PREDICTING TRAJECTORIES OF EMOTIONAL WELL-BEING FOLLOWING MEDICAL DISCHARGE FOR TRAUMATIC INJURY: A LONGITUDINAL STUDY USING MULTILEVEL MODELING

A Dissertation

by

VANESSA CATHERINE LAIRD

Submitted to the Office of Graduate and Professional Studies of
Texas A&M University
in partial fulfillment of the requirements for the degree of

DOCTOR OF PHILOSOPHY

Chair of Committee,	Daniel F. Brossart
Committee Members,	Timothy R. Elliott
	Wen Luo
	Joshua A. Hicks
Head of Department,	Shanna Hagan-Burke

August 2017

Major Subject: Counseling Psychology

ABSTRACT

Prior research has shown that the impact of traumatic injury on subjective well-being (SWB) varies significantly depending on personal, environmental, and injury characteristics. Although SWB comprises both life satisfaction and emotional well-being, studies of SWB following traumatic injury have focused almost exclusively on life satisfaction. This dissertation examined trajectories of emotional well-being among 488 individuals admitted to a Level 1 trauma center for serious physical injury. Emotional well-being was measured prior to hospital discharge, and at three, six, and 12 months post-discharge, using the Mental Health scale of the Veterans RAND 12-Item Health Survey (VR-12). Multilevel modeling (MLM) was used to investigate whether initial demographic variables, injury characteristics, resilience [measured with the Connor-Davidson Resilience Scale 10 (CD-RISC 10)], and social support [measured with the Social Provisions Scale (SPS)] predicted the emotional well-being trajectories. Participants' change in resilience and social support over the 12-month period were also tested as predictors.

Hierarchical linear modeling (HLM) software revealed that the optimal growth model was cubic with a random linear growth component. On average, emotional well-being decreased over time, but individual variability in linear growth remained significant. Meaningful changes in resilience and social support, both positive and negative, occurred during the 12 months.

Emotional well-being was initially predicted by educational attainment but not by age, gender, racial/ethnic minority status, employment status, injury severity, or presence of mild traumatic brain injury (mTBI). When controlling for resilience and social support variables, education was no longer a significant predictor. In the final model, initial resilience, resilience change, initial social support, and social support change significantly predicted emotional well-being 12 months post-discharge, while resilience change and social support change predicted the linear growth in emotional well-being over time. This model accounted for 33.2% of the between-individual variance in final scores and 46.9% of the variance in linear growth.

The findings challenge assumptions of hedonic adaptation following traumatic injury and indicate that emotional well-being trajectories are strongly associated with changes in resilience and social support, even when controlling for initial resilience and social support.

ACKNOWLEDGMENTS

I would first like to thank my committee members, Professors Daniel Brossart, Timothy Elliott, Wen Luo, and Joshua Hicks, for their ongoing support and guidance throughout the writing of this dissertation. I am particularly grateful to my advisor, Dr. Brossart, for being an exceptional teacher and mentor to me during this program. Thank you for your insight, compassion, and lightheartedness. Special appreciation goes to Dr. Elliott for generously offering me the opportunity to work with this data set and providing tremendous guidance along the way. Thank you also for your moving confidence in me as a student. I want to express my sincere gratitude to Dr. Luo for teaching me hierarchical linear modeling and providing statistical expertise on so many occasions, and to Dr. Hicks for his valuable suggestions and understanding of the conceptual issues. I also want to thank Dr. Ann Marie Warren and the team of researchers at Baylor University Medical Center who created the Baylor Trauma Outcome Project. It was a privilege to work with this data set.

I want to thank the dedicated faculty who have supported me throughout this doctoral program, particularly Charles Ridley, Linda Castillo, Lizette Ojeda, and William Rae; my counseling psych friends for riding the emotional roller-coaster of graduate school with me; and Kristie Stramaski for being the most helpful academic advisor. I also want to thank Mme Saberian, Betsy Sunstrom, and Professors John Ruszkiewicz, Alice Batt, and William Scheick, whose passion and nurturance as teachers made me like school so much that I kept wanting more of it.

Finally, I want to acknowledge my family, who made every step of this journey possible and to whom I dedicate this dissertation. To my parents, thank you for your unfailing love and support. For valuing my education so strongly. For passing down to me a tremendous love of thinking, learning, and discovering. And for teaching me the helpful strategy of not peeing until I write one more sentence. To my sister, thank you for being my best friend since birth and always having my back. I owe so much to being able to follow in your footsteps, not just in school but in life. To Cory, thank you for being my favorite reason to procrastinate, and for getting me through graduate school with my integrity, sanity, and sense of humor intact.

CONTRIBUTORS AND FUNDING SOURCES

Contributors

This work was supervised by a dissertation committee consisting of Professors Daniel Brossart, Timothy Elliott, and Wen Luo of the Department of Educational Psychology and Professor Joshua Hicks of the Department of Psychology.

The data used in the study was provided by Professor Timothy Elliott and research collaborators at the Baylor Scott & White Medical Center. Scope and methodology for the study were selected by the student, in collaboration with Professors Timothy Elliott and Daniel Brossart. Statistical analyses were conducted by the student, in collaboration with Professor Wen Luo. All other work for the dissertation was completed by the student, under the advisement of Professors Daniel Brossart, Timothy Elliott, Wen Luo, and Joshua Hicks.

Funding Sources

Graduate study was supported by a fellowship from Texas A&M University. There are no other outside funding contributions to acknowledge related to the research and compilation of this document.

TABLE OF CONTENTS

Page

ABSTRACT ii

ACKNOWLEDGMENTS iv

CONTRIBUTORS AND FUNDING SOURCES vi

TABLE OF CONTENTS vii

LIST OF FIGURES ix

LIST OF TABLES x

CHAPTER I INTRODUCTION 1

- Purpose of the Study 8
  - Research Questions 9

CHAPTER II LITERATURE REVIEW 10

- Subjective Well-Being (SWB) 10
  - Development of SWB Research 10
  - SWB Construct and Its Components 12
  - Theories and Models of SWB 14
  - Major Predictors of SWB 18
- Traumatic Injury 25
- SWB Following Traumatic Injury 28
  - Models of SWB Following Traumatic Injury 28
  - Major Findings on SWB Following Traumatic Injury 30
  - Predictors of SWB Following Traumatic Injury 34

CHAPTER III METHOD 41

- Participants 41
- Procedure 42
- Measures 44
  - Predictor Variables 44
  - Outcome Variable 49
  - Variable Level Classification 55

Data Preparation ... 56
Data Analysis ... 58
Rationale for the Use of Multilevel Modeling ... 58
Modeling Strategy and Procedures ... 60

CHAPTER IV RESULTS ... 66

Preliminary Analyses ... 66
Descriptive Statistics ... 66
Correlations ... 68
Variable Descriptives by Factor ... 69
Missing Data ... 72
Model Analyses ... 75
Unconditional Means Model (Model 1) ... 75
Growth Function Over Time ... 76
Level-1 Error Covariance Structure ... 77
Unconditional Growth Model (Model 2) ... 79
Transitional Models (Models 3 & 4) ... 80
Final Model (Model 5) ... 83
Unique Predictive Ability of Primary Variables ... 86
Checking Assumption Violations ... 87

CHAPTER V SUMMARY ... 93

Summary and Implications of Major Findings ... 93
Emotional Well-Being ... 93
Demographic and Injury-Related Variables ... 96
Resilience ... 99
Social Support ... 102
Final Model ... 104
Limitations ... 105
Future Directions ... 107

REFERENCES ... 110

LIST OF FIGURES

Page

Figure 1 Average unconditional growth trajectory 80

Figure 2 Frequency distribution of Level-1 residuals 88

Figure 3 Q-Q plot of Level-1 residuals 89

Figure 4 Q-Q plot of Level-1 random effects 90

Figure 5 Plots of Level-2 predictors against Level-2 residuals 91

LIST OF TABLES

Page

Table 1 Demographic and injury-related descriptives for sample 67

Table 2 Means and standard deviations for repeated measurement variables 68

Table 3 Correlations for continuous variables 69

Table 4 Emotional well-being means and standard deviations by variable factor 70

Table 5 Resilience and social support means and standard deviations by variable factor.. 71

Table 6 Number of missing data points for repeated measurement variables 72

Table 7 Demographic and injury-related statistics for participants with complete versus incomplete data 73

Table 8 Emotional well-being scores for participants with complete versus incomplete data.. 74

Table 9 Comparison of linear, quadratic, and cubic growth models.. 77

Table 10 Results for Model 2.. 80

Table 11 Results for Model 3.. 81

Table 12 Results for Model 4.. 83

Table 13 Results for Model 5.. 84

Table 14 Comparison of the restricted model (Model 2) and full model (Model 5) 86

Table 15 Unique predictive abilities of primary variables.................................... 87

CHAPTER I

INTRODUCTION

Traumatic physical injuries are a significant public health concern in the United States. Each year, traumatic injury accounts for approximately 27 million emergency department visits, 3 million hospital admissions, and 193,000 deaths (Centers for Disease Control and Prevention, 2013; National Trauma Institute, 2014). Consequences of traumatic injury can include not only physical harm but also psychological and social difficulties for the injured individual and their surrounding family and community. Trauma centers provide care to individuals who sustain a major traumatic injury, and are evaluated and ranked from Level 1 through 5, with Level 1 trauma centers providing the highest standard of patient care (American Trauma Society, n.d.). As medical advances have improved survival rates and medical outcomes for individuals who sustain a traumatic injury, there is an increasing focus on understanding, predicting, and promoting psychological and social well-being after the injury.

Until recently, studies of psychosocial outcomes following traumatic injury have been dominated by an emphasis on negative reactions and psychological distress (Elliott, Kurylo, & Rivera, 2002; Myers, 2000; Seligman, 2002). Seligman (2002, p. 14) accuses contemporary psychological research of having an “obsession with pathology,” emphasizing mental illness while neglecting mental health and well-being. The field of positive psychology has been a major force in correcting this imbalance, putting forth the premise that “what is good about life is as genuine as what is bad and therefore deserves equal attention from psychologists" (Peterson, 2006, p. 4). Positive psychology focuses on positive subjective experiences (e.g., happiness), positive individual traits (e.g., resilience), and positive institutions (e.g., supportive families), and examines how individual traits and positive institutions contribute to positive experiences (Peterson, 2006; Seligman, 2002). The positive psychology movement has been a prominent source of research interest in positive psychological outcomes following traumatic injury.

Studies of subjective well-being (SWB) have proliferated in the trauma literature since the 1980s, largely in parallel with the growing positive psychology movement. SWB refers to a positive, global experience of one's life, characterized by high life satisfaction, high positive affect, and low negative affect (Diener, 1994). SWB is a desirable outcome in its own right, but it also contributes to other positive outcomes, such as improved health and longevity, better ability to cope with stressors, healthier social behaviors, and overall, greater productivity and engagement with life (Argyle, 1997; Diener, 2012; Fredrickson, 2013; Lyubomirsky, King, & Diener, 2005a). Studying SWB in samples of traumatically injured individuals can reveal potential facilitators of and barriers to SWB. This information may be used to develop and implement interventions that will facilitate SWB and support the long-term quality of life for individuals who sustain a traumatic injury.

SWB is comprised of three sub-constructs: life satisfaction, the presence of positive affect, and an absence of negative affect (Diener, 1984; Diener, 1994). However, the majority of studies examining SWB following traumatic injury focus on life satisfaction, while emotional well-being (i.e., the affective component of SWB that characterizes the relative frequency of positive emotions to negative emotions) has been largely ignored in the trauma literature (Diener, 1994; Dijkers, 2004). Studies that do examine emotion as the outcome variable of interest focus almost invariably on emotional distress reactions or mood disorders (Jumisko, Lexell, & Söderberg, 2009; Kortte, Gilbert, Gorman, & Wegener, 2010; Pollard & Kennedy, 2007; Weiter, 2014). Therefore, while much is known about life satisfaction and negative emotional reactions following traumatic injury, there is a dearth of information on emotional well-being, an important component of SWB, after traumatic injury.

The lack of research on emotional well-being following traumatic injury is problematic for several reasons. First, life satisfaction research can contribute only partially to the understanding of SWB following traumatic injury. Life satisfaction and emotional well-being are often correlated because they share the same higher order construct of SWB, but they are empirically independent constructs (Diener, 1994; Lucas, Diener, & Suh, 1996). Therefore, studies of emotional well-being are necessary in order to fully understand SWB.

Second, there is considerable debate regarding to what extent the sub-constructs of SWB react and change in response to major life events such as traumatic injury. For instance, some scholars maintain that emotional well-being is more susceptible to short-term changes than life satisfaction, while others argue that emotional well-being is more closely related to stable personality traits that do not permit large, lasting fluctuations (Diener, 1994; Diener, Lucas, & Scollon, 2006; Fujita & Diener, 2005; Luhmann, Hofmann, Eid, & Lucas, 2011; Jovanovic, 2011). More studies of emotional well-being would allow for scholars to compare the temporal stability of life satisfaction and emotional well-being.

Third, one study by van Leeuwen and colleagues (2012b) provided evidence of a unidirectional relationship between life satisfaction and emotional well-being, with emotional well-being predicting life satisfaction but not the reverse. Without further replication, conclusions regarding a causal relationship between emotional well-being and life satisfaction cannot be made. Yet this evidence raises concerns. If emotional well-being influences life satisfaction more than life satisfaction influences emotional well-being, then greater (or, at least, more balanced) emphasis should be given to emotional well-being as an indicator of SWB.

Lastly, just as studies of life satisfaction can elucidate only part of the SWB construct, studies of negative affect contribute only partially to the understanding of emotional well-being. Positive emotions are functionally and empirically independent of the absence of negative emotions (Cohn, Fredrickson, Brown, Mikels, & Conway, 2009; Diener, 1994; Fredrickson, Mancuso, Branigan, & Tugade, 2000; Seligman & Csikszentmihalyi, 2000; Williams, Rapport, Millis, & Hanks, 2014). In fact, the presence of positive affect may be considered "the hallmark of well-being" (Lyubomirsky et al., 2005a, p. 803). Therefore, the numerous research studies on post-injury emotional distress and psychological disorders do not contribute meaningfully to a scholarly understanding of emotional well-being.

SWB following traumatic injury is a complex process with many interacting and contributing variables, including injury-related, demographic, and individual psychosocial factors. While early research emphasized the influence of demographic and injury-related variables on outcomes, researchers have increasingly recognized the long-term impact of individual psychological and social factors on post-injury adjustment (Holtslag, van Beeck, Lindeman, & Leenen, 2007; O'Donnell, Creamer, Elliott, Atkin, & Kossmann, 2005; Wiseman, Foster, & Curtis, 2012). Two prominent psychosocial variables of interest are resilience and social support.

Resilience is "the ability of adults in otherwise normal circumstances who are exposed to an isolated and potentially highly disruptive event, such as the death of a close relation or a violent or life-threatening situation, to maintain relatively stable, healthy levels of psychological and physical functioning" (Bonanno, 2008, p. 102). Resilience is distinct from recovery (Bonanno, 2008), the absence of psychopathology (Bonanno, 2008; Bonanno, 2012), and coping (Fletcher & Sarkar, 2013). One of the most prominent distinguishing characteristics of resilience is that resilience includes "the capacity for generative experiences and *positive emotions* [emphasis added]" (Bonanno, Papa, & O'Neill, 2001, as cited in Bonanno, 2008, p. 102). Resilience fosters healthy adjustment through the use of positive emotions, and this process appears to be independent of the relationship between resilience and negative psychological traits and emotions (Cohn et al., 2009; Ong, Bergeman, & Boker, 2009; Ong, Zautra, & Reid, 2010). However, the majority of research studies have examined the impact of resilience on negative outcomes, particularly posttraumatic stress disorder (PTSD; Bonanno, Galea, Bucciarelli, & Vlahov, 2007; Daniels et al., 2012) and depression (Bonanno et al., 2007; Rainey, Petrey, Reynolds, Agtarap, & Warren, 2014). Given the clear relationship between resilience and positive affect, more research on resilience and emotional well-being (which considers both positive and negative affect) following trauma should be conducted.

Social support has been widely researched as a predictor of SWB outcomes following traumatic injury, with most research showing strong positive effects (Douglas, 2012; Dunn & Brody, 2008; Fuhrer, Rintala, Hart, Clearman, & Young, 1992; Halcomb, Daly, Davidson, Elliott, & Griffiths, 2005; Müller, Peter, Cieza, & Geyh, 2012; van Leeuwen et al., 2012a). However, many studies focus on specific components of social support (Cutrona & Russell, 1987), such as social integration (Burleigh, Farber, & Gillard, 1998; Corrigan, Bogner, Mysiw, Clinchot, & Fugate, 2001; Kalpinski et al., 2013), satisfaction with one's social support (Rintala, Young, Hart, Clearman, & Fuhrer, 1992; Tomberg, Toomela, Pulver, & Tikk, 2005; Tomberg, Toomela, Ennok, & Tikk, 2007), family support (Mortenson, Noreau, & Miller, 2010), family satisfaction (Hernandez et al., 2014; Johnson et al., 2010), and number of social supports (Rintala et al., 1992; Tomberg et al., 2005; Tomberg et al., 2007). These studies rely on unidimensional conceptualizations and instruments that fail to capture the different types and functions of social support (Cutrona & Russell, 1987). Measures of social support that account for the various dimensions and functions of social support would provide researchers a more thorough and generalizable measure of social support.

Researchers have called for more studies that explore how internal psychological factors (e.g., resilience) and external socioenvironmental variables (e.g., social support) interact and impact traumatic injury outcomes (Diener, Suh, Lucas, & Smith, 1999;

Mortenson et al., 2010; Post & van Leeuwen, 2012; van Leeuwen et al., 2012a). It is particularly important to examine how these variables interact and impact SWB in the context of injury-related and demographic characteristics (e.g., injury severity, race/ethnicity, gender, etc.), as this would allow researchers to identify relationships between key variables, such as emotional well-being, resilience, and social support, while controlling for potentially confounding variables.

Knowledge of SWB following traumatic injury is also influenced by research methodology. Longitudinal studies (in contrast to cross-sectional studies) permit variables of interest to be studied over time, and are therefore critical for understanding whether SWB levels fluctuate or remain stable after sustaining a traumatic injury (Diener, 1984; Diener, 1994; Pollard & Kennedy, 2007; van Leeuwen et al., 2012a). However, a more sophisticated understanding of these trajectories will identify specifically for whom and under what circumstances SWB levels fluctuate (Diener et al., 2006), as well as "who is at risk, and who responds optimally regardless" (Elliott, 2002, p. 138). These types of research questions require statistical techniques capable of assessing individual trajectories and average trajectories simultaneously. Statistical techniques that aggregate across individuals (e.g., repeated-measures univariate analysis of variance [UANOVA]) sacrifice researchers' ability to examine individual phenomena and may produce "average" results that fail to accurately characterize any of the individuals in the sample (Hunt, 1997). Multilevel modeling (MLM), also known as hierarchical linear modeling (HLM), allows researchers to examine individual trajectories over time by "clustering" the repeated measurements of each participant and then modeling each participant's score trajectory using his or her unique characteristics (e.g., resilience, social support; Hox, 2010). In addition, HLM provides greater statistical flexibility and accuracy than alternative methods (Kwok et al., 2008; Raudenbush & Bryk, 2002). Unfortunately, HLM continues to be underused in research (Kwok et al., 2008).

As a final point, most research has examined outcomes within specific trauma population sub-groups, particularly survivors of spinal cord injury (SCI) and traumatic brain injury (TBI). However, as the general trauma population is heterogeneous, results from one sub-group may not easily generalize to the trauma population as a whole (Halcomb et al., 2005). Research studies based on heterogeneous trauma samples are important for understanding the general trauma population as a whole, but they are rare within trauma literature.

Purpose of the Study

The current study will examine trajectories of emotional well-being within a heterogeneous population of traumatically injured individuals over the first 12 months following medical discharge from a Level 1 trauma center. HLM methodology will be used to model individual trajectories of emotional well-being and obtain information regarding both within-individual and between-individual variations in emotional well-being across time. To this end, the study will identify the average emotional well-being at each of the four time points (prior to hospital discharge, and 3, 6, and 12 months post-discharge) and the average trajectory (i.e., slope) of emotional well-being during the 12 months post-discharge, but will also assess for statistical variation in individuals' emotional well-being scores and trajectories over time. In addition, this study will attempt to model participants' emotional well-being scores at 12 months and their unique trajectories using resilience and social support variables, while simultaneously controlling for any significant injury-related or demographic variables.

Research Questions

1. What is the average growth trajectory of emotional well-being for individuals after sustaining a traumatic injury?
2. Is there statistically significant variation between individuals' emotional well-being growth trajectories?
3. Which (if any) demographic and injury-related variables significantly predict emotional well-being at 12 months and/or the growth trajectory?
4. Controlling for any significant demographic and injury-related variables, do resilience and social support variables significantly predict emotional well-being at 12 months and/or the growth trajectory?
5. What proportion of the between-individual variance in emotional well-being is explained by resilience and social support variables?

CHAPTER II

LITERATURE REVIEW

Subjective Well-Being (SBW)

Development of SWB Research

The field of subjective well-being (SWB) developed out of several broad societal shifts. First, there was recognition that SWB was more than merely the absence of distress or pathology and therefore a legitimate construct in its own right, and that individuals do not merely avoid negative states, but actively seek and pursue positive states (Diener et al., 1999; Diener, 1984). Negative states and affective reactions (e.g., depression, anxiety) have dominated contemporary psychological research (Diener, 1994; Elliott et al., 2002). Literature searches and systematic reviews confirm this imbalance; for example, Myers (2000) conducted an electronic search of *Psychological Abstract* articles since 1887 and found that articles studying negative emotions outnumbered those studying positive emotions by a ratio of 14-to-1. As knowledge of the unique role and processes of positive human experience grew, there was increasing concern about the overwhelming emphasis on negative experience (Diener, 1994; Diener et al., 1999). Positive psychologists helped generate interest in the scientific study of positive human experience by showing that positive states, such as SWB, could not be reduced to the absence of negative states; they showed that positive constructs such as

SWB have unique mechanisms and functions and therefore deserve greater theoretical and empirical attention (Cohn et al., 2009; Diener, 1994).

Second, there was a gradual recognition that an individual's subjective evaluation of his or her own life could not be not captured by objective indicators such as health and economic prosperity (Post, de Witte, & Schrijvers, 1999). In the field of health research, the World Health Organization expanded the definition of health from the absence of disease to the presence of "physical, mental and social well-being" (Grad, 2002). Quality of life researchers found that subjective indicators of wellness are not always consistent with objective health indicators, although the two are related. Furthermore, evidence began to suggest that a person's perception of his or her health influences his or her objective health status (Diener et al., 1999; Hunt, 1997). As a result, a separate line of research, one that focuses on people's subjective experiences, split off from the broader field of quality of life research, setting the stage for SWB studies.

Third, researchers began to identify benefits of SWB beyond the intrinsic pleasure and societal value of living a "happy" life. Long-term SWB broadens people's awareness; helps them achieve better life outcomes; allows them to build enduring physical, social, and intellectual resources; and strengthens their ability to cope and adapt to difficult life circumstances (Argyle, 1997; Diener et al., 2006; Folkman & Moskowitz, 2000, as cited in Pollard & Kennedy, 2007; Fredrickson et al., 2000; Fredrickson, 2013; Lyubormirsky et al., 2005a). Individuals with higher levels of SWB tend to be "less self-focused, less hostile and abusive, and less vulnerable to disease… [as well as] more loving, forgiving, trusting, energetic, decisive, creative, sociable, and helpful" (Myers, 2000, p. 57-58). Furthermore, SWB promotes physical health and longevity, not only by mitigating the impact of stress reactions on cardiovascular health but also by mediating relationships between health and other predictors (Argyle, 1997; Carstensen et al., 2011; Diener et al., 2006; Fredrickson et al., 2000; Fredrickson, 2013; Lyubormirsky et al., 2005a).

In sum, the field of SWB developed as researchers began to recognize that (1) a positive view of one's life is real and conceptually more than the absence of negative feelings; (2) subjective indicators are equally if not more important than objective indicators; and (3) a person's subjective sense of well-being has meaningful effects worthy of pursuit and scholarly research.

SWB Construct and Its Components

The field of SWB lacks a clear, consistently used operationalized definition, in part due to various terms used interchangeably (e.g., happiness, psychological well-being, eudaimonia, perceived wellness, life satisfaction, subjective health-related quality of life). For this reason, SWB is poorly defined in most research studies (Dijkers, 1997; Dunn & Brody, 2008). SWB has been equated with life satisfaction, a preponderance of pleasant emotional experiences, and even a quality deemed virtuous by an external value system (i.e., eudaimonia; Diener, 1984).

Comprehensive reviews (Diener, 1984; Diener, 1994; Diener et al., 1999) propose that SWB comprises multiple phenomena that strongly correlate under a single higher order construct. Specifically, SWB comprises peoples' long-term levels of (a) life satisfaction, (b) positive affect, and (c) negative affect (Diener, 1984; Dunn & Brody, 2008; Luhmann et al., 2011). Together, these phenomena form a “global experience of positive reactions to one’s life” (Diener, 1994, p. 108). However, SWB cannot be equated to a transient state of happiness; rather, SWB refers to the ways in which people evaluate and react to their own lives over long periods of time (e.g., weeks, months).

Individuals evaluate their lives on both a cognitive and affective level (Diener, 1984; Dijkers, 1997; Luhmann et al., 2011; Post & van Leeuwen, 2012). Life satisfaction is considered to be a global, *cognitive* appraisal of one’s life, while emotional well-being is an *affective* appraisal. Emotional well-being comprises the presence of positive affect and absence of negative affect, and represents a person’s “hedonic” balance of pleasant and unpleasant emotions over time. Although one’s hedonic level is impacted by both duration/frequency and intensity of emotions (Diener, 1994), several studies have found that frequency is a stronger predictor of emotional well-being than is intensity (Diener, Colvin, Pavot, & Allman, 1991; Diener, Sandvik, & Pavot, 2009; Larsen & Diener, 1985; Larsen, Diener, & Emmons, 1985).

While life satisfaction and emotional well-being are correlated, they are theoretically and empirically independent (Lucas et al., 1996). Similarly, while positive affect and negative affect are often correlated, they too are theoretically and empirically separable, particularly when measured over longer periods of time (Diener, 1994; Diener & Emmons, 1984). Overall, research supports the divergent validity of life satisfaction and emotional well-being, as well as the divergent validity of positive and negative affect (Diener, 1984; Diener, 1994; Fredrickson et al., 2000; Lucas et al., 1996; Lyubormirsky et al., 2005a; Tugade, 2011).

Theories and Models of SWB

SWB can be conceptualized as a series of ongoing appraisal processes in which individuals evaluate their life against some standard (Diener, 1984; Lazarus, 1991). People may compare themselves to others, or compare events in their life to previous life events, in order to make both moment-to-moment and global evaluations. Theories of SWB differ in the degree to which they explain this appraisal process using "bottom-up" or "top-down" approaches (Diener, 1984). "Bottom-up" theories propose that when people accumulate many "happy" experiences, they appraise their life favorably and subsequently report that they are happy. These theories focus on the impact that external variables (e.g., life circumstances, life events, and socioenvironmental variables) have on an individual's SWB. "Top-down" theories propose that some people are happier by nature, so they tend to appraise specific life experiences more favorably and subsequently report that they are happy. These theories focus on the impact that internal variables (e.g., genetic inheritance, personality factors) have on SWB. Researchers frequently assess to what degree SWB is impacted by stable, internal factors versus changing, external factors by studying how individuals respond to significant external events (e.g., spousal loss, acquired disability).

In the field of SWB, adaptation refers to the concept that people tend to adapt to changes in life circumstances (Headey & Wearing, 1989; Dunn & Brody, 2008;

Luhmann et al., 2011). Hedonic adaptation models (e.g., hedonic treadmill, dynamic equilibrium, or set-point model), more specifically, suggest that people's SWB fluctuates around a biologically determined happiness set point (Lucas, 2007a; Lucas, 2007b; Lyubomirsky, Sheldon, & Schkade, 2005b). Over time, the emotional impact of even major favorable and unfavorable life events diminishes, so people inevitably adapt back to prior SWB levels (Frederick & Loewenstein, 1999; Myers, 2000). Three key research findings provide support, albeit indirectly, for hedonic adaptation (Lucas, 2007a). First, about 40-50% of the variance in long-term SWB can be attributed to genetic heritability (Archontaki, Lewis, & Bates, 2013; Lykken & Tellegen, 1996; Lyubomirsky et al., 2005b; Tellegen et al., 1988). Second, stable personality traits such as extraversion and neuroticism correlate strongly with SWB (Diener, 1994; Diener et al., 2006; Jovanovic, 2011). Third, studies show SWB to possess moderately high levels of cross-situational consistency and temporal stability (Diener, 1994; Diener et al., 2006).

However, direct evidence for hedonic adaptation is lacking (Lucas, 2007a). One of the most frequently cited studies compared happiness levels of lottery winners, individuals with SCI, and controls (Brickman, Coates, & Janoff-Bulman, 1978). The authors concluded that hedonic adaptation had occurred because mean level differences between the three groups were smaller than would be expected (i.e., lottery winners, individuals with SCI, and controls did not have significantly different happiness levels). However, subsequent analyses of the actual effect sizes indicated that the individuals with SCI were in fact significantly less happy than the control group (Frederick & Loewenstein, 1999; Lucas, 2007a).

Several researchers have challenged hedonic adaptation models, pointing to evidence that SWB is independent of personality, fluctuates over time, and reacts to changes in life circumstances and events (Diener, 1994; Diener et al., 2006; Frederick & Loewenstein, 1999; Fujita & Diener, 2005; Jovanovic, 2011; Lucas, 2007a; Lucas, 2007b; Lucas, Clark, Georgellis, & Diener, 2003). Large-scale, longitudinal panel studies have revealed that life satisfaction and emotional well-being fluctuate over one's lifespan (Baird, Lucas, & Donnellan, 2010; Carstensen et al., 2011; Fujita & Diener, 2005). Several studies have examined SWB following major changes in life circumstances, such as marital transitions, income increase, cosmetic surgery, unemployment, bereavement, incarceration, and onset of disability/disease (Frederick & Loewenstein, 1999; Lucas et al., 2003; Lucas, 2007a; Lucas, 2007b; Luhmann et al., 2011; Powdthavee, 2009). For many of these studies, average statistics do reveal a predominant trend that is characterized by an initial decrease in SWB level followed by adaptation (Frederick & Loewenstein, 1999; Lucas et al., 2003; Lucas, 2007a; Lucas, 2007b).

However, there were several other important findings. Depending on the life event, the component of SWB being measured, and the individual, adaptation did not always occur. First, the direction, magnitude, and rate of adaptation varied depending on what the event was (Frederick & Loewenstein, 1999; Lucas, 2007a; Luhmann et al., 2011). Second, adaptation effects varied based on the specific component of SWB being measured. Life satisfaction appeared to be more strongly affected by negative life events (e.g., onset of disability) than emotional well-being, while more adaptation seemed to occur for emotional well-being (Lucas, 2007b; Luhmann et al., 2011). Third, when examining individual trajectories, significant individual differences in the rate and extent of adaptation were found (Diener et al., 2006; Lucas et al., 2003; Lucas, 2007a; Lucas, 2007b). Some individuals experienced moderate to large changes in SWB with almost no adaptation, others adapted partially yet never returned to their baseline SWB levels, and still others had SWB trajectories that were opposite to the sample's average trajectory (Lucas et al., 2003; Lucas, 2007a; Lucas, 2007b). These individual differences were clouded and poorly represented by average trajectories. Overall, these findings provide compelling evidence that adaptation does not always occur, and that individuals can and do experience lasting and significant changes in SWB in response to life circumstances and events.

Overall, SWB seems to be affected a combination of state and trait factors, which gives support to both the bottom-up and top-down theories (Diener, 1994; Diener et al., 1999). Lyubomirsky and colleagues (2005b) proposed a model of happiness to help quantify the relative impact of these factors. In this model, approximately 50% of happiness variance is attributed to a person's biologically determined happiness set point, comprised of genetic inheritance, personality traits, and the neurobiological and neurochemical processes underlying these traits. Approximately 10% of the variance is attributed to life circumstances, the relatively stable facts of a person's life, such as demographic and cultural factors, life status variables (e.g., marriage, income, health), and personal life history. The remaining 40% is attributed to intentional activities—the cognitive, behavioral, and volitional activities that people engage in.

Most research supports Lyubomirsky and colleagues' (2005b) assertion that life circumstances are a weak predictor of SWB, although some estimates attribute closer to 20% of the SWB variance to life circumstances when examined collectively (Diener, 1984; Diener, 1994; Diener et al., 2006; Dunn & Brody, 2008; Kammann, 1983). Additionally, some researchers question the assumption that individuals possess a single happiness set point, arguing that individuals may possess multiple adaptation levels, including separate levels for the different components of SWB (i.e., life satisfaction, positive affect, negative affect; Diener et al., 2006; Frederick & Loewenstein, 1999).

The following section summarizes the evidence regarding the major predictors of SWB. While emotional well-being is the focus of this study, the lack of research on emotional well-being makes it difficult to summarize research findings on predictors of emotional well-being. Therefore, a review of SWB correlates is provided here to serve as a basis for identifying potential correlates of emotional well-being.

Major Predictors of SWB

Genetic heritability. Research indicates that many people possess a temperamental predisposition for higher SWB, which may be due to a genetic, immutable inheritance and/or a personality component that reacts and interacts with the environment. Twin studies, for instance, reveal strong genetic influences on SWB, estimating that 40-80% of the variance is due to genetic heritability (Archontaki et al., 2013; Lykken & Tellegen, 1996; Lyubomirsky et al., 2005b; Tellegen et al., 1988).

However, one review found heritability to have smaller effects on SWB and suggested that genetics may impact negative affect more than positive affect (Diener et al., 1999).

Personality. Several stable personality traits have been correlated with SWB. The strongest and most consistent relationships are between SWB and extraversion and neuroticism (Diener, 1984; Diener & Lucas, 1999; Diener et al., 1999; Dunn & Brody, 2008; Fujita & Diener, 2005). While both the affective and cognitive components of SWB are influenced by personality (Diener & Lucas, 1999), some researchers have suggested that affective well-being is more strongly affected by personality than life satisfaction (Fujita & Diener, 2005). Furthermore, personality constructs seem to impact positive and negative affect differently. Extraversion tends to correlate moderately with positive affect but only slightly with negative affect, while neuroticism tends to correlate moderately with negative affect but only slightly with positive affect (Diener & Lucas, 1999; Fujita & Diener, 2005).

Age. Research regarding the effect of age on SWB is inconsistent, with findings showing negative, positive, and no correlation (Argyle, 1999; Diener, 1984; Dunn & Brody, 2008). Large-scale panel studies suggest that life satisfaction may increase slightly in the middle years, but tends to decrease after age 70 (Argyle, 1999). There is also evidence that the effect of age on SWB may depend on the SWB construct being measured; younger people, on average, tend to report more intense affect (both positive and negative), while older people seem to report greater life satisfaction (Diener, 1984).

Gender. On average, women and men report similar SWB levels (Diener et al., 1999; Dunn & Brody, 2008). However, many studies indicate that women report higher levels of negative affect and more psychological distress than men (Diener, 1984; Diener et al., 1999). While these may seem incompatible, one proposed explanation is that women on average experience more intense emotions, both positive and negative (Diener et al., 1999). Therefore, women may be more vulnerable to developing conditions such as depression and anxiety, but their greater frequency and intensity of positive feelings may counterbalance intense negative feelings, producing SWB levels comparable to men (Diener et al., 1999). Furthermore, there is evidence for an interaction between gender and age, with younger women reporting more SWB than younger men, but older women reporting less SWB than older men (Argyle, 1999; Diener, 1984).

Race/ethnicity. Most evidence consistently shows that race/ethnicity impacts SWB. Generally, African Americans report lower SWB than Caucasians in both the United States (Diener, 1984) and other countries (Argyle, 1999). However, one review found race/ethnicity to have little to no correlation with happiness (Dunn & Brody, 2008). Furthermore, the impact of race/ethnicity on SWB may be due to racial/ethnic minorities having less education, less income, lower job status, and greater urbanicity on average (Argyle, 1999; Diener, 1984). Controlling for these variables results in either small or no effects for race/ethnicity on SWB.

Income. Overall, income correlates positively with SWB, but there are significant caveats to this point (Argyle, 1999; Diener & Seligman, 2004; Dunn & Brody, 2008; Myers, 2000). The relationship diminishes at higher ends of the income scale and is particularly weak in the United States due to the relative wealth of most citizens compared to poorer countries (Argyle, 1999; Myers, 2000). Thus, between-country differences in income tend to show much stronger effects than within-country differences (Argyle, 1999). However, even at the country level, average increases in wealth and income yield only minor increases in SWB (Argyle, 1999; Diener & Seligman, 2004). For instance, although affluence doubled in the United States between 1957 and 1988, the number of people reporting themselves as "very happy" declined from 35% to 33% (Myers, 2000). Some evidence suggests that constructs such as financial satisfaction and relative wealth have a stronger impact on SWB than absolute income (Argyle, 1999). Even some negative effects of income on SWB have been found, which may be due the impact of increased stress, materialism, or life disruptions brought on by sudden increases in wealth (Argyle, 1999).

Employment status. Employment status is generally a strong predictor of SWB (Diener, 1984; Dunn & Brody, 2008), yet it may primarily affect SWB through its impact on other variables, such as income, boredom, and self-esteem (Argyle, 1999). For example, the effect is diminished when income is controlled for and when unemployment rates are high because there is less sense of personal failure. In addition, the effect of employment status on SWB does not seem to apply to individuals who are unemployed by choice (e.g., retirement, being a homemaker; Argyle, 1999).

Education. Education typically has a small positive effect on SWB (Argyle, 1999; Diener, 1984; Dunn & Brody, 2008). However, these effects are largely confounded due to education's impact on subsequent income and occupational status (Argyle, 1999). When income and occupational status are controlled for, the effect of education becomes negligible or disappears entirely (Argyle, 1999; Diener, 1984). Social class—a composite construct of occupational status, income, education, area of residence, and lifestyle—has a small effect on SWB also, but again this may attributed to other by-products, such as improved health and leisure status.

Religion. Studies indicate there is a positive effect of religion on SWB, although the effect is small and findings have been mixed (Argyle, 1999; Diener, 1984; Diener et al., 1999; Dunn & Brody, 2008; Myers, 2000). Religious behaviors (e.g., church attendance, participation) seem to have stronger effects on SWB than religious beliefs or attitudes (Argyle, 1999; Diener et al., 1999). The social support provided by faith communities serves as one of the strongest mechanisms by which religion facilitates SWB (Argyle, 1999; Myers, 2000). In addition, religion seems to support life satisfaction by providing a greater sense of meaning and purpose and by facilitating better coping and more positive cognitive appraisals, particularly during major life crises (Diener et al., 1999; Myers, 2000). As a result, the benefits of religion on SWB appears to be greatest for those with less social support and those coping with crises, including those who are single, widowed, divorced, unemployed, bereaved, older, retired, or struggling with poor health or serious illness (Argyle, 1999; Diener et al., 1999, Myers, 2000).

Activities and leisure. There is both theoretical and empirical support for the relationship between certain leisure activities and SWB (Argyle, 1999; Diener, 1984; Dunn & Brody, 2008). Activities that are more active than passive and that provide opportunity for social interaction (e.g., sports, exercise, social clubs, volunteer work) tend to have the strongest impact on SWB. However, active leisure tends to correlate with physical health and social class variables (e.g., education, income, employment), and the relationship between leisure and SWB tends to drop considerably after controlling for these variables (Argyle, 1999; Diener, 1984).

Health. While some researchers have found objective health to be a fairly poor predictor of SWB (Diener, 1984; Diener et al., 1999), others have found a moderate association between physical health and happiness (Dunn & Brody, 2008). Subjective health is a more consistently moderate-to-strong predictor of SWB than objective health (Diener, 1984; Diener et al., 1999). Furthermore, the effect of health on SWB may be better attributed to poor health interfering with individuals' ability to attain important goals and participate in meaningful activities (Diener, 1984; Diener et al., 1999).

Marital status. Marital status is consistently found to be one of the strongest predictors of SWB, as married persons report more happiness, more life satisfaction, and better mental health compared to individuals in any of the unmarried categories (never married, widowed, divorced, or separated; Argyle, 1999; Diener, 1984; Dunn & Brody, 2008; Myers, 1999; Myers, 2000), and this effect occurs equally for men and women (Myers, 2000). After controlling for other variables such as age and income, the effect of marital status on SWB diminishes but is still observable (Argyle, 1999; Diener, 1984). However, not all studies have found an association between marital status and SWB (Lucas, 2007a), and some researchers have concluded that marital/family satisfaction has a greater impact on SWB than marital status (Argyle, 1999; Diener, 1984; Myers, 2000).

Still, most findings suggest that marital status offers beneficial effects that support SWB (e.g., intimacy, companionship, support, relief from loneliness; Myers, 2000).

Social relationships and support. Most research findings have revealed strong associations between social support and SWB (Diener, 1984; Dunn & Brody, 2008; Myers, 1999; Myers, 2000). The impact of social support on SWB may be strongest when individuals experience adverse life events, by facilitating better coping during times of stress (Frederick & Loewenstein, 1999; Myers, 2000) and serving as a protective buffer against the negative effects of stressful situations (Cassel, 1974). At the same time, not all studies show a positive correlation, possibly because some control for confounding variables (e.g., extraversion, leisure activity, marital status) or focus on different aspects of social support (e.g., social network size, satisfaction with one's social support, time spent in social interactions; Diener, 1984). Some of the research discrepancy may be explained by competing theoretical models. The *buffering* hypothesis of social support (Cassel, 1974) suggests that social support will be protective and therefore beneficial to people primarily in stressful situations, while the *relationship* model suggests that people with more supportive relationships will have higher well-being regardless of the stress level (Cutrona, 1984). In addition, research findings that link social support to negative outcomes such as depression have been criticized as spurious due to the predisposition of depressed people to negatively appraise their social relationships and level of support (Elliott, Marmarosh, & Pickelman, 1994; Elliott & Shewchuk, 1995). In the context of social support and positive outcomes like SWB, it is similarly possible that individuals with higher levels of SWB are more likely to positively appraise their social support, and that this accounts for the strong association between SWB and social support.

Traumatic Injury

Traumatic injury is the leading cause of death and disability among people under age 44 in the United States (Centers for Disease Control and Prevention, 2013). Each year, approximately 3 million Americans are hospitalized after sustaining traumatic injuries (Centers for Disease Control and Prevention, 2013). The two most common causes of traumatic injury are falls and motor vehicle accidents (Mortenson et al., 2010; Powers et al., 2014; Rhee et al., 2014). Because traumatic injury affects individuals of all ages, it is the leading cause of loss of productivity in the United States (Halcomb et al., 2005). The economic burden of trauma, due to health care costs and loss of productivity, is more than $585 billion annually (National Trauma Institute, 2014).

The majority of studies examining quality of life outcomes following traumatic injury reveal diminished quality of life, psychosocial well-being, and physical and mental/emotional health on average. Traumatic injury has been linked to greater disability and functional impairment (Dimopoulou et al., 2004; Halcomb et al., 2005; Holtslag et al., 2007); loss of productivity in work and daily activities (Dimopoulou et al., 2004; Halcomb et al., 2005; Holtslag et al., 2007; McCarthy et al., 2006); poorer social activity and satisfaction (McCarthy et al., 2006; O'Donnell et al., 2005; Sluys, Häggmark, & Iselius, 2005); poorer physical health, including somatic complaints such as pain and fatigue (Dimopoulou et al., 2004; Holtslag et al., 2007; Lee, Chaboyer, & Wallis, 2008; O'Donnell et al., 2005; Sluys et al., 2005); lower vitality (Lee et al., 2008; McCarthy et al., 2006; Sluys et al., 2005); and diminished mental health/emotional functioning (Bryant et al., 2010; Dimopoulou et al., 2004; Halcomb et al., 2005; Holtslag et al., 2007; Kreuter, Sullivan, Dahllöf, & Siösteen, 1998; O'Donnell et al., 2005; Powers et al., 2014; Quale, Schanke, Frøslie, & Røise, 2009; Sluys et al., 2005; Wiseman et al., 2012; Zatzick et al., 2008; Zatzick et al., 2002). Studies that consider both physical and mental health outcomes following traumatic injury generally reveal that trauma survivors have more physical/somatic complaints than mental/emotional complaints, although mental/emotional health is still significantly impacted (Dimopoulou et al., 2004; Lee et al., 2008; Sluys et al., 2005).

Several studies have found a high incidence of psychological distress symptoms and diminished mental health functioning following traumatic injury (Bryant et al., 2010; Dimopoulou et al., 2004; Halcomb et al., 2005; Holtslag et al., 2007; Kreuter et al., 1998; O'Donnell et al., 2005; Powers et al., 2014; Quale et al., 2009; Sluys et al., 2005; Wiseman et al., 2012; Zatzick et al., 2008; Zatzick et al., 2002). Bryant and colleagues (2010) found that 31% of trauma survivors had developed a psychiatric disorder within 12 months following injury. The most common sequelae reported in the trauma literature are PTSD, depression, and anxiety, and comorbidity is common (Halcomb et al., 2005; Post & van Leeuwen, 2012; Wiseman et al., 2012). PTSD is one of the most frequently investigated psychiatric disorders following traumatic injury (Wiseman et al., 2012). Incidence rates of PTSD following traumatic injury range from

3-40%, and may vary depending on the study's sample characteristics and methodology for identifying PTSD (Bryant et al., 2010; O'Donnell et al., 2005; Powers et al., 2014; Quale et al., 2009; Wiseman et al., 2012; Zatzick et al., 2008; Zatzick et al., 2002). Depression has been reported in 7-42% of trauma survivors (Bryant et al., 2010; Kreuter et al., 1998; O'Donnell et al., 2005; Rainey et al., 2014; Wiseman et al., 2012; Zatzick et al., 2008). Anxiety and non-PTSD anxiety disorders such as generalized anxiety disorder, acute stress disorder, and agoraphobia have been reported as well, with incidence rates ranging from 1-40% (Bryant et al., 2010; O'Donnell et al., 2005; Wiseman et al., 2012).

Longitudinal studies have shown that poorer quality of life (Holtslag et al., 2007; Sluys et al., 2005) and psychiatric symptoms (Bryant et al., 2010; Halcomb et al., 2005; Zatzick et al., 2008; Zatzick et al., 2002) following traumatic injury do not remit even over long periods of time. Moreover, psychological distress symptoms, in turn, negatively impact physical health, daily activities, coping skills, and ability to function in work and other roles (Halcomb et al., 2005; Holtslag et al., 2007; Zatzick et al., 2008). This is particularly troubling given that rehabilitation and treatment following traumatic injury has been found to be insufficient and inadequate for addressing the full range of negative consequences that can occur (Halcomb et al., 2005; McCarthy et al., 2006; Wiseman et al., 2012).

Increasing SWB can benefit individuals, families, and communities affected by traumatic injury. Individuals with higher SWB are more likely to engage in activities that promote better adjustment, less impairment, greater participation, and more social and community integration (Dijkers, 1997). Because positive outcomes such as SWB benefit individuals above and beyond reducing negative outcomes (e.g., PTSD, depression), research on SWB can provide important information about how to build upon patients' strengths and foster personal growth, as opposed to merely treating psychological problems (Kortte et al., 2010).

SWB Following Traumatic Injury

Models of SWB Following Traumatic Injury

Few models have been proposed specifically for SWB following traumatic injury. Therefore, this section will discuss theoretical models of both SWB and, more broadly, quality of life. Some models focus on adjustment generally, and the stress and coping processes that mediate adjustment; others focus on positive outcomes following major stressors or traumatic events; and still others focus specifically on the dynamic process of adjusting to an acquired disability.

One model that laid the groundwork for understanding the adjustment process was a mediated model of stress and coping (Lazarus, 1993; Lazarus & Folkman, 1984). In this model, a person's (a) appraisal and (b) coping (e.g., problem-focused, emotion-focused) mediate the relationship between that person's personal and environmental resources and his or her adjustment to a stressful event or situation. In this model, poor adjustment depends neither on the person nor the situation itself but rather on whether the person appraises the situation as (a) stressful and (b) unable to be managed successfully with the resources available to the person. Cohen and Edwards (1989) proposed an alternative model. In their model, rather than appraisal and coping processes mediating the individual's personal and environmental resources, resources actually moderate the impact of stress on SWB; personal and environmental resources work as stress-buffers that protect a person's SWB against the negative impact of stress by reducing his or her susceptibility to stress. When situations are more stressful, then stress-buffer resources will be strongly associated with SWB, but the relationship will be weaker in less stressful situations.

Congruent with the emerging positive psychology movement, models of posttraumatic growth and resilience focus on positive adjustment following traumatic events (Davydov, Stewart, Ritchie, & Chaudieu, 2010; Powell, Gilson, & Collin, 2012; Somerfield & McCrae, 2000; Tugade, 2011). For instance, Tedeschi and colleagues (1996, 1998) put forth a theory of posttraumatic growth, whereby cognitive processes are initiated that allow a person to not only cope effectively with a traumatic event but also grow and advance personally after the event. In addition, Bonanno and other researchers have argued that most individuals are resilient when exposed to potentially traumatic events and that people tend to follow a limited number of trajectories, with resilience being the most common (Bonanno et al., 2007; Bonanno, 2008; Bonanno, Westphal, & Mancini, 2011; Davydov et al., 2010; deRoon-Cassini, Mancini, Rusch, & Bonanno, 2010; Fletcher & Sarkar, 2013). However, researchers debate whether resilience should be modeled as a process, or whether it more closely represents a personal trait (Bonanno, 2012; Daniels et al., 2012; Fletcher & Sarkar, 2013; Rainey et al., 2014; Tugade, 2011; Waugh, Wager, Fredrickson, Noll, & Taylor, 2008). Studies that examine resilience tend to emphasize the role of positive emotions in coping (Cohn et al., 2009; Ong et al., 2010; Tugade, 2011; Tugade, Fredrickson, & Barrett, 2004).

Models of health-related quality of life (HRQoL) and psychosocial adaptation following traumatic injury apply the concept of the mediated model of stress and coping to the process of adjusting to a traumatic injury and/or acquired disability. These models typically share the same basic structure, with (a) antecedent factors related to the person, their environment, and their injury; (b) process-linked factors (e.g., appraisal, perceptions, coping strategies); and (c) outcomes (e.g., quality of life, life satisfaction; Bezner & Hunter, 2001; Martz, Livneh, Priebe, Wuermser, & Ottomanelli, 2005). Elliott and colleagues (2002) proposed a mediated model for understanding positive growth following disability that closely resembles the mediated model of stress and coping. In their model, phenomenological and appraisal processes (e.g., appraisal, self-efficacy, coping strategies) mediate the relationship between (a) individual and socio-environmental factors and (b) psychological well-being and physical health.

Major Findings on SWB Following Traumatic Injury

There are many inconsistent findings within the research examining SWB following traumatic injury. Of primary importance, it is unclear to what extent traumatically injured individuals experience lower levels of SWB following their injury and to what extent SWB returns to pre-injury levels as people "adapt" to their injuries over time.

One way to approach this question is to compare samples of traumatically injured individuals to control groups. Several studies indicate that survivors of traumatic injury report, on average, lower levels of SWB compared to the general population and non-traumatically injured comparison groups. This trend has been found across multiple injury sub-groups, including survivors of burn injuries (Patterson, Ptacek, Cromes, Fauerbach, & Engrav, 2000), SCI (Dijkers, 1997; Fuhrer et al., 1992; Krause, 1997; Post & van Leeuwen, 2012), and TBI (Dijkers, 2004; Resch et al., 2009; Rothwell, McDowell, Wong, & Dorman, 1997). However, most of these studies are cross-sectional rather than longitudinal; therefore, it is unknown whether SWB discrepancies between traumatically injured samples and control groups are stable over time. For instance, Patterson and colleagues (2000) found significantly lower life satisfaction scores for burn survivors compared to the general population six months post-injury. On the other hand, Bezner and Hunter (2001) found no difference in perceived wellness scores between individuals with TBI and the general population 10 years later. Other research suggests that traumatically injured individuals adapt somewhat but not completely; that is, their average SWB levels do not converge with the average SWB levels of the general population. For example, Post and van Leeuwen (2012) found that life satisfaction scores for individuals with SCI improved over time but were still lower than those for the general population.

Another consideration is whether lower levels of SWB for traumatically injured individuals remain stable, worsen, or improve over time. Longitudinal studies are needed in order to track SWB trajectories following traumatic injury, yet even longitudinal research findings are inconsistent. For instance, Martz and colleagues (2005) conducted a literature review of psychosocial adaptation following SCI and found that studies were mixed in whether SWB levels improved over time.

Several studies suggest that, after SCI (Kennedy, Lude, Elfström, & Smithson, 2010; van Leeuwen et al., 2012a) and TBI (Corrigan, Smith-Knapp, & Granger, 1998; Lin et al., 2010; Lippert-Grüner, Maegele, Haverkamp, Klug, & Wedekind, 2007), SWB levels may drop initially but ultimately increase over time. These returns in SWB levels have been demonstrated across widely varying time frames. For instance, significant improvements in SWB have been found between six and 12 weeks post-injury (Kennedy et al., 2010), during the first six months post-injury (Lin et al., 2010), between six and 12 months post-injury (Lin et al., 2010; Lippert-Grüner et al., 2007), and between two and five years post-injury (Corrigan et al., 1998; van Leeuwen et al., 2012a). Interestingly, Corrigan and colleagues (1998) found that life satisfaction declined over the first two years following TBI but then significantly improved from two to five years post-injury, and van Leeuwen and colleagues (2012a) found an almost identical trajectory for individuals with SCI. Generally, these studies provide support for hedonic adaptation following traumatic injury.

However, other studies have found that SWB levels remained stable (Corrigan et al., 2001; Hernandez et al., 2014; McCord et al., 2016; Williamson et al., 2015) or even subtly worsened (Krause, 1997; Resch et al., 2009) several years after traumatic injury. Two studies found stable trajectories of life satisfaction (Hernandez et al., 2014) and happiness (McCord et al., 2016) five years after individuals had discharged from hospitalization for traumatically acquired disabilities. Interestingly, Williamson and colleagues (2015) found that life satisfaction scores increased over a ten-year period following TBI but only when significant predictors were not included in the analysis. When significant predictor variables were held constant, the trajectory of life satisfaction scores was stable.

Research studies that examine individual trajectories over time, rather than relying solely on average scores, help explain some of the discrepant findings. Many of these studies have found significant individual variation in SWB trajectories among traumatically injured populations. Inter-individual variation has been found within studies where SWB levels, on average, increase (Post & van Leeuwen, 2012), decrease (Johnson et al., 2010; Resch et al., 2009), and remain stable (Mortenson et al., 2010) over time. In 1994, Stensman identified four broad trajectory patterns of SWB among individuals with SCI: (1) high SWB/good adjustment, (2) low SWB/poor adjustment with no recovery, (3) a "recovered" group (improved SWB after an initial drop), and (4) fluctuating SWB. Mortenson and colleagues (2010) found that subjective quality of life remained stable for a majority (67%) of individuals during the first year following discharge for SCI; however, of the remaining sample, exactly half (16%) reported improved quality of life while the other half (16%) reportedly regressed. Most individuals with acquired physical disabilities report high levels of SWB as well (Dunn & Brody, 2008). In studies where life satisfaction scores declined on average, significant variations in trajectories were found, with some individuals experiencing positive gains in life satisfaction (Johnson et al., 2010; Resch et al., 2009). Furthermore, these individually varying adjustment patterns have been shown to change over time (Krause, 1997). Researchers should consider interindividual variations in order to better understand how (and for whom) traumatic injury affects SWB (Dijkers, 1997).

Predictors of SWB Following Traumatic Injury

Injury characteristics. Injury-related variables frequently assessed in the traumatic injury literature include injury severity, functional independence, and restricted participation. Most research is consistent in showing that injury severity (represented by *impairment* in the International Classification of Functioning, Disability and Health [ICF] model) is, at best, a weak predictor of SWB outcomes following traumatic injury (Corrigan et al., 1998; Davis et al., 2012; Dawson, Levine, Schwartz, & Stuss, 2000; Dijkers, 1997; Dijkers, 2004; Dikmen, Machamer, Powell, & Temkin, 2003; Fuhrer et al., 1992; Kalpinski et al., 2013; Mailhan, Azouvi, & Dazord, 2005; Martz et al., 2005; Mortenson et al., 2010; Pierce & Hanks, 2006; Stensman, 1994; Teasdale & Engberg, 2005). However, there are exceptions. For instance, some specific injury severity variables, such as pain (Stensman, 1994; van Leeuwen et al, 2012a) and days of intensive care and medical complications during hospitalization (Patterson et al., 2000), have been linked to lower life satisfaction among traumatically injured samples.

Functional independence (represented by *disability* in the ICF model) seems to be a moderately strong, but inconsistent, predictor of SWB following traumatic injury (Dijkers, 1997; Pierce & Hanks, 2006). Several studies indicate that greater functional independence, including both motor and cognitive independence, predicts life satisfaction up to one, five, and 10 years following traumatic injury (Corrigan et al., 2001; Hicken, Putzke, Novack, Sherer, & Richards, 2002; Johnson et al., 2010; Resch et al., 2009; McCord et al., 2016; van Leeuwen et al., 2012a; Williamson et al., 2015). Yet other studies have failed to find a correlation between functional independence and SWB outcomes, again, at one, five, and 10 years post-injury (Bezner & Hunter, 2001; Corrigan et al., 1998; Davis et al., 2012; Fuhrer et al., 1992). One possible explanation is that functional independence may be less predictive of SWB outcomes when other variables are accounted for, such as ability to participate in meaningful activities (Kalpinski et al., 2013) and marital status and family satisfaction (Hernandez et al., 2014).

Being restricted from participating in meaningful activities (represented by *handicap* in the ICF model) appears to be a strong and fairly consistent predictor of SWB post-injury (Dijkers, 1997; Pierce & Hanks, 2006). Less handicap and greater ability to participate is strongly linked to SWB following SCI (Fuhrer et al., 1992; Mortenson et al., 2010; van Leeuwen et al., 2012b). Furthermore, several studies have found that participation mediates the relationship between injury severity/functional independence and SWB outcomes (Erosa, Berry, Elliott, Underhill, & Fine, 2014; Kalpinski et al., 2013).

In addition to injury severity, functional independence, and restricted participation, some studies have assessed injury type. Within specific injury groups, such as major burn injuries (Patterson et al., 2000) and TBI (Teasdale & Engberg, 2005), injury characteristics appear to have some effect on SWB; however, other studies have failed to find significant differences (Rainey et al., 2014). McCord and colleagues (2016) found significant differences in happiness scores based on injury type (SCI, TBI, burn injury, and interarticular fractures) up to five years post-injury. Traumatic injuries that include TBI are a growing concern, as research studies have found that TBI can result in significant emotional and behavioral problems (Bryant et al., 2015; Hanks, Temkin, Machamer, & Dikmen, 1999; Kreuter et al., 1998) and lower life satisfaction (Braden et al., 2012). Even mild traumatic brain injury has been shown to result in long-term symptoms and distress (Nampiaparampil, 2008; Ponsford et al., 2000) and lower life satisfaction (Stålnacke, 2007). The relationship between TBI and long-term distress may stem from damage the prefrontal cortex and subsequent impairment in an individual's ability to process and regulate fear and anxiety (Bryan, 2008).

Demographic variables. Most studies reveal that race/ethnicity affects SWB following traumatic injury, with African Americans reporting significantly lower levels of SWB than other racial/ethnic groups (Arango-Lasprilla et al., 2009; Krause, Saladin, & Adkins, 2009; Perrin et al., 2014; Williamson et al., 2015). However, some studies have found none or only small correlations between race/ethnicity and SWB (Davis et al., 2012; Dunn & Brody, 2008). Gender differences do not appear to significantly impact SWB outcomes post-injury (Davis et al., 2012; Dunn & Brody, 2008; Johnson et al., 2010; Krause et al., 2009; Resch et al., 2009; Williamson et al., 2015).

Evidence regarding the impact of age at injury, time since injury, and current chronological age is mixed. Some studies show that time since injury is related to SWB following SCI while others do not (Martz et al., 2005). In addition, while some studies have found that SWB declines with age (Martz et al., 2005; Williamson et al., 2015), these results are inconsistent, and several studies have found no significant associations between age and SWB (Davis et al., 2012; Dunn & Brody, 2008; Resch et al., 2009).

Married individuals tend to report higher levels of SWB following traumatic injury than individuals who are single, divorced, or widowed (Corrigan et al., 2001; Dunn & Brody, 2008; Hernandez et al., 2014; Patterson et al., 2000; Williamson et al., 2015). Some studies suggest marital status impacts life satisfaction for individuals with TBI but not SCI (Hicken et al., 2002; Warren & Wrigley, 1996), while other studies did not find marital status to affect life satisfaction after TBI (Davis et al., 2012; Johnson et al., 2010). Interestingly, Putzke, Elliott, and Richards (2001) found that, one year after SCI, marital status had a significant impact on life satisfaction but not emotional well-being.

Employment status is a fairly strong and consistent predictor of SWB following traumatic injury (Corrigan et al., 2001; Davis et al., 2012; Dunn & Brody, 2008). One review (Dunn & Brody, 2008) found education and income to be poorly correlated with SWB following traumatic injury, but other studies (Davis et al., 2012; Williamson et al., 2015) have found education and income to be positively associated with greater levels of life satisfaction following TBI.

Psychological factors. Several psychological factors have been examined in relation to SWB following traumatic injury. While one review found personality to be, overall, a weak and inconsistent predictor (Post & van Leeuwen, 2012), other studies have identified relationships between SWB and specific personality traits, such as agreeableness (Boyce & Wood, 2011), positivity (Stensman, 1994; Suarez, Levi, & Bullington, 2013), obstinacy (Stensman, 1994; Suarez et al., 2013), and neuroticism (van Leeuwen et al., 2012b). While both the presence of positive affect and absence of negative affect contribute to SWB (Diener, 1984) and correlate with SWB outcomes (Post & van Leeuwen, 2012), some findings suggest positive affect may have a stronger impact than negative affect on SWB post-injury (Kortte et al., 2010; Leoniuk, 2009).

Pre-injury substance abuse and psychological disorders can predict life satisfaction post-injury (Corrigan et al., 2001; Patterson et al., 2000) but these variables tend to have a smaller impact than processes and factors that take place after injury onset (Davis et al., 2012). For instance, coping styles and appraisal processes appear to have a strong impact on SWB, life satisfaction, and emotional well-being following traumatic injury (Kennedy et al., 2010; Tomberg et al., 2005; van Leeuwen et al., 2012b). Optimism (Dunn & Brody, 2008; Tomberg et al., 2005), hope (Kortte et al., 2010), self-esteem (Dunn & Brody, 2008), and self-efficacy (Braden et al., 2012; van Leeuwen et al., 2012a; van Leeuwen et al., 2012b) also correlate positively with SWB outcomes after traumatic injury. Mixed results have been found regarding the impact of depression on life satisfaction following TBI (Corrigan et al., 2001; Mailhan et al., 2005).

Resilience. Psychological resilience, "the ability to bounce back from negative events by using positive emotions to cope" (Tugade et al., 2004, p. 1162), has been studied not only as an outcome trajectory following traumatic injury (Quale & Schanke, 2010) but also as a psychological trait that predicts other positive outcomes post-injury (Weiter, 2014). Research has revealed strong associations between resilience and personality traits such as low neuroticism/negative emotionality, high positive emotionality, and high constraint (Elliott et al., 2015). Farkas and Orosz (2015) identified several components of resilience and found unique relationships between specific components of resilience and personality traits such as agreeableness, conscientiousness, emotional stability, extraversion, and openness. Most findings suggest that resilience correlates negatively with depression and other psychiatric problems (Rainey et al., 2014; Sigurdardottir, Andelic, Roe, & Schanke, 2014) and positively with SWB outcomes (Dunn & Brody, 2008; White, Driver, & Warren, 2010). Furthermore, the strong relationship between resilience and both positive and negative emotions suggests that resilience is interconnected with emotional well-being (Ong et al., 2010; Quale & Schanke, 2010; Tugade, 2011). Resilient outcomes following traumatic injury have been associated with emotional regulation and flexibility, cognitive appraisals, coping strategies and self-efficacy, personality traits (e.g., optimism, extraversion, conscientiousness), and social support (McGiffin, Galatzer-Levy, & Bonanno, 2016).

Social support. Social support is one of the most frequently studied and strongly correlated predictors of SWB outcomes following traumatic injury. Having positive connections with others provides one not only with a sense of social integration but also with resources that buffer against the adverse effects of stressful events (Cohen & Wills, 1985; Dunn & Brody, 2008). These include tangible, emotional, and informational support obtained through meaningful relationships with others (Schaefer, Coyne, & Lazarus, 1981). Some evidence suggests that positive affect and social support have a reciprocal impact, with positive emotions promoting closeness and connection with others and social connectedness promoting more positive emotions (Kok et al., 2013). Several empirical studies indicate that social support and related constructs (e.g., social integration, social activity, satisfaction with one's social support, family support, family satisfaction, number of social supports/relationships) predict SWB following traumatic injury (Burleigh et al., 1998; Corrigan et al., 2001; Douglas, 2012; Dunn & Brody, 2008; Fuhrer et al., 1992; Halcomb et al., 2005; Hernandez et al., 2014; Lammel, 2004; Müller et al., 2012; Tomberg et al., 2005; Tomberg et al., 2007; van Leeuwen et al., 2012a). However, other studies have found either weak (Rintala et al., 1992) or no relationships (Kalpinski et al., 2013) between social support and life satisfaction. Furthermore, there is some evidence that social support variables are significant only under certain conditions (Johnson et al., 2010; Lin et al., 2010).

Summary. Studies of emotional well-being after traumatic injury are warranted because of a lack of positive outcomes research in the posttraumatic literature; and a disproportionate emphasis on one sub-component of SWB, life satisfaction, with little research on emotional well-being, the relative balance of positive and negative emotions over time. Some research suggests that people eventually adapt to major life events, such as traumatic injury, but more longitudinal research and contextual models are required in order to identify significant psychosocial variables that may predict individual differences in emotional well-being following traumatic injury. The next section introduces the study and the methodological approaches used.

CHAPTER III

METHOD

The current study comprises a secondary dataset derived from the Baylor Trauma Outcome Project (BTOP) at the Baylor Scott & White Trauma Center in Dallas, Texas. This comprehensive research project measures health-related quality of life (HRQOL) outcomes among patients during a one-year period following discharge from the Level 1 Baylor Scott & White Trauma Center. The BTOP is conducted by researchers at the Division of Trauma at Baylor University Medical Center (BUMC) and has been reviewed and approved by the Baylor Scott & White Medical Center Dallas Institutional Review Board. Enrollment for the project began in March 2012 and concluded in May 2014. The current study has been approved by the Institutional Review Board at Texas A&M University.

Participants

Participants in the study included patients who were admitted to the Trauma Service at BUMC and met the inclusion and exclusion criteria. Patients were eligible for inclusion if they met the following criteria: (a) admitted to the Trauma Service with an admission of at least 24 hours, (b) age 18 or older, and (c) able to provide at least one contact phone number in order to be contacted for follow up at three, six and 12 months. Patients were excluded if they were unable to understand spoken English or Spanish, or if they had a TBI and/or any premorbid cognitive deficits (i.e. dementia) severe enough to impair their ability to provide informed consent.

Five hundred and six individuals consented. One participant who did not meet the age inclusion criteria was removed prior to analysis. Of the 505 consenting participants who met eligibility criteria, 488 had data for at least one time point and were included in the study.

Participants ranged in age from 18 to 92, with a mean age of 44.41 (*SD* = 16.92). There were 314 men (64%) and 174 (36%) women in the sample. Most of these participants identified as Caucasian/White (67.4%; n = 329), followed by African American/Black (24.4%; n = 119), Multiracial (3.9%; n = 19), American Indian or Alaskan Native (1.8%; n = 9), Asian (0.6%; n = 3), Native Hawaiian or Pacific Islander (0.4%; n = 2), and missing (1.4%; n = 7). About one-fifth of the sample identified as Hispanic (18.6%; n = 91). Most participants were never married (37.5%; n = 183); others were either married (33.2%, n = 162), divorced (19.1%, n = 93), widowed (6.6%, n = 32), or separated (2.5%, n = 12); and 6 participants (1.2%) either did not answer or selected a "multiple" or "other" category. More participants were employed (57.0%, n = 278) than unemployed (43.0%, n = 210).

Procedure

Once medically stable, patients who met inclusionary criteria were approached, informed about the aim and requirements of the study, and then invited to participate.

The investigator discussed informed consent with the prospective participant, and patients who agreed to participate were provided with informed consent forms. Patients who were unable to physically sign their name were allowed to verbally provide consent and have their consent forms signed by a third party non-biased witness (e.g., patient advocate or guest relation). When available, family and/or friends of the patient were included in the consent process and asked to co-sign for documentation on the consent form. All informed consent procedures took place in a private room during participants' admission at the hospital.

After informed consent was obtained, participants were formally entered into the study. Prior to their hospital discharge (Time1), participants were administered a set of pseudo-baseline questionnaires relating to their physical and psychological health. The questionnaires required approximately 30 minutes to complete. Some demographic and injury-related information was extracted from the BUMC Trauma Registry.

Research investigators followed up with participants by phone at three months post-discharge (Time2), six months post-discharge (Time3), and 12 months post-discharge (Time4). The three- and six-month follow-ups were conducted within a four-week window around each participant's target date (i.e., within two weeks prior and two weeks after the target date). The 12-month follow-up was conducted within a four-month window (i.e., two months prior and two months after the target date). During these windows, the research investigators attempted to contact participants with a maximum attempt of 12 calls, each separated by a minimum of 24 hours. Either an email or postcard reminder was sent to participants approximately one week prior to the start of each window. If participants were not reached during the window, a reminder letter was mailed to them. Unless a participant declined to continue participation, the researchers continued to attempt to contact participants at each follow-up (e.g., if no contact was made at three months, the participant would still be contacted at six months).

When a participant was reached by phone, the research assistant read an IRB-approved script at the beginning of the call to further inform him or her about the follow-up. Once the participant provided continued consent for participation in the study, the research assistant read the questionnaires over the phone and recorded the participant's responses. Each participant's responses were maintained in a study chart assigned to that participant.

An Excel spreadsheet was created to maintain participant data for each time period, as well as the demographic and injury data for all participants. This spreadsheet remains password protected, and only key personnel have access to the file.

Measures

Predictor Variables

Resilience. Resilience was measured with the Connor-Davidson Resilience Scale 10 (CD-RISC 10; Campbell-Sills & Stein, 2007). The CD-RISC 10 is a self-report questionnaire that was derived from the original 25-item CD-RISC (Connor & Davidson, 2003) using factor analysis. The CD-RISC 10 is strongly correlated with the original 25-item CD-RISC (r = .92; Campbell-Sills & Stein, 2007), and it has demonstrated a unidimensional factor structure (Burns & Anstey, 2010) and acceptable internal consistency (Campbell-Sills & Stein, 2007; Hartley, 2012). The questionnaire consists of 10 Likert-type items ranging from "Not true at all" (0) to "True nearly all the time" (4) that capture four dimensions of resilience: hardiness, social support/purpose, faith, and persistence. The combined CD-RISC total score ranges from 0 to 40, with higher scores reflecting greater self-reported resilience. Resilience was measured both prior to hospital discharge (Time1) and at 12 months post-discharge (Time4). In the current study, the CD-RISC 10 items had alpha internal reliability coefficients of .87 at Time1 (n = 469) and .90 at Time4 (n = 239).

Social support. Social support was measured using the Social Provisions Scale (SPS; Cutrona & Russell, 1987). The SPS is a self-report questionnaire that accounts for various dimensions and functions of social support. The SPS was developed based on Weiss's (1974) model, which conceptualizes relationships with others as providing six different "provisions," or social functions: (1) guidance (advice or information), (2) reliable alliance (the assurance that others can be counted upon for tangible assistance), (3) reassurance of worth (recognition of one's competence, skills, and value by others), (4) opportunity for nurturance (the sense that others rely upon one for their well-being), (5) attachment (emotional closeness from which one derives a sense of security), and (6) social integration (a sense of belonging to a group that shares similar interests, concerns, and recreational activities). Because the SPS operationalizes social support in terms of functions and assesses a comprehensive array of functions, it provides researchers a thorough and generalizable measure of social support. In addition, "the model of social provisions does not construe individuals as passive recipients of support, but as active participants who engage in a variety of social and personal roles" (Herrick, Elliott, & