified items, summing the ratings for the items on each subscale, and dividing by the total number of items to obtain a mean score. Alpha reliabilities were reported ranging .75 to .80 for subscales and 3-month test-retest reliabilities from .80 to .90 (John & Srivastava, 1999). The reliability and validity of scores on the Big Five Inventory (BFI; John, Donahue, & Kentle, 1991) were examined in a sample of 336 African American college students. Results indicated moderate
reliability and structural validity for BFI scores. Additionally, BFI subscales had few meaningful correlations with self-esteem and social desirability.

To provide a measure of the Big Five for contexts in which participant time is severely limited, the Big Five Inventory (BFI-44) can be abbreviated to a 10-item version, the BFI-10. Rammstedt and John (2007) examined the psychometric characteristics of the 2-item scales on the BFI-10. Results indicated that the BFI-10 scales retain significant levels of reliability and validity. Overall mean correlation with the BFI-44 and BFI-10 was .83. The BFI-10 scales include less than 25% of the full BFI-44 scales, although still predicted almost 70% of the variance of the full scales. Extraversion, Neuroticism, and Conscientiousness, represented by their 2-item versions had average correlations of .89, .86, and .82 with each of these scales on the BFI-44 scale. The 2-item scales of Agreeableness had correlations of .74 and Openness .79 with each of these scales on the BFI-44 scale. The items used in this measure can be found in Appendix F.

*Cognitive Processing of Trauma Scale (CPOTS)*

The Cognitive Processing of Trauma Scale (CPOTS; Williams et al., 2002) is a 17-item scale measuring cognitive processing of traumatic events that an individual experiences. Each item is scored on a rating response scale ranging from -3 (strongly disagree) to +3 (strongly agree). The CPOTS measures five aspects of cognitive processing including: (a) positive cognitive restructuring, (b) downward comparison, (c) resolution, (d) denial, and (e) regret. Examples of items are: “Even though my experience was difficult, I can think of ways that it could have been worse” and “I have figured out how to cope.” The instrument is scored by adding +3 to each item score, and then computing a mean score for each of the five subscales.
The CPOTS was developed utilizing two different samples of college students. The initial testing included 35 participants with the second study including 229 undergraduates. The researchers used multiple confirmatory factor analyses using a five factor model. The five factors in the final model were: (a) Positive Cognitive Restructuring (three items, $\alpha = .83$), (b) Resolution/Acceptance (four items, $\alpha = .81$), (c) Downward Comparison (three items, $\alpha = .72$), (d) Denial (four items, $\alpha = .85$), and (e) Regret (three items, $\alpha = .74$; Williams et al., 2002). Test-retest reliability was assessed by utilizing a sub-sample of 67 participants that completed the measure four weeks after the first administration. Results indicated that correlations between each of the subscales administered at baseline and four weeks afterward ranged from $r = .70$ to .85 (all significant at $p < .001$). Further, correlations among each of the five subscales revealed that the subscales indicative of positive cognitive processing (i.e., Positive Cognitive Restructuring, Resolution, and Downward Comparison) are negatively associated with those subscales that indicate minimal/negative cognitive processing (i.e., Denial, Regret). Therefore, it appears appropriate to use two composite variables (positive and negative cognitive processing).

*CPOTS* has been correlated with the *Impact of Event Scale* (IES) and the *Stress-Related Growth Scale* (SRGS) in order to determine construct validity. IES items that are indicative of relatively little cognitive processing were positively associated with Denial and Regret ($r$ values ranged from .24 to .51, all $p$ values < .001) and negatively associated with Resolution, Positive Cognitive Restructuring and Downward Comparison ($r$ values ranged from -.16 to -.54, all $p$ values < .01). Positive Cognitive Restructuring was also
associated with the SGRS ($r = .31, p < .001$), while Denial and Regret were minimally associated with SRGS. The items used in this measure can be found in Appendix G.

**Measures of Social Support**

*Social Support* (House & Wells, 1978) measures support from sources: immediate supervisor, other people at work, and husband/wife/partner (skips this response if single), and friends and relatives. The scale consists of 13 items. The first two items relate to all four sources of support and the third to the two work related sources (supervisor and co-workers). The last item contains 3 items about the participant’s supervisor. A four-point response scale is used, scored 0-3 (not at all, a little, somewhat, and very much). Each set of four items is summed into an index of support from that source. The indices of support from the three sources are not highly inter-correlated ($r's = .11, .34, and .39$), showed little social desirability influence, and had alpha coefficients ranging from .73 to .83 (House and Wells, 1984). Jenkins (2004), found the reliability coefficient for the House and Wells scale to be .84

**Procedure**

Permission to conduct this study was granted from the Institutional Review Board (IRB #2008-0558 “incidence of PTSD in locomotive engineers and trainmen) and is supported by a United Stated Congressional Certificate of Confidentiality that protects from subpoenas. Additionally, permission to invite employees to consider participation in the study was requested from management.

The confidentiality of participant responses was emphasized and assured verbally and in writing. The study was presented to management staff in order to gain full cooperation. Management helped to encourage employees who have been documented as
being involved in a traumatic event while working as well as utilizing the entire population of railroad drivers to participate in the study. On the date of the study’s commencement, a division wide e-mail was sent in which the purpose of the study was described and included an informed consent, and in which employees were offered the opportunity to participate on a voluntary basis (see Appendix A). Included in this email was a link to the survey on survey monkey. The completion time of the survey was estimated at no more than 30 minutes. The confidentiality of participant answers was also emphasized and assured. Third, the researcher was on-site for 10-12 hours each day for three days in a room in the crew room in order to answer employee questions and concerns about the study. The researcher also circulated periodically through the crew room to increase visibility and to encourage participation. Participants were carefully monitored for any signs or symptoms of discomfort or anxiety as a result of participation in the study and surveys were completed with researcher present on site. The investigator kept on hand referral information for referring people to EAP or other resources should the need arise.

Data Analyses

The significance level was set at p < .05 for all statistical analyses. A cross-sectional design was used. Simple hierarchical linear regression analyses were used to determine the contribution of number of work related traumas in predicting PTSD and PTG independently. Also, hierarchical linear regression analyses were used to determine the contribution of age, number of life traumas, number of work traumas, personality characteristics, social support, and cognitive coping strategies in predicting PTSD and PTG independently. Hierarchical regression analyses were used to examine how much
variance in the dependent variable (PTSD and PTG) can be attributed to some independent variables after earlier independent variables have been accounted for. The orders of variables were based on the more theoretically important independent variables entered last to see if they add anything to the prediction over and above earlier entered variables. Therefore, positive and negative cognitive coping were placed in the last block of the regression. The assumptions of normality, linearity, homoscedasticity, and independence were tested in the following analyses:

1. Number of work related traumas predict PTSD symptoms in transportation workers.

   *Analyses:* Simple linear regression analysis was used to determine the contribution of having a work related traumatic event in predicting PTSD symptoms. Work related trauma was the independent variable. PTSD scores were entered as the dependent variable.

2. Number of work related traumas predict PTG characteristics in transportation workers.

   *Analyses:* Simple linear regression analysis was used to determine the contribution of having a work related traumatic event in predicting PTG characteristics. Work related trauma was the independent variable. PTG score was the dependent variable.

3. Number of work traumas, number of life traumas, age, personality characteristics extraversion and openness, social support, and negative and positive cognitive coping strategies predict PTSD in transportation workers.
Analyses: Hierarchical linear regression analyses were used to determine the contribution of number of work traumas, number of life traumas, age, personality characteristics extraversion and openness, social support, and negative and positive cognitive coping strategies scores in predicting PTSD in transportation workers. Number of life traumas and number of work traumas were entered as predictors in the first block; and age entered in the second block; personality characteristics extroversion and openness entered in the third block; social support in the fourth block; and negative and positive cognitive coping strategies scores in the fifth block. PTSD was the dependent variable.

4. Number of work traumas, number of life traumas, age, personality characteristics extraversion and openness, social support, and negative and positive cognitive coping strategies predict PTG in transportation workers.

Analyses: Hierarchical linear regression analyses were used to determine the contribution of number of work traumas, number of life traumas, age, personality characteristics extraversion and openness, social support, and negative and positive cognitive coping strategies scores in predicting PTG in transportation workers. Number of life traumas and number of work traumas were entered as predictors in the first block; and age in the second block; personality characteristics extroversion and openness in the third block; social support in the fourth block; and negative and positive cognitive coping strategies scores in the fifth block. PTG as the dependent variable.
Summary

The variable of work traumas in transportation was examined in predicting PTSD and PTG utilizing hierarchical regression analyses. The role of number of work traumas, number of life traumas, age, personality characteristics extraversion and openness, social support, and negative and positive cognitive coping strategies in facilitating PTSD and PTG was also examined using hierarchical regression analyses. Data were collected through an online survey using Survey Monkey with self-report measures including: demographic questionnaire, Big Five Inventory Personality Test (short form), House and Wells Social Support questionnaire (short form), Cognitive Processing of Trauma Scale, Post Traumatic Stress Disorder Checklist – Specific, and Posttraumatic Growth Inventory.
CHAPTER FOUR
RESULTS

Overview

Results of both the preliminary analyses and primary analyses of the four hypotheses are included in this chapter. The Statistical Package for the Social Sciences version 19.0 (SPSS 19.0) was used to analyze data for preliminary, primary, and follow-up statistical analyses. Two-tailed tests of significance with the alpha level set at \( p < .05 \) were used.

Preliminary Analyses

The following is covered: 1) survey response rate, 2) an analysis of missing data and how this was addressed, 3) the participants’ demographic and trauma information, 4) reliability analyses for the study variables: PTSD, PTG, Personality Characteristics, Social Support, and Cognitive Processing, 5) descriptive statistics and correlations related to the main variables analyzed in the research hypotheses, 6) and results of regression analyses.

Survey Details and Response Rate

This study used a confidential e-mail survey method. Train drivers and locomotive engineers from a leading transportation company in North America were invited to participate in the survey that was sent to their work email from a manager of operating practices. One hundred and ninety five employees responded and completed the
online questionnaire from computers stationed at work. Inclusion criteria were met before having access to the survey as everyone who was invited to participate worked as a train engineer or conductor and was at least 18 years old. Out of the 195 potential participants, 138 fully completed the questionnaires (n = 138). 19% of employees did not fill out the survey to completion. It is unclear as to why this percentage of employees did not complete the survey. It is possible they may have felt that the questionnaire contained items that were too personal or could possibly be harmful to their employment if confidentiality was not kept and therefore made the decision to cease completion of the survey. Also due to the unpredictable nature of railroad work, employees may have had to stop in order to fulfill requirements of their employment such as leaving to drive a train. Both of these issues should be considered as possible limitations of the study.

According to management, the survey was sent out to approximately 300 employees in a specific regional area. This could have also created bias in who responded which is another limitation of this study and is furthered addressed below.

The final screening procedure was to examine whether or not retained participants had a valid score on each scale. Participants who were missing more than 20% of data points on any scale were excluded. Of the remaining 138 participants, data from two participants were not used due to failing to fill out more than 20% of a scale. Therefore, the final sample used in all subsequent analyses was 136 participants.

Analysis of Missing Data

After the data were screened, the data set was examined for missing data points. Missing values accounted for roughly 0.8% of the total data points, with an average of less than one missing data point per participant. After completing a visual inspection of
the data, there did not appear to be a pattern to the missing data. Missing data were then
treated as random. According to Tabachnick and Fidell (2007), various methods of data
imputation do not significantly differ when missing data account for less than 5% of the
data set. Missing data are filled in using the group mean for each scale using SPSS 19.

**Distributional Assumptions of Measured Variables**

The mean, standard deviation, skewness, kurtosis, and coefficient alpha level of
each indicator variable for the study are depicted in Table 2 below. All statistics are based
on a sample size of 136. The standard error for skewness with \( N = 136 \) is .208, and the
standard error for kurtosis for \( N = 136 \) is .413. Conventionally, skewness values above
three times the standard error of skewness are considered significantly non-normal. In the
data set, the skewness values for PTSD and work-related trauma were significant. To
understand the distributions of these variables, the histograms and p-p plots were
examined. Normality was examined through the plotting of residuals for each regression
model. Histograms were examined with a normal curve placed on top. By looking
closely at the histograms, the residuals followed a normal distribution with the exception
of PTSD and PTG. See Figures 2 - 5.
Table 2

*Descriptive Statistics for Measured Variables*

<table>
<thead>
<tr>
<th>Variable</th>
<th>M</th>
<th>SD</th>
<th>Skewness</th>
<th>Kurtosis</th>
<th>Alpha</th>
</tr>
</thead>
<tbody>
<tr>
<td>PTSD</td>
<td>25.35</td>
<td>10.08</td>
<td>1.34</td>
<td>.94</td>
<td>.92</td>
</tr>
<tr>
<td>PTG</td>
<td>58.9</td>
<td>31.82</td>
<td>.41</td>
<td>-1.04</td>
<td>.97</td>
</tr>
<tr>
<td>CogPos</td>
<td>48.42</td>
<td>11.64</td>
<td>-.86</td>
<td>1.37</td>
<td>.83</td>
</tr>
<tr>
<td>CogNeg</td>
<td>18.72</td>
<td>8.20</td>
<td>.11</td>
<td>-1.15</td>
<td>.78</td>
</tr>
<tr>
<td>Extro</td>
<td>6.67</td>
<td>1.99</td>
<td>-.24</td>
<td>-.26</td>
<td>.87</td>
</tr>
<tr>
<td>Open</td>
<td>6.79</td>
<td>1.75</td>
<td>-.28</td>
<td>.02</td>
<td></td>
</tr>
<tr>
<td>SocSup</td>
<td>35.55</td>
<td>7.33</td>
<td>.23</td>
<td>-.46</td>
<td></td>
</tr>
<tr>
<td>SumWRT</td>
<td>2.83</td>
<td>2.94</td>
<td>1.09</td>
<td>.60</td>
<td></td>
</tr>
<tr>
<td>SumLT</td>
<td>2.66</td>
<td>1.60</td>
<td>.55</td>
<td>.15</td>
<td></td>
</tr>
</tbody>
</table>

*Note.* SE = .208 for skewness, .413 for kurtosis. PTSD = Post Traumatic Disorder Checklist; PTG = Post Traumatic Growth Inventory; Cog Pos = Positive Cognitive Coping; CogNeg = Negative Cognitive Coping; Extro = Extroversion for Personality; Open = Openness for Personality; SocSup = Social Support Measure; SumWRT = Sum of Work Related Trauma; SumLT = Sum of Lifetime Traumas.

Figure 2

Histogram of PTSD
Figure 3

Histogram of PTG

Figure 4

Histogram of WRT
Histogram of LTR

**Demographic Information**

A demographic questionnaire (Appendix C) designed for this study was used to collect information on the participants’ demographic characteristics as well as work related traumatic events and lifetime traumatic events. Results are presented in Tables 3 and 4. The demographic variables used in the analyses were number of work related traumas, number of lifetime traumas, and age.
Table 3

Overview of Demographic Characteristics

<table>
<thead>
<tr>
<th>Variable</th>
<th>Frequency</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total Participants</td>
<td>136</td>
<td>100</td>
</tr>
<tr>
<td>Age Range</td>
<td></td>
<td></td>
</tr>
<tr>
<td>18 to 29</td>
<td>16</td>
<td>11.8</td>
</tr>
<tr>
<td>30 to 39</td>
<td>33</td>
<td>24.3</td>
</tr>
<tr>
<td>40 to 49</td>
<td>49</td>
<td>36</td>
</tr>
<tr>
<td>50 to 59</td>
<td>30</td>
<td>22.1</td>
</tr>
<tr>
<td>60 or older</td>
<td>8</td>
<td>5.9</td>
</tr>
<tr>
<td>Gender</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Male</td>
<td>133</td>
<td>97.8</td>
</tr>
<tr>
<td>Female</td>
<td>3</td>
<td>2.2</td>
</tr>
<tr>
<td>Race/Ethnicity</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Caucasian</td>
<td>90</td>
<td>66.2</td>
</tr>
<tr>
<td>Hispanic, Latino/a</td>
<td>24</td>
<td>17.6</td>
</tr>
<tr>
<td>African-American</td>
<td>18</td>
<td>13.2</td>
</tr>
<tr>
<td>Asian or Pacific Islander</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>American Indian or Alaskan Native</td>
<td>1</td>
<td>.7</td>
</tr>
<tr>
<td>Other</td>
<td>2</td>
<td>1.5</td>
</tr>
<tr>
<td>Marital Status</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Single (never married)</td>
<td>10</td>
<td>7.4</td>
</tr>
<tr>
<td>Committed relationship</td>
<td>10</td>
<td>7.4</td>
</tr>
<tr>
<td>Married/Remarried</td>
<td>102</td>
<td>75.0</td>
</tr>
<tr>
<td>Divorced/Separated/Widowed</td>
<td>13</td>
<td>9.6</td>
</tr>
<tr>
<td>Other</td>
<td>1</td>
<td>0.7</td>
</tr>
<tr>
<td>Education</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Did not finish high school</td>
<td>2</td>
<td>1.5</td>
</tr>
<tr>
<td>High school diploma (or GED)</td>
<td>30</td>
<td>22.1</td>
</tr>
<tr>
<td>Some college</td>
<td>80</td>
<td>58.8</td>
</tr>
<tr>
<td>College degree (Bachelor’s)</td>
<td>20</td>
<td>14.7</td>
</tr>
<tr>
<td>Some graduate school training</td>
<td>2</td>
<td>1.5</td>
</tr>
<tr>
<td>Graduate degree</td>
<td>2</td>
<td>1.5</td>
</tr>
<tr>
<td>Household Income</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Under $25,000</td>
<td>2</td>
<td>1.5</td>
</tr>
<tr>
<td>$25,001 - $50,000</td>
<td>6</td>
<td>4.4</td>
</tr>
<tr>
<td>$50,001 - $75,000</td>
<td>28</td>
<td>20.6</td>
</tr>
<tr>
<td>Variable</td>
<td>Frequency</td>
<td>Percentage</td>
</tr>
<tr>
<td>-------------------------</td>
<td>-----------</td>
<td>------------</td>
</tr>
<tr>
<td>$75,001 - $100,000</td>
<td>64</td>
<td>47.1</td>
</tr>
<tr>
<td>$100,000 +</td>
<td>36</td>
<td>26.5</td>
</tr>
</tbody>
</table>

Table 4

*Overview of Work Traumatic Events*

<table>
<thead>
<tr>
<th>Variable</th>
<th>Frequency</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total Participants</td>
<td>136</td>
<td>100</td>
</tr>
</tbody>
</table>

Type of Work Traumas
- Employee: 29 (21.3%)
- Passenger: 2 (1.5%)
- Trespasser: 54 (39.7%)
- Jumper: 6 (4.4%)
- Auto/Vehicle: 44 (32.4%)
- Auto/Truck: 25 (18.4%)
- Auto/Tractor Trailer: 26 (19.1%)
- Auto/AV: 3 (2.2%)
- Train/Freight: 18 (13.2%)
- Near Miss: 57 (41.9%)
- Derailed: 40 (29.4%)
- Grade Crossing: 46 (33.8%)
- Passenger Expired: 4 (2.9%)
- Bicycle: 3 (2.2%)
- Debris: 28 (20.6%)

Table 5

*Overview of Lifetime Traumatic Events*

<table>
<thead>
<tr>
<th>Variable</th>
<th>Frequency</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total Participants</td>
<td>136</td>
<td>100</td>
</tr>
</tbody>
</table>

Type of Life Traumas
- Car Accident: 80 (58.8%)
- Bereavement (loss of loved one): 90 (66.2%)

94
<table>
<thead>
<tr>
<th>Variable</th>
<th>Frequency</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Heart Attack/Stroke</td>
<td>3</td>
<td>2.2</td>
</tr>
<tr>
<td>Cancer</td>
<td>10</td>
<td>7.4</td>
</tr>
<tr>
<td>Major Injury</td>
<td>18</td>
<td>13.2</td>
</tr>
<tr>
<td>Witness Death</td>
<td>55</td>
<td>40.4</td>
</tr>
<tr>
<td>Military Combat</td>
<td>16</td>
<td>11.8</td>
</tr>
<tr>
<td>Sexual Assault/Rape</td>
<td>2</td>
<td>1.5</td>
</tr>
<tr>
<td>Maritime Disasters (Boating)</td>
<td>3</td>
<td>2.2</td>
</tr>
<tr>
<td>Plane Crash</td>
<td>1</td>
<td>0.7</td>
</tr>
<tr>
<td>Tornadoes</td>
<td>20</td>
<td>14.7</td>
</tr>
<tr>
<td>Hurricanes</td>
<td>47</td>
<td>34.6</td>
</tr>
<tr>
<td>Shootings</td>
<td>17</td>
<td>12.5</td>
</tr>
<tr>
<td>Work-related Trauma</td>
<td>30</td>
<td>22.1</td>
</tr>
</tbody>
</table>

Reliability Analyses Related to Main Variables

Internal consistency of scales was examined through Cronbach’s coefficient alpha. Nunnally and Bernstein (1994) recommended that the general convention of research is to strive to have at minimum a .7 to establish adequate reliability. Values can range from zero to one, with values closer to one indicating better reliability. Reliability analyses were conducted for the scales of the PTSD Checklist Specified Version (PCL-S), Post Traumatic Growth Inventory (PTGI), Cognitive Processing of Trauma Scale, and Social Support Scale.

In regards to the PCL-S, results indicated that the seventeen items comprising the PCL-S had an estimated reliability of .92. These results indicated that the measure was reliable.

Reliability analysis was performed on the Posttraumatic Growth Inventory (PTGI). The 21 items had an alpha of .96, indicating that items are essentially measuring the same construct.
The Social Support scale looked at four sources of social support. Reliability analyses for the Social Support scale indicated an alpha of .87. This result indicated good reliability.

Lastly, reliability analyses were conducted to examine two subscales of the Cognitive Processing of Trauma Scale (CPOTS): Positive Cognitive Processing and Negative Cognitive Processing instead of looking at each of the five subscales separately. The CPOTS was used in both predicting PTSD and PTG and so therefore split into positive and negative cognitive processing. Ten items comprise the subscales that are theorized to represent Positive Cognitive Processing (i.e., Positive Cognitive Restructuring, Resolution, and Downward Comparison). Results revealed that these 10 items have a Cronbach’s alpha of .83. Seven items comprise the subscales that form Negative Cognitive Processing (i.e., Denial and Regret). The items had an alpha of .77. Overall, the results suggested that the two CPOTS subscales assessing Positive and Negative Cognitive Processing showed adequate reliability.

The Big Five Inventory was also used in this study. Due to time constraints, the 44 item measure was not used and replaced with the abbreviated 10 item version which has shown to be highly correlated with the longer version and also having good reliability. Two scales of this scale were used as separate subscales: extroversion and openness. Since only two items were used to measure extraversion and two items were used to measure openness, there were not enough items to assess reliability. This is another limitation of the study.

Table 6 provides the correlation coefficients for the demographic variable age, independent variables, and dependent variables PTSD and PTG utilized in the study.
Several variables were significantly correlated. Age was related to WRT as well as LTR, which is interpreted as the older you are the more likely you are to have experienced a WRT and LTR. WRT and LRT were significantly correlated. WRT was related to PTSD, as well as LT was related to PTSD. PTG was related to PTSD which both impacted by trauma, although according to literature review these two concepts do not necessarily co-exist and are considered separate entities. The two personality characteristics used in this study, extroversion and openness, were significantly correlated. Negative cognitive coping was related to PTSD, as well as positive cognitive coping was related to PTSD. PTSD and negative coping were correlated. PTG was related to positive cognitive coping and to social support.
Primary Analyses

Primary regression analyses are addressed. Assumptions regarding regression are examined. Analyses for the four hypotheses are discussed. It should be noted that for all statistical analyses the alpha level was set at $p < .05$.

Regression assumptions of normality, linearity, independence, and homoscedasticity were assessed (Tabachnick & Fidell, 2007). Linearity was assessed using the normal probability plot (P–P) of the regression standardized residual. Histograms and p-p plots demonstrate that the non-normality in PTSD and PTG scale is apparent. PTSD and PTG are not normally distributed. One would not expect scores on this scale to be normally distributed since it is a clinical scale used for clinical populations. It is expected that not everyone will have PTSD, nor PTG. Further, it also possible the skewing of this scale could be due to the small sample size and the method in which respondents were chosen which will be discussed further in the limitation section. Further, the non-normality could be a result of response style in that participants in the study chose the same response. If there was a definitive need to assess the degree to which PTSD and PTG negative skew may introduce error into further analyses, variables would be rank transformed and the correlations between the skewed variables and other variables would be observed for significant changes. Results of the study do not appear to be influenced by this non-normality as variables were still correlated with PTSD and PTG. Also, results were significant using PTSD and PTG as the dependent variable. Further, it should be considered that the distribution on the scales may be an accurate reflection of train engineers’ report of work traumas indicating low levels for both PTSD (negative outcome) and PTG (positive outcome). Other scales were assessed using
normal P-P plots and indicated a reasonably straight line from bottom left to top right showing a linear relationship between variables. Homoscedasticity and independence of residuals were examined through looking at scatterplots of the standardized residuals. Residuals were mostly rectangularly distributed and overall evenly distributed (Cohen, Cohen, West, & Aiken, 2003).

Independent variables pertinent to the analyses should be included in the regression model and the assumption is violated when they are not included. Variables that were utilized in the models were demonstrated to be appropriate predictors according to literature review. Variables should also be measured without error, so therefore measures should be based on having good reliability (Cohen, et al., 2003). Independent and dependent variables were shown to produce good reliability (with the exception of the two item personality characteristics). Durbin-Watson coefficient $d$ values are a test statistic used to detect the presence of autocorrelation. Durbin-Watson statistics range in value from 0 to 4; values near two indicate autocorrelation (Montgomery, Peck, & Vining, 2001). The regression equation for the 4 models had coefficient $d$ values of 1.85, 2.10, 1.97, and 1.96 indicating that the Durbin-Watson values did not indicate strong evidence for autocorrelation.

Multicollinearity was assessed using tolerance and variance inflation factor (VIF) values (Cohen, et al., 2003). VIF shows how much the variance of the coefficient estimate is inflated by multicollinearity. Tolerance provides information in regards to how much variability of the specified independent variable is not explained by the other independent variables in the model. The reciprocal of tolerance is VIF. The cutoff values for tolerance and VIF used in the analyses were based on Allsion’s (1999) cutoff levels of
less than .10 for tolerance and more than 10 for VIF. All variables used in models did not indicate the presence of multicollinearity.

Correlations coefficients were also examined to detect strong correlations between variables. Upon revisiting correlation coefficients, only low to moderate correlations were found. Variables were kept in models as initially placed.

Mahalanobis distances are often used in to identify multivariate outliers (Cohen et al., 2003). Critical chi-square values were determined for each regression equation using the number of independent variables as the degrees of freedom. Maximum Mahalanobis values for cases in the four models indicated that there were no values that exceeded the critical values. This indicated that there were no multivariate outliers in the data set.

**Statistical Analyses Addressing Research Hypotheses**

**Hypothesis 1:** Number of work related traumas predict PTSD symptoms in transportation workers. A linear regression analysis was used to determine the contribution of having a work related traumatic event in predicting PTSD symptoms. Work related traumas was the independent variable, while PTSD scores were entered as the dependent variable with \( r = .33 \). Results indicated that number of work related traumas significantly predicted a portion of variance of PTSD in transportation workers, \( R^2 = .109, p < .001 \), accounting for 10.9% of the variance.

**Hypothesis 2:** Number of work related traumas predict PTG characteristics in transportation workers. A linear regression analysis was used to determine the contribution of having a work-related traumatic event in predicting PTG characteristics. Work related traumas was the independent variable, while PTG scores were entered as the dependent variable. Results indicated that number of work related traumas did not
significantly predict PTG in transportation workers, $r = .024$, $R^2 = .001$.

Hypothesis 3: Number of work traumas, number of life traumas, age, personality characteristics extraversion and openness, social support, and negative and positive cognitive coping strategies significantly predict PTSD in transportation workers.

Hierarchical linear regression analysis was used to determine the contribution of number of work traumas, number of life traumas, age, personality characteristics extraversion and openness, social support, and negative and positive cognitive coping strategies in predicting PTSD in transportation workers. Number of work traumas and number of life traumas were entered as predictors in the first block; and age in the second block, personality characteristics extraversion and openness in the third block; social support in the fourth block; and negative and positive cognitive coping strategies scores in the fifth block. PTSD was the dependent variable. Number of work traumas and number of life traumas, were variables in the first equation (Block 1), that significantly contributed to the model, $R^2 = .119$, $F(2, 132) = 8.96$, $p < .01$, accounting for 11.9% of the variance.

When age was added to the model for the second block, their incremental contribution was not significant. Personality characteristics, extraversion and openness, were placed in the third block and they also did not contribute to the model. Adding the fourth block of social support also did not contribute. Adding the fifth block of negative cognitive coping and positive coping significantly contributed to the model, $R^2 = .09$ or 9% of the incremental variance was accounted for by the fifth block. When combining all blocks, 21.5% of the variance in PTSD was explained. Hierarchical regression indicates that variance in PTSD is explained by number of work traumas, number of life traumas, negative cognitive coping, and positive cognitive coping.
Table 7 provides a summary of the hierarchical regression results.

Hierarchical Regression of Number of work traumas, Number of life traumas, Age, Personality Characteristics Extraversion and Openness, Social Support, and Negative and Positive Cognitive Coping on PTSD (n = 136)

<table>
<thead>
<tr>
<th>Variable</th>
<th>Post Traumatic Stress Disorder</th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>B</td>
<td>SE B</td>
<td>β</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Block 1.</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Number of Life Traumas</td>
<td></td>
<td>.69</td>
<td>.56</td>
<td>.11</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Number of Work Traumas</td>
<td></td>
<td>.98</td>
<td>.30</td>
<td>.29**</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>$R^2$</td>
<td></td>
<td></td>
<td></td>
<td>.12*</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>F for change in $R^2$</td>
<td></td>
<td></td>
<td></td>
<td>8.96***</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Block 2.</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Number of Life Traumas</td>
<td></td>
<td>.70</td>
<td>.56</td>
<td>.11</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Number of Work Traumas</td>
<td></td>
<td>1.23</td>
<td>.33</td>
<td>.36***</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Age</td>
<td></td>
<td>-1.50</td>
<td>.85</td>
<td>-.16</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Incremental $R^2$</td>
<td></td>
<td></td>
<td></td>
<td>.02</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>F for change in $R^2$</td>
<td></td>
<td></td>
<td></td>
<td>3.12</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Model $R^2$</td>
<td></td>
<td></td>
<td></td>
<td>.14</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>F for model</td>
<td></td>
<td></td>
<td></td>
<td>7.10***</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Block 3.</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Number of Life Traumas</td>
<td></td>
<td>.71</td>
<td>.56</td>
<td>.11</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Number of Work Traumas</td>
<td></td>
<td>1.19</td>
<td>.34</td>
<td>.35***</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Age</td>
<td></td>
<td>-1.59</td>
<td>.85</td>
<td>-.17</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Extroversion</td>
<td></td>
<td>-.78</td>
<td>.42</td>
<td>-.15</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Openness</td>
<td></td>
<td>.39</td>
<td>.47</td>
<td>.07</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Incremental $R^2$</td>
<td></td>
<td></td>
<td></td>
<td>.02</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>F for change in $R^2$</td>
<td></td>
<td></td>
<td></td>
<td>1.84</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Model $R^2$</td>
<td></td>
<td></td>
<td></td>
<td>.16</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>F for model</td>
<td></td>
<td></td>
<td></td>
<td>5.05***</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
### Variable Post Traumatic Stress Disorder

<table>
<thead>
<tr>
<th>Variable</th>
<th>B</th>
<th>SE B</th>
<th>β</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Block 4.</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Number of Life Traumas</td>
<td>1.02</td>
<td>.54</td>
<td>.16</td>
</tr>
<tr>
<td>Number of Work Traumas</td>
<td>1.09</td>
<td>.33</td>
<td>.32***</td>
</tr>
<tr>
<td>Age</td>
<td>-1.59</td>
<td>.85</td>
<td>-.17</td>
</tr>
<tr>
<td>Extroversion</td>
<td>-.77</td>
<td>.42</td>
<td>-.15</td>
</tr>
<tr>
<td>Openness</td>
<td>.39</td>
<td>.47</td>
<td>.07</td>
</tr>
<tr>
<td>Social Support</td>
<td>-.05</td>
<td>.11</td>
<td>-.04</td>
</tr>
<tr>
<td>Incremental $R^2$</td>
<td>.00</td>
<td></td>
<td></td>
</tr>
<tr>
<td>F for change in $R^2$</td>
<td>.20</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Model $R^2$</td>
<td>.16</td>
<td></td>
<td></td>
</tr>
<tr>
<td>F for model</td>
<td>4.22***</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

### Variable Post Traumatic Stress Disorder

<table>
<thead>
<tr>
<th>Variable</th>
<th>B</th>
<th>SE B</th>
<th>β</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Block 5.</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Number of Life Traumas</td>
<td>1.03</td>
<td>.54</td>
<td>.16</td>
</tr>
<tr>
<td>Number of Work Traumas</td>
<td>1.07</td>
<td>.33</td>
<td>.31***</td>
</tr>
<tr>
<td>Age</td>
<td>-1.8</td>
<td>.82</td>
<td>-.13</td>
</tr>
<tr>
<td>Extroversion</td>
<td>.67</td>
<td>.40</td>
<td>-.13</td>
</tr>
<tr>
<td>Openness</td>
<td>.53</td>
<td>.45</td>
<td>.10</td>
</tr>
<tr>
<td>Social Support</td>
<td>.01</td>
<td>.11</td>
<td>.01</td>
</tr>
<tr>
<td>Negative Cognitive Coping</td>
<td>.29</td>
<td>.10</td>
<td>.24**</td>
</tr>
<tr>
<td>Positive Cognitive Coping</td>
<td>-.14</td>
<td>.07</td>
<td>-.16*</td>
</tr>
<tr>
<td>Incremental $R^2$</td>
<td>.09</td>
<td></td>
<td></td>
</tr>
<tr>
<td>F for change in $R^2$</td>
<td>7.35</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Model $R^2$</td>
<td>.25</td>
<td></td>
<td></td>
</tr>
<tr>
<td>F for model</td>
<td>5.31***</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

*p < .05  **p < .01  ***p < .001

**Hypothesis 4:** Number of work traumas, number of life traumas, age, personality characteristics extraversion and openness, social support, and negative and positive cognitive coping strategies significantly predict PTG in transportation workers.

Hierarchical linear regression analysis was used to determine the contribution of number of work traumas, number of life traumas, age, personality characteristics extraversion and
openness, social support, and negative and positive cognitive coping strategies significantly predict PTG in transportation workers. Number of work traumas and number of life traumas were entered as predictors in the first block; and age in the second block, personality characteristics extroversion and openness in the third block; social support was in the fourth block; and negative and positive cognitive coping strategies scores in the fifth block. PTG was the dependent variable. Number of work traumas and number of life traumas were variables in the first equation (Block 1). The model was not significant. Age was entered in the second block with nonsignificant results. Personality characteristics, extroversion and openness, were entered in the third block and also did not contribute significantly to the model. Adding the fourth block of variable social support significantly contributed to the model, incremental $R^2 = .12$ or 12%. Also negative cognitive coping and positive cognitive coping significantly contributed to the model, $R^2 = .09$ or 9% of the variance was accounted for by block five. When combining all blocks, $R^2 = .25$, $F(2, 125) = 7.32$, $p < .05$. Hierarchical regression indicates that 25% of the variance in PTG is explained by the variables, with social support, negative cognitive coping, and positive cognitive coping as significant predictors. Number of work traumas, number of life traumas, age, personality trait extroversion and personality trait openness did not significantly contribute to the model. These findings suggest that social support and negative and positive cognitive coping account for significant amounts of variance in PTG.

Table 8 provides a summary of the regression.
Table 8

Hierarchical Regression of Number of work traumas, Number of life traumas, Age, Personality Characteristics Extraversion and Openness, Social Support, and Negative and Positive Cognitive Coping on PTG (n = 136)

<table>
<thead>
<tr>
<th>Variable</th>
<th>Post Traumatic Growth</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>$B$</td>
</tr>
<tr>
<td><strong>Block 1.</strong></td>
<td></td>
</tr>
<tr>
<td>Number of Life Traumas</td>
<td>-.03</td>
</tr>
<tr>
<td>Number of Work Traumas</td>
<td>-.26</td>
</tr>
<tr>
<td>$R^2$</td>
<td></td>
</tr>
<tr>
<td>$F$ for change in $R^2$</td>
<td></td>
</tr>
<tr>
<td><strong>Block 2.</strong></td>
<td></td>
</tr>
<tr>
<td>Number of Life Traumas</td>
<td>-.00</td>
</tr>
<tr>
<td>Number of Work Traumas</td>
<td>.42</td>
</tr>
<tr>
<td>Age</td>
<td>-4.01</td>
</tr>
<tr>
<td>Incremental $R^2$</td>
<td></td>
</tr>
<tr>
<td>$F$ for change in $R^2$</td>
<td></td>
</tr>
<tr>
<td>Model $R^2$</td>
<td></td>
</tr>
<tr>
<td>$F$ for model</td>
<td></td>
</tr>
<tr>
<td><strong>Block 3.</strong></td>
<td></td>
</tr>
<tr>
<td>Number of Life Traumas</td>
<td>-.12</td>
</tr>
<tr>
<td>Number of Work Traumas</td>
<td>.57</td>
</tr>
<tr>
<td>Age</td>
<td>-3.84</td>
</tr>
<tr>
<td>Extroversion</td>
<td>2.54</td>
</tr>
<tr>
<td>Openness</td>
<td>-.42</td>
</tr>
<tr>
<td>Incremental $R^2$</td>
<td></td>
</tr>
<tr>
<td>$F$ for change in $R^2$</td>
<td></td>
</tr>
<tr>
<td>Model $R^2$</td>
<td></td>
</tr>
<tr>
<td>$F$ for model</td>
<td></td>
</tr>
<tr>
<td>Variable</td>
<td>Post Traumatic Growth</td>
</tr>
<tr>
<td>--------------------------------</td>
<td>-----------------------</td>
</tr>
<tr>
<td></td>
<td>$B$</td>
</tr>
<tr>
<td><strong>Block 4.</strong></td>
<td></td>
</tr>
<tr>
<td>Number of Life Traumas</td>
<td>.14</td>
</tr>
<tr>
<td>Number of Work Traumas</td>
<td>.95</td>
</tr>
<tr>
<td>Age</td>
<td>-2.77</td>
</tr>
<tr>
<td>Extroversion</td>
<td>2.47</td>
</tr>
<tr>
<td>Openness</td>
<td>-.66</td>
</tr>
<tr>
<td>Social Support</td>
<td>1.53</td>
</tr>
<tr>
<td>Incremental $R^2$</td>
<td>.12</td>
</tr>
<tr>
<td>$F$ for change in $R^2$</td>
<td></td>
</tr>
<tr>
<td>Model $R^2$</td>
<td>.16</td>
</tr>
<tr>
<td>$F$ for model</td>
<td></td>
</tr>
<tr>
<td><strong>Block 5.</strong></td>
<td></td>
</tr>
<tr>
<td>Number of Life Traumas</td>
<td>.14</td>
</tr>
<tr>
<td>Number of Work Traumas</td>
<td>1.54</td>
</tr>
<tr>
<td>Age</td>
<td>-3.38</td>
</tr>
<tr>
<td>Extroversion</td>
<td>2.00</td>
</tr>
<tr>
<td>Openness</td>
<td>-.51</td>
</tr>
<tr>
<td>Social Support</td>
<td>1.51</td>
</tr>
<tr>
<td>Negative Cognitive Coping</td>
<td>.61</td>
</tr>
<tr>
<td>Positive Cognitive Coping</td>
<td>.77</td>
</tr>
<tr>
<td>Incremental $R^2$</td>
<td>.09</td>
</tr>
<tr>
<td>$F$ for change in $R^2$</td>
<td></td>
</tr>
<tr>
<td>Model $R^2$</td>
<td>.25</td>
</tr>
<tr>
<td>$F$ for model</td>
<td></td>
</tr>
</tbody>
</table>

*p < .05  **p < .01  ***p < .001

**Summary**

Chapter four outlined the results of the study including findings from the statistical analyses conducted. Results of both the preliminary analyses and primary analyses of the four hypotheses were included. The first hypothesis was supported with
number of work traumas significantly predicting PTSD. This finding was expected as supported by previous research in this area in the literature review. It would be expected that those with traumatic work experience would be likely to have PTSD.

The second hypothesis was that number of work related traumas would predict PTG. This hypothesis was not supported in that number of work traumas did not predict PTG. Possible reasons for this nonsignificant finding are presented in the final chapter.

The third hypothesis was partially supported. In the first block in the hypothesis number of work traumas and number of life traumas were significant predictors of PTSD. In the second block, age was not a predictor of PTSD, likewise the personality characteristics of extroversion and openness added in the third block did not predict PTSD. In the fourth block social support also was not a significant contributor. Adding negative cognitive coping and positive cognitive coping in the fifth block significantly predicted PTSD.

The fourth hypothesis was partially supported. In the first block, number of work traumas, and number of life traumas did not significantly predict PTG. Age was also not a predictor. In the third block personality characteristics extroversion and openness were added which also did not predict PTG. In the fourth block social support was a predictor of PTG. Negative cognitive coping and positive cognitive coping were also predictors of PTG for the fifth block. Chapter five will discuss these results further in regards to implication for research, limitations of the study, and recommendations for future research.
CHAPTER FIVE

DISCUSSION

Chapter 5 includes 1) a concise summary of the study, 2) a discussion of the overall findings associated with each of the four research hypotheses and their implications, 3) limitations of the study, 4) recommendations for future research, and 5) conclusions.

Summary of the Study

Being involved in a traumatic event can have a lasting, profound impact on the individuals involved. Trauma has traditionally been studied from a more pathological, negative, stance, although more recently the positive outcomes of trauma have also been investigated. Workers that are employed in transportation, specifically railroad for this study, are likely to encounter a work-related trauma at some point in their career according to research. Traumatic events, also known as critical incidents, can involve suicide on the tracks, impact with other trains and vehicles, derailments, and near misses and can cause symptoms associated with PTSD and lead to psychological impairment. A negative response to trauma can impact an employee’s job performance, daily functioning, and personal life. Understanding potential risk factors, as well as appropriate interventions to be implemented after a traumatic event, can be helpful in maintaining the psychological well being of these individuals.
More recent research has addressed the concept that individuals involved in a traumatic event can experience positive psychological change from a trauma, which in the literature can be defined as PTG. Research has only recently attempted to explain this concept and terminology related to PTG. It should be noted that understanding the underlying mechanisms is challenging as it is used in a variety ways and is not clearly defined in the literature. Some view PTG as a cognition, attitude, or belief, while others view it as a coping mechanism that challenges the negative impact of trauma or the positive results of struggles with a major life event (Pat-Horenczyk, & Brom, 2007; Calhoun, Cann, Tedeschi, & McMillan, 2000). Others view PTG in terms of meaning making; also, there is debate in regard to its adaptive significance. Use of various names for growth and disagreement on the underlying constructs has contributed to the inconsistency in this area of research. This makes the concept more difficult to study and to build upon prior findings. This study attempted to explore this concept from a cognitive stance employing a cognitive coping scale.

The purpose of this study was to gain a better understanding of the underlying mechanisms of response to traumatic work-related events in transportation, specifically factors contributing to positive and negative outcomes of involvement in trauma. In regard to PTSD and PTG, there has not been agreement on the underlying mechanisms that serve as protective or mediating factors or also specific indicators that either of these outcomes will occur, although there have been some suggestions in literature of possible indicators. Variables that may help to predict PTSD and PTG include number of life traumas, number of work traumas, personality characteristics, the amount of social support the individual has, and the way the individual cognitively processes the trauma.
Therefore, this study focused on predictors of PTSD and PTG in transportation workers, specifically using the variables of number of work related traumas, number of life traumas, age, personality characteristic extroversion, personality characteristic openness, social support, negative cognitive coping, and positive cognitive coping as predictors. Specific findings and implications for hypotheses are further discussed in the following sections.

Specific Findings and Implications for Hypotheses

Four hypotheses were examined including two hypotheses using PTSD as the outcome measure and two hypotheses using PTG as the outcome variable. Hypothesis one examined the relationship between number of work traumas and PTSD. Results indicated that number of work-related trauma predicted PTSD. This finding was expected as previous research in this area has indicated that multiple traumatic events increase the likelihood of PTSD occurring and that traumatic events at work can lead to psychologically disturbing symptoms.

Hypothesis two examined the relationship between number of work traumas and PTG. Results indicated that number of work-related trauma did not predict PTG. This result was surprising as the literature review supported that PTG is found in all populations that involve a traumatic event, as well as naturally occurring in individuals over time with life experience. Calhoun and Tedeschi (2004) advise that PTG is not necessarily universal, nor inevitable. Just as most individuals will not develop severe pathology from a trauma; it should also not be assumed that they will experience PTG as a result of a trauma (Tedeschi & Calhoun, 2004). Also, Tedeschi and Calhoun (1995) reported that in terms of gender outcomes, women typically tend to report more benefits
than men. In the current study, of the 136 participants only 3 of them were women. The majority of the sample was male, which could have impacted results.

Another area for consideration is that while the respondents indicated that they had experienced so called traumatic events (i.e. about a third of them had had a grade crossing accident), only 6 of them met the criteria for PTSD. Thus we might assume that it may have been the case that these events did not rise to the threshold of significant traumas that might have precipitated traumas. Employees may have viewed these incidents as just part of their jobs.

Also, the amount of time that passed may have also impacted results. A certain amount of time may have passed that the employee had already processed the trauma. Alternatively, the trauma may have been so recent or the employee experienced multiple events that in order to protect themselves they were not able to start processing the event. This would be an area for future researchers to consider.

Another area of consideration is that growth may emerge from struggle with coping and not from the trauma itself. Possible explanations of this finding may be that the work-related trauma experienced by these individuals did not contribute to a direct perceived sense of threat. Some research has indicated that in order to develop PTG the trauma has to challenge the individual’s worldview. PTG in the literature has been associated with perceived life threat, especially studies involving those with medical conditions. The incident the workers witness does not usually threaten their own life or involve a perceived sense of threat, but often will threaten the physical integrity of another. Since train engineers typically are driving a vehicle that causes damage, the
integrity of their own life is typically not at risk or threatened. This understanding of trauma may help to explain why this hypothesis was not supported.

Another area for consideration is the cultural norms of the railroad environment. The way the individual tells their story of trauma and adversity can be shaped by the culture in which they are entrenched which can include coloring from economic, political, religious, ideological, and historical factors (Pal & McAdams, 2004. Train culture is majority male and being involved in incidents is part of the job and not even considered in terms of growth, although with proper training may become an area to be developed which could lead to healthier employees if were educated about how to grow form a traumatic event.

The independent variable number of work-related trauma predicted PTSD in the first hypothesis, but did not predict PTG in the second hypothesis. It should be noted that Zoellner and Maercker (2006) suggest that most cross sectional studies indicate that there is no relationship between PTSD and PTG, though in the present study there was a low, but statistically significant correlation between the two. Further, sociodemographic variables (gender, age, education, and income) and psychological distress variables (depression, anxiety, PTSD) have shown inconsistent associations with growth. Further examination is needed to gain a better understanding of the reasons number of work traumas predicted PTSD and not PTG.

Hypothesis three examined the variables number of work traumas, number of life traumas, age, personality characteristic extroversion, personality characteristic openness, social support, negative cognitive coping, and positive cognitive coping in predicting PTSD. This hypothesis was supported by the data. Five blocks were used in this model.
In the first block, number of life traumas and number of work traumas contributed to PTSD and accounted for 11.9% of the variance (Hagstrom, 1995). Research with Korean railroad drivers found that drivers that were exposed to more than one critical incident had acute and chronic PTSD. Specifically, researchers found that the more experiences of a person-under-train within one year the higher rate of PTSD (Yum, Roh, Ryu, Won, Kim, Lee, & Kim, 2006).

When age was entered in block two, it did not contribute to the model. Further, personality characteristics extroversion and openness were added in block three and they also did not significantly explain variance in the model. Certain studies have suggested that the trait of extroversion may serve as a protective factor against PTSD (Dorfel, Rabe, & Karl, 2008; Kuhne, Orr, & Barraga, 1993; Nightingale & Williams, 2000), although there is not conclusive evidence to overall support that personality traits or lack of traits will contribute to PTSD. This finding corroborated previous findings. Personality factors may merit further consideration in future research. Using a different instrument or the full version BFI may want to be considered.

In the fourth block social support also did not significantly contribute, while negative cognitive coping and positive cognitive coping were added in the fifth block and accounted for an additional 9% of the variance in the model in predicting PTSD.

Social support failing to be a significant contributor to the model is surprising. Previous research has suggested that social support has numerous benefits. One study reported that individuals who have experienced a traumatic event and have strong social support networks adapt better than those who do not (Sherry & Philbrick, 2003). Social support may serve as a buffer against developing adverse symptoms including ASD,
PTSD, anxiety, and depression. Further, social support from an individual’s personal network and within his/her organization, specifically from supervisors, may be helpful in mediating traumatic stress (Leffler & Dembert, 1998; Regehr, Hill, & Glancy, 2000; Regehr et al., 2007; Weiss, Marmar, & Metzler, 1995). Stress was found to be mitigated by acknowledgement by the victims’ family and reassurance from the employer that the driver was not at fault for the accident (Weiss & Farrell, 2006). A lack of recognition by others including supervisors, co-workers, and family may also increase psychological distress. In a study with French train drivers by Cothereau et al. (2004), results indicated that risk factors for drivers for PTSD included those who were alone after the incident and those who had experienced previous trauma. Also, research has indicated that those who initially had stress reactions were more likely to have increased stress reaction when having a critical incident; however having immediate help reduced stress (Mishara, 2007).

Nearly 12% of variance in PTSD was explained by number of work traumas and number of life traumas and 9% of variance in PTSD was explained by negative cognitive coping and positive cognitive coping. The total variance in PTSD explained by the model was 25%.

Hypothesis four examined the variables number of work traumas, number of life traumas, age, personality characteristic extroversion, personality characteristic openness, social support, negative cognitive coping, and positive cognitive coping in predicting PTG. This hypothesis was partially supported by the data. Five blocks were used in this model. In the first block, number of work traumas and number of life traumas did not contribute to predicting the variance in PTG. Work and life traumas were not
significantly related to PTG. Age did not contribute to the model, which is understandable due to having a fairly homogenous sample. Personality characteristics extroversion and openness were added to the model and they also did not contribute to the model. This is an unexpected result as personality variables are factors that appear to contribute to whether an individual experiences PTG. Extraversion, openness to experience, agreeableness, and conscientiousness were variables found to have a positive correlation with PTG, while neuroticism has had a negative association (Linley & Joseph, 2004). Openness to new experiences, which is correlated with extraversion, is found in those who are imaginative, emotionally responsive, and intellectually curious. Tedeschi and Calhoun (1996) found that in a sample of college students that openness was correlated with PTG (Zoellner & Maercker, 2006). Personality trait extraversion was the most consistent and significant predictor of growth as found in previous studies (Sheikh, 2004).

In the fourth block social support was added and contributed 12% of the variance in PTG. Negative cognitive coping and positive cognitive coping were added in the fifth block and accounted for an additional 9% of the variance in the model in predicting PTG, though positive cognitive coping was a statistically significant predictor and negative cognitive coping was not. Combining all blocks accounted for 25% of the variance in the model. These findings contribute to the current literature, as little is known about factors associated with cognitive processing. Tedeschi, Park, and Calhoun (1998) suggested that after large-scale disasters, social support is usually decreased so therefore growth will not necessarily be as high as it is in individuals with medical concerns such as the diagnosis of cancer. Social support is considered an essential component necessary for growth as it
affects rumination and coping behaviors and certain traumatic events may not elicit this as much as others. Schulz and Mohamed (2004) reported that those individuals who underwent tumor surgery found that social support was the strongest indicator of positive changes after a stressful surgery, both directly and indirectly regarding social comparison. Park et al. (1996) found six significant predictors of stress-related growth; positive reinterpretation, intervening positive life events, acceptance coping, intrinsic religiousness, initial stressfulness of the event, and social support satisfaction (Linley & Joseph, 2004).

Difficulty lies in making definitive conclusions regarding Park et al.’s findings; however, it appears the greater traumatic experience, dealt with positive reinterpretation and acceptance coping, in people who are optimistic, intrinsically religious, and experience more positive affect, are likely to lead to reports of greater adversarial growth (Linley & Joseph, 2004).

Results from the current study indicted that positive cognitive coping strategies including positive cognitive restructuring, downward comparison, and resolution/acceptance, contributed greatly as a predictor of PTG. Thus it appears that when an individual is challenged by a traumatic event that it may be helpful for them to cognitively process by applying positive strategies, although further research is needed in regard to amount of time passed form traumatic event. Results suggest that an individual may benefit from viewing the traumatic event from a positive perspective by challenging maladaptive, distorted thoughts and replacing them with logic and reality. Downward comparison is a strategy where individuals judge themselves against others who are less fortunate or whom they see as lower than himself or herself by comparison. Through downward comparison, individuals can feel better about their own life circumstances. Through resolution/acceptance an individual can make amends with themselves and feel
calmer and at peace about the event that occurred. The individual does not ignore, but accepts this event as a part of their life.

Negative cognitive coping was barely significant which included negative cognitive coping strategies denial and regret. An individual that is unable to cognitively process the event and uses denial will not be able to be comfortable to think or talk about the traumatic event. In addition, an individual that utilizes regret would feel that they could have done something differently even though in most circumstances they could not have. By utilizing regret the individual continues to stay stuck and is unable to move forward in a positive manner and grow from the event. Negative cognitive coping being significant in this study may be due to a method issue. In a practical sense, it does not seem helpful for an individual to use denial or regret to process a traumatic event. One possible explanation is that a train engineer may use denial to protect themselves considering they may have to continually drive on the route that the incident occurred. Regret is more difficult to explain and this would be interesting to explore in future research. Overall, denial and regret are not cognitive strategies that would be encouraged to foster PTG.

**Summary of Study Implications**

The experience of trauma has been examined in numerous studies. Trauma has been studied as a result of work-related incidents in varying professions including train engineers, although underlying mechanisms has not been fully explored. This study contributed to current literature by studying factors that contribute to PTSD and PTG. Number of work traumas, number of life traumas, positive cognitive coping, and negative
cognitive coping were shown to predict PTSD. Positive and negative cognitive coping and social support were predictors of PTG in blocks in the model.

Cognitive processing is an important part of an individual’s attempt to recompose worldviews and adjust to the trauma (Calhoun, Cann, Tedeschi, & McMillan, 2000; Tedeschi & Calhoun, 1995). Developing cognitive based programs that help drivers to develop the necessary skills to cognitively process trauma appropriately may be helpful. Drivers may worry about having future accidents or be retriggered when driving through areas where accidents occurred. These measures could be developed to direct prevention and intervention protocols to help train drivers process trauma in an appropriate manner. For instance focusing on positive cognitive restructuring, downward comparison, and resolution/acceptance may help train drivers process traumatic events in a positive way. By employing these positive strategies, it may also help employees to develop growth from the event. Alternatively, train drivers that use cognitive coping strategy that uses denial and regret may not be as helpful and impact their psychological well-being.

Keeping a therapeutic journal may be helpful for individuals in finding meaning and positive emotion by being able to write deeply and consistently about the painful events in their lives. Through this process they may reap mental health benefits (Neimeyer, 2004; Pennebaker, 1997). In addition to this strategy, the use of narrative methods including biographical techniques, loss characterizations, metaphoric stories, and life chapters’ exercises may be helpful in promoting meaning reconstruction from a traumatic event (Neimeyer, 2004; Neimeyer, in press). This is only one example of the use of cognitive strategies. Different protocols addressing cognitive strategies to implement into railroad companies would be essential to an employee’s mental health.
Social support was also shown to be a significant predictor of PTG. Working as a railroader often can be a very isolating life due to long and unpredictable hours of work. Work programs that encourage mentorship may be helpful in alleviating some feelings of isolation and loneliness. Specifically, when a train worker is involved in a work-related traumatic event, it may be helpful to have programs whereas the driver has a set support network in place to be able to employ positive cognitive coping strategies to process the event. Further research in this area would be beneficial to gain a better understanding of best ways to implement these findings.

Researchers have recommended educating employees on understanding the impact of trauma-related work on professionals, developing coping skills for managing personal distress while helping others in distressed states, and applying strategies for detecting their own personal meaning that are positive in nature in order to become empowered in traumatic situations and enable personal growth (Lev-Wiesel, et al., 2009). It appears that training programs that thoroughly include the multiple aspects of trauma would be beneficial to employees. Programs that describe the varying traumatic events an employee may encounter and the different reactions to trauma including PTSD and PTG responses would be advantageous. Further, explaining the importance of social support as a possible agent in increasing positive trauma responses seems fruitful as wanting employees to be as healthy as possible. In addition, trainings that talk about best practices to cognitively process trauma may also be useful.

Having a work related trauma while employed driving a train seems to be almost inevitable for most employees. Understanding factors that contribute to negative and positive outcomes following a work related traumatic event is important to help workers
perform optimally in their jobs, as well as their personal lives. Results of this study have indicated that cognitive processing helps to explain the variance in PTSD and PTG. These variables are applicable to using in training of employees to be able to manage work related traumatic events, as well as trauma in general.

Study Limitations

There are always limitations that should be considered in a research study. First, the study tested the above hypotheses in a sample of freight train workers, thereby limiting the generalizability of the results to other transportation workers, those with careers exposed to trauma in the workplace, or trauma survivors, as a whole. The sample in this study consisted of transportation employees who were responsible for driving trains. Results should not be generalized to other professions involved in traumatic events. It should be noted that individuals in this sample were predominantly male, married, Caucasian, age range of 40-49, some college, and had higher incomes ($75,000-$100,000). For example, Tedeschi and Calhoun (1995) reported that in terms of gender outcomes, women typically tend to report more benefits than men. Overall, these demographics indicate the sample was quite homogeneous in terms of gender and also that they may not have actually experienced much trauma. This should be taken into consideration when considering results.

The entire sample only consisted of 9 people who were actually having difficulty with the critical events. Thus, it could be argued that the overall sample was one that had not truly experienced significant levels of trauma and that there for some of the results are limited due to the lack of significant exposure to trauma.
Participants were sent an email link from a manager within their organization. This could lead to some bias in responses. Participants may have felt pressure that they had to complete the survey since it came from someone who was in a position of power. Also, there may have been an element of social desirability in that the surveys were about the work they engage in and they completed the surveys on a computer at work while waiting and being paid. The sample size of 136 participants (after data were screened) was adequate and produced significant results; however, a larger sample would be desired. Future research might want to consider recruiting more than one company to participate, from different regions of the country to help with a more heterogeneous sample, and utilizing both email as well as paper surveys. Also, future research may want to have a larger window for applicants to complete the survey (this study utilized a window of four days). Also, selection bias could have been an issue for those who did not feel comfortable with completing a survey online. In addition, item repeated response may have also interfered with results, where as participants repeatedly chose the same answer in a scale such as the PTSD scale. It could also be the case that those persons who were greatly affected by the traumatic events chose not to participate in the study. Since the study was voluntary and invitation was mostly through an anonymous email link it could have been the case that those persons who were most affected by a traumatic event were less likely to report. Persons that were most impacted by work traumatic events may have been too traumatized to answer questions and therefore selected out of participating in the study.

Train workers were given a checklist of critical work incidents that was developed from a major train company in the United States. A limitation would be that the events on
this list were not specifically defined. Workers may have had some difficulty understanding this checklist and deciding what box to check that applied to them. Future researchers may want to specifically define each of these incidents. Also future researchers may want to include in the directions to only check off work events that they felt were traumatic and further defining trauma.

Another limitation of this study is that it is a cross-sectional research design, whereas participants are only studied at one particular point in time. Future researchers may want to consider a longitudinal study where observed changes are more accurate since research is conducted with the same individuals over time. It would be interesting to be able to conduct research with individuals before being employed in the transportation industry, during employment, and after employment in the transportation industry. Also, this research was based on self-report which may not always be an accurate representation. Even though measures used in this study had good reliability and validity, it would be interesting to include various methods including email and paper surveys or different measures for the primary variables PTSD, PTG, Personality, Social Support, and Cognitive Coping and again using more than one sample.

Measures were selected based on previous research and having good reliability and validity, although several limitations in regards to the scales should be discussed. The Big Five Inventory was shortened in this study due to time constraints, although even with the shortened scale research indicated variables still having good reliability and validity. In the PTG model, personality characteristics were not significant predictors. Since there were only two items for each scale of extroversion and openness, the full 44-item scale may want to be considered in future research.
The other scale that may be considered as a limitation is the *Cognitive Processing of Trauma Scale* (CPOTS). The CPOTS has not been extensively in the literature. The scale demonstrated good reliability, even with items divided into positive and negative scales. Also, with the scale divided into positive and negative cognitive coping, it still predicted PTSD and PTG. Future researchers might want to consider examining the measure’s five subscales individually. Developers of the CPOTS indicated that the five-factor model is the most appropriate (Williams et al., 2002). Using the scale divided still had significant results in predicting PTG and PTSD so this did not appear to be problematic.

**Recommendations for Future Research**

The following section will address recommendations for further research and possible areas to explore. Results of this study may be understood better from a larger sample representing more diverse demographics. If time and money were not a concern, then a longitudinal study may serve in more concise understanding of variables responsible for change. Specifically this study had an underrepresentation in gender. Of the 136 participants, only 3 of them were women although the train industry is predominantly males. In the field of PTG, there has been a consensus that PTG is more likely to occur in women than men which may have contributed to results.

Future researchers may want to consider using several of the scales differently. Instead of looking at PTGI as a whole, the measure can be divide into subscales of relating to others, new possibilities, personal strengths, spiritual change, and appreciation of life. In train employees, some aspects of growth may be more important to them than others. For example, it is possible that train engineers may value appreciation of life
above spiritual change. Further examination would be needed to understand what areas of
growth would be more applicable.

The personality measure used in the study consisted only of 4 items due to
concern about length and completion of study. Future researchers may want to consider
using the entire 44 items or the items for extroversion and openness from the 44 item
scale instead of the 10 item scale to gain an understanding about personality factors
contributing to PTSD and PTG.

Other research addressing PTG discusses the concept of perceived threat. In train
work an individual’s perceived sense of threat to self may impact how traumatic they
view an event. Future researchers may want to consider adding in a perceived threat scale
to assess how the work related traumas perceived.

Lastly, for this study work traumas was summed together to create a continuous
variable. Life traumas were also summed together to derive a continuous variable.
Looking more specifically at work traumas and/or life traumas may have different results.
Identifying which events are the most traumatic may help in understanding the predicting
variable responsible for change. For example, running analyses with those who work
related trauma involved witnessing a death may be different than looking at work related
trauma summed.

Conclusions

Workers who are employed in transportation, specifically railroad, are likely to
encounter a work-related trauma in their career. The results of this study indicated that
number of work traumas, number of life traumas, positive cognitive coping, and negative
cognitive coping were significantly related to the occurrence of symptoms of PTSD in
railroad employees. Persons who reported higher levels of social support and who also endorse using positive cognitive coping techniques were likely to report more post traumatic feelings of growth.
References


Retrieved Nov, 2008, from

recovering TWA Flight 800. *Journal of Nervous and Mental Disease, 186, 574-577.*

of war: The case of social workers and nurses working in a shared war reality.

survivors of childhood sexual abuse in relation to the perpetrator identity. *Journal
of Loss and Trauma, 10,* 7-17.

Light Rail Transit Association. A World of trams and urban transit. Available at: http://


135.


trauma and their relationship to subsequent posttraumatic stress, depression, and


under train’ incidents from the driver’s point of view—a prospective one year
follow-up study: The design, and medical and psychiatric data. *Social Sciences
and Medicine, 38*(3), 471-475.


following involvement in a railway suicide or attempted suicide. *Counselling
Psychology Quarterly, 8*(2), 157-162.


US Department of Transportation, Federal Railroad Administration, Office of Safety
http://safetydata.fra.dot.gov/Prelim/2005/r01.htm

traumatic and stressful events. *Depression and Anxiety, 7*, 141-144.


Appendix A

Glossary of Terms

Acute stress disorder. According the American Psychiatric Association (2000), acute stress disorder (ASD) is considered an immediate, short-term response to trauma that lasts between two days and four weeks. The essential feature of ASD is the development of characteristic anxiety, dissociative, and other symptoms that occurs within 1 month after exposure to an extreme traumatic stressor. After one month the diagnosis can then turn into post traumatic stress disorder.

Avoidance. Avoidance is when the individual is involved in a traumatic event and makes deliberate efforts to try not to have thoughts, feelings, or conversations about the traumatic event and may also avoid activities, situations, or people who invoke the memory of the event (APA, 2000).

Cognitive coping strategies. The mental process an individual employs after a traumatic event in order to make sense of the event. Cognitive processing is an important component of an individual’s attempt to recompose worldviews and adjust to the trauma (Calhoun, Cann, Tedeschi, & McMillan, 2000; Tedeschi & Calhoun, 1995).

Cognitive Appraisal Variables. Cognitive appraisal variables that have been associated with positive growth include problem-focused coping, acceptance, positive reinterpretation coping, positive religious coping, cognitive processing, rumination, intrusions, and avoidance. These variables are considered necessary “for the rebuilding of shattered world views following trauma (Linley & Joseph, 2004; Calhoun & Tedeschi, 1998; Janoff-Bulman, 1992).”
Critical Incidents. Critical incidents are defined as events out of the ordinary in the transportation field that can include derailments, collisions, near misses, accidents, and suicides (Weiss & Farrell, 2006).

Deliberate rumination. Deliberate rumination is the effortful and purposeful thinking that may include reminiscing, problem solving, and trying to make sense out of a situation. The process of deliberate rumination tends to repair or restructure the individual’s general way of understanding the world (Tedeschi & Calhoun, 2006).

Negative cognitive Processing. Negative cognitive processing in the current study is utilized by two of the subscales within the Cognitive Processing of Trauma Scale; Denial and Regret (Williams et al., 2002).

Person-under-train. Person-under-train (PUT) is terminology used in the railroad industry when an individual ends up under the train. Most frequent individuals arrive under the train as a result of a suicide attempt. Not all PUT’s are fatalities (Yum, Roh, Ryu, Won, Kim, Lee, & Kim, 2006).

Personality characteristics. There are five broad domains of personality are generally recognized as including openness, conscientiousness, extraversion, agreeableness, and neuroticism are used to describe personality. (Russell & Karon, 1994). This five factor model is often referred to as the "Big Five" factors (or Five Factor Model; FFM) (Costa & McCrae, 1992).

Positive cognitive processing. Positive cognitive processing in the current study is utilized by three of the subscales within the Cognitive Processing of Trauma Scale; Positive cognitive restructuring, Resolution, and Downward comparison (Williams et al., 2002).
Posttraumatic growth. Posttraumatic growth is generally recognized as an individual surpassing previous level of functioning and gaining personal growth. Posttraumatic growth is defined as “the individual’s experience of significant positive change resulting from the struggle with a major life crisis” (Calhoun, Cann, Tedeschi, & McMillian, 2000, p. 521). Posttraumatic growth has been divided into five domains: personal strength, new possibilities, relating to others, appreciation of life, and spiritual change (Tedeschi & Calhoun, 1996).

Post traumatic stress disorder. According to the DSM-IV (APA, 2000), post traumatic disorder (PTSD) occurs when an individual is exposed to an extreme traumatic stressor involving direct personal experience of an event that involves actual or threatened death or serious injury, or other threat to one's physical integrity, or witnessing an event that involves death, injury, or a threat to the physical integrity of another person. Symptoms of the PTSD may include reexperiencing, avoidance, and hyperarousal symptoms.

Railway. Railway is defined as transportation that utilizes trains in order to transport people or goods. Words used synonymously in the literature are subway, railway, metro, underground, and tubes (Ratnayake, et al., 2007).

Social support. Social support is defined by the physical and emotional comfort given by friends, family, co-workers, and others.

Suicide. Suicide is defined by as the act of an individual taking their own life. Suicide specifically occurring in railroad can occur by the individual placing their vehicle on the track or laying on the track in order to be run over and killed (trespassing fatalities) (Mishara, 2007).
Trauma/Traumatic Event. In the study, trauma is defined as an event that occurs unexpectedly and causes challenges for the individual to cope (Janoff-Bulman, 1992). Traumatic events or critical incidents in the railroad industry may include derailments, collisions and near misses, and suicides on the tracks (Weiss & Farrell, 2006).
Appendix B

Informed Consent

Trauma in Transportation: Addressing Both Positive and Negative Outcomes for Railroad Workers

Principal Investigator: Jill Pinarowicz, MS

INTRODUCTION

You are invited to take part in a research study that is a doctoral dissertation conducted by Jill V. Pinarowicz, MS, a counseling psychology doctoral student at University of Denver. This study is being supervised by Dr. Patrick Sherry, PhD, Professor of Counseling Psychology, University of Denver, Denver, CO, 80208, 303-871-2495, psherry@du.edu.

You are being asked to participate because you witnessed a traumatic event while working. Your participation in this study is entirely VOLUNTARY. You should read the information below before deciding whether or not to participate.

PURPOSE OF STUDY

The purpose of this study is to explore factors that contribute to negative and positive changes following the experience of a traumatic event at work. It is necessary to gain a better understanding about factors that contribute to these positive and negative changes. Such information can be used to develop useful interventions that recognize the complexity of being involved in trauma in railroad in order to develop better training and improvement of current protocols.

PROCEDURES

If you volunteer to participate in this study, we will ask you to do the following things:

• By filling out the questionnaire this will act as your informed consent.

• Fill out the enclosed questionnaires about your demographic information, mood, thoughts and experiences related to the traumatic event you have experienced at work, and changes you may have experienced. The questionnaire will take approximately 15-30 minutes to complete. You will fill out this questionnaire just once.
• Return and complete questionnaire during the time you are given it or a pre-paid envelope will also be available if you are unable to fill it out before you are required to work.

POTENTIAL RISKS AND DISCOMFORTS

The risks associated with this project are minimal. However, sometimes people experience mild emotional distress when asked to think about their thoughts and feelings related to their traumatic experience. Filling out the questionnaires may evoke unpleasant feelings related to your traumatic experience by filling out the questionnaires. You are encouraged to participate only if you feel that filling out these questionnaires will not cause undue emotional distress. While we encourage you to answer every question, we respect your right to choose not to answer any questions that make you feel uncomfortable. If you become upset by participating in the study, please contact your local Employee Assistance Program for counseling.

ANTICIPATED BENEFITS TO SUBJECTS

Potential benefits may include gaining more understanding about traumatic experiences in the railroad industry.

ANTICIPATED BENEFITS TO SOCIETY

The possible benefits from this study to society could include developing better interventions that may benefit those who are employed in the railroad.

ALTERNATIVES TO PARTICIPATION

You may discontinue the study at any time.

PAYMENT FOR PARTICIPATION

You will receive no money for participation in this study.

FINANCIAL OBLIGATION

You will not be billed for your participation in this research.

PRIVACY AND CONFIDENTIALITY

We will make every effort to keep your research records confidential. You will be assigned an “identification number” and this will be used for all questionnaires and data analysis. The list that identifies your name with your identification number will be kept in a locked file separate from your questionnaire data. Please do NOT include your name anywhere on the questionnaire.
Records that identify you may be looked at by the following people:

- Federal agencies that oversee human subject research
- University of Denver Institutional Review Board
- The investigators and research team for this study
- Regulatory officials from the institution where the research is being conducted, to ensure compliance with policies or monitor the safety of the study.

The results of this research may be presented at meetings or in published articles; however, your name will always be kept private. Information collected during the research study will be kept in a secure computer system. After your participation in the study is complete, you will be identified only by code number.

**PARTICIPATION AND WITHDRAWAL**

Your participation in this research is **VOLUNTARY**. Consent to participate in this research, and the use of the answers you supply, is given when you return you complete the questionnaire.

**IDENTIFICATION OF INVESTIGATORS**

If you have any questions or concerns about this research, or if you experience a negative reaction to this study, please feel free to contact the principal investigator:

Principal Investigator: Jill Pinarowicz, MS (570) 902-1035, jvp107@msn.com

**RIGHTS OF RESEARCH SUBJECTS**

You may discontinue participation and simply throw away this questionnaire at any time without penalty. You are not waiving any legal claims or rights because of your participation in this research study. If you have questions regarding your rights as a research subject, you may contact Susan Sadler, Chair, University of Denver Institutional Review Board for the Protection of Human Subjects, at 303-871-3454, or Sylk Sotto-Santiago, Office of Research and Sponsored Programs at 303-871-4052 or write to either at the University of Denver, Office of Research and Sponsored Programs, 2199 S. University Blvd., Denver, CO 80208-2121.
Appendix C

Demographics

Please answer the following questions about yourself. These will be used for statistical analysis only.

For the following questions, please place a checkmark in the area to the left of the option that best applies to you.

**Part 1: Background Information**

1. Age?
   - [ ] Less than 18
   - [ ] 18 to 29
   - [ ] 30 to 39
   - [ ] 40 to 49
   - [ ] 50 to 59
   - [ ] 60 or older

2. What is your gender?
   - [ ] Female
   - [ ] Male
   - [ ] Transgender

3. Which of the following categories below do you feel best describes your race or ethnicity?
   - [ ] Caucasian
   - [ ] Hispanic
   - [ ] Latino/a
   - [ ] African-American
   - [ ] Asian or Pacific Islander
   - [ ] American Indian or Alaskan Native
   - [ ] Multi-racial
   - [ ] Other (please indicate) __________________________________________________________

4. What is your marital status? (Specify only one)
   - [ ] Single (never married)
5. How many years of school have you completed? (please circle the number that best explains your level of education)

___ Did not finish high school
___ High school diploma (or GED)
___ Some college
___ College degree (Bachelor’s)
___ Some graduate school training
___ Graduate degree

7. Approximately, what is your household income?
   Check one income range that best describes your household income for last year from all sources of income (salaries, wages, tips, social security, disability income or insurance, retirement income, or any other income).

___ Under $25,000
___ $25,001-$50,000
___ $50,001-$75,000
___ $75,001-$100,000
___ $100,000 +

Part 2: One of the things we are trying to find out in this study is the extent to which you have been involved in critical incidents at work. Please reflect over the course of your work history as you answer the following questions.

A critical incident is defined as being exposed to an extremely traumatic stressor involving direct personal experience of an event that involves actual or threatened death or serious injury, or other threat to one’s physical integrity; or observing or witnessing an event that involves death, injury, or a threat to the physical of another person; or learning about unexpected or violent death, serious harm, or threat of death or injury experienced by a family member or other close associate.

In the railroad industry a critical incident can be a grade crossing accident, a collision with a trespasser or pedestrian, a personal injury or an assault.

1. Please check all of the critical incidents you have been involved in:

___ Employee
___ Passenger
___ Trespasser
___ Jumper
___ Auto/Vehicle
___ Auto/Truck
___ Auto/Tractor Trailer
___ Auto/AV
___ Train/Freight
___ Near Miss
___ Derailed
___ Grade Crossing
___ Passenger Expired
___ Bicycle
___ Debris
___ Other (please specify)

2. If yes, how many incidents have you been involved in?
___ 0
___ 1
___ 2
___ 3
___ 4
___ 5 or more

3. The most recent work-related incident occurred when?
___ Within the last month
___ Within in the last 6 months
___ Within the last year
___ Over a year ago
___ More than 5 years ago
___ Never

4. Was the incident a suicide?
___ Yes
___ No
___ N/A

5. Were you frightened and/or concerned for your own safety by the incident?
___ Yes
___ No
___ N/A

6. Was anyone killed?
___ Yes
___ No
___ N/A
7. Was the person(s) injured, but alive?
___ Yes
___ No
___ N/A

8. Have you been in a near miss incident where you were nearly injured?
___ Yes
___ No

9. Have you been injured as a result of a work-related accident?
___ Yes
___ No

10. What kind of traumatic life events have you experienced? (Check all that apply)
___ Car accident
___ Bereavement (loss of loved one)
___ Heart Attack/Stroke
___ Cancer
___ Major Injury
___ Witness Death
___ Military Combat
___ Sexual Assault/Rape
___ Maritime Disasters (Boating)
___ Plane Crash
___ Tornadoes
___ Hurricanes
___ Shootings
___ Work-related trauma
___ Other (please specify)

11. How many traumatic events have you experienced in your lifetime? Please DO NOT include work related traumatic events for this question.
___ 0
___ 1
___ 2
___ 3
___ 4
___ 5 or more

12. Of all the traumas you have experienced, including work-related trauma, what event would you consider the MOST traumatic?
___ Car accident
___ Bereavement (loss of loved one)
___ Heart Attack/Stroke
___ Cancer
___ Major Injury
___ Witness Death
___ Military Combat
___ Sexual Assault/Rape
___ Maritime Disasters (Boating)
___ Plane Crash
___ Tornadoes
___ Hurricanes
___ Shootings
___ Work-related trauma

13. The most traumatic event of your life occurred when?
___ Within the last month
___ Within the last 6 months
___ Within the last year
___ Over a year ago
___ More than 5 years ago
Appendix D

PTSD Checklist Specific Version (PCL-S)

The following set of questions asks you about your experience with a critical incident in the transportation field. Please rate the extent to which you agree with each of the following statements. If you have not experienced a work related trauma, please still answer these questions based on how you feel in general due to overall life experiences.

1 = Not at all  
2 = A little bit  
3 = Moderately  
4 = Quite a bit  
5 = Extremely

_____ 1. Have repeated, disturbing memories, thoughts, or images of the stressful extent?

_____ 2. Had distressing dreams of this event?

_____ 3. Suddenly act or feel as if the stressful event were happening again?

_____ 4. Feel very upset when something reminded you of the stressful experience?

_____ 5. Have physical reactions (e.g., sweating, trouble breathing, heart pounding) when something reminded you of the stressful event?

_____ 6. Avoid thinking or talking about the stressful experience or avoid having feelings related to it?

_____ 7. Avoid activities or situations because they remind you of the stressful experience?

_____ 8. Have trouble remembering important parts of the stressful experience?

_____ 9. Lose interest in activities that you used to enjoy?

_____ 10. Feel distant or cut-off from other people?

_____ 11. Feel emotionally numb?

_____ 12. Feeling as if your future would somehow be cut short?

_____ 13. Have trouble falling or staying asleep?
14. Feel irritable or have angry outbursts?
15. Have difficulty concentrating?
16. Become super alert or vigilant?
17. Feel jumpy or easily startled?
Appendix E

The Posttraumatic Growth Inventory

People sometimes find that a crisis such as a traumatic work related event may eventually lead to positive changes in their lives. For each of the items below, indicate the degree to which the changes described in the items has occurred in your life-as of today-as a result of work related traumatic event. If you have not experienced a work-related traumatic event, please still answer these questions based on how you feel in general due to overall life experiences.

0= I did not experience this change.
1= I experienced this change to a very small degree.
2= I experienced this change to a small degree.
3= I experienced this change to a moderate degree.
4= I experienced this change to a great degree.
5= I experienced this change to a very great degree.

_____ 1. I changed my priorities about what is important in life.
_____ 2. I have a greater appreciation for the value of my own life.
_____ 3. I developed new interests.
_____ 4. I have a greater feeling of self-reliance.
_____ 5. I have a better understanding of spiritual matters.
_____ 6. I more clearly see that I can count on people in times of trouble.
_____ 7. I established a new path for my life.
_____ 8. I have a greater sense of closeness with others.
_____ 9. I am more willing to express my emotions.
_____ 10. I know better that I can handle difficulties.
_____ 11. I am able to do better things with my life.
_____ 12. I am better able to accept the way things work out.
_____ 13. I can better appreciate each day.
_____ 14. New opportunities are available which wouldn’t have been otherwise.
15. I have more compassion for others.
16. I put more effort into my relationships.
17. I am more likely to try to change things which need changing.
18. I have a stronger religious faith.
19. I discovered that I’m stronger than I thought I was.
20. I have learned a great deal about how wonderful people are.
21. I better accept needing others.
Appendix F

Cognitive Processing of Trauma Scale

The following set of questions asks you about your experience with your critical incident in the transportation field. Please rate the extent to which you agree with each of the following statements, using the following rating scale. If you have not experienced a work-related traumatic event, please still answer these questions based on how you feel in general due to overall life experiences.

-3, strongly disagree
-2, moderately disagree
-1, slightly disagree
0, neither mainly agree nor disagree
1, slightly agree
2, moderately agree
3, strongly agree

_____ 1. There is ultimately more good than bad in this experience
_____ 2. I have figured out how to cope
_____ 3. I say to myself ‘this isn’t real’
_____ 4. I have moved on and left this event in the past
_____ 5. Overall, this event feels resolved for me
_____ 6. I have comes to terms with this experience
_____ 7. I often think, ‘if only I had done something different’
_____ 8. I blame myself for what happened
_____ 9. I refuse to believe that this really happened to me
_____ 10. I wish I could have handled this differently
_____ 11. Other people have had worse experiences than mine
_____ 12. I act as if this event never really happened
_____ 13. Even though my experience was difficult, I can think of ways that it could have been worse
14. My situation is not so bad compared to other peoples’ situations
15. I am able to find positive aspects of this experience
16. I have been able to find a ‘silver lining’ in this event
17. I pretend this didn’t really happen
Appendix G

The Big Five Inventory Personality Test

Directions: The following statements concern your perception about yourself in a variety of situations. Your task is to indicate the strength of your agreement with each statement, utilizing a scale in which 1 denotes strong disagreement, 5 denotes strong agreement, and 2, 3, and 4 represent intermediate judgments. In the boxes before each statement, click a number from 1 to 5 from the following scale:

1. Strongly disagree
2. Disagree a little
3. Neither disagree nor agree
4. Agree a little
5. Strongly agree

There are no "right" or "wrong" answers, so select the number that most closely reflects yourself on each statement. Take your time and consider each statement carefully.

I see myself as someone who... Disagree 1 2 3 4 5 Agree

_____ Tends to find fault with others
_____ Does a thorough job
_____ Is reserved
_____ Is relaxed, handles stress well
_____ Has an active imagination
_____ Is generally trusting
_____ Tends to be lazy
_____ Is outgoing, sociable
_____ Gets nervous easily
_____ Has few artistic interests
Appendix H

Measures of Social Support

The following sets of questions pertain to work stress and social support.

1. How much can each of these people be relied on when *things get tough at work*?

<table>
<thead>
<tr>
<th></th>
<th>Not at all</th>
<th>A little</th>
<th>Somewhat</th>
<th>Very</th>
</tr>
</thead>
<tbody>
<tr>
<td>A. Your immediate supervisor (boss)</td>
<td>0</td>
<td>1</td>
<td>2</td>
<td>3</td>
</tr>
<tr>
<td>B. Other people at work</td>
<td>0</td>
<td>1</td>
<td>2</td>
<td>3</td>
</tr>
<tr>
<td>C. Your wife, husband</td>
<td>0</td>
<td>1</td>
<td>2</td>
<td>3 Not Married</td>
</tr>
<tr>
<td>D. Your friends and relatives</td>
<td>0</td>
<td>1</td>
<td>2</td>
<td>3</td>
</tr>
</tbody>
</table>

2. How much is each of the following people *willing to listen to your work-related problems*?

<table>
<thead>
<tr>
<th></th>
<th>Not at all</th>
<th>A little</th>
<th>Somewhat</th>
<th>Very</th>
</tr>
</thead>
<tbody>
<tr>
<td>A. Your immediate supervisor (boss)</td>
<td>0</td>
<td>1</td>
<td>2</td>
<td>3</td>
</tr>
<tr>
<td>B. Other people at work</td>
<td>0</td>
<td>1</td>
<td>2</td>
<td>3</td>
</tr>
<tr>
<td>C. Your wife, husband</td>
<td>0</td>
<td>1</td>
<td>2</td>
<td>3 Not Married</td>
</tr>
<tr>
<td>D. Your friends and relatives</td>
<td>0</td>
<td>1</td>
<td>2</td>
<td>3</td>
</tr>
</tbody>
</table>

3. How much is each of the following people *helpful to you in getting your job done*?

<table>
<thead>
<tr>
<th></th>
<th>Not at all</th>
<th>A little</th>
<th>Somewhat</th>
<th>Very</th>
</tr>
</thead>
<tbody>
<tr>
<td>A. Your immediate supervisor</td>
<td>0</td>
<td>1</td>
<td>2</td>
<td>3</td>
</tr>
<tr>
<td>B. Other people at work</td>
<td>0</td>
<td>1</td>
<td>2</td>
<td>3</td>
</tr>
</tbody>
</table>

Please indicate *how true* each of the following statements is of your *immediate supervisor*.

<table>
<thead>
<tr>
<th></th>
<th>Not at all true</th>
<th>Not too true</th>
<th>Somewhat true</th>
<th>Very true</th>
</tr>
</thead>
<tbody>
<tr>
<td>6. My supervisor is competent in doing (his/her) job</td>
<td>0</td>
<td>1</td>
<td>2</td>
<td>3</td>
</tr>
</tbody>
</table>

169
7. My supervisor is very concerned about the welfare of those under him.

8. My supervisor goes out of his way to praise good work.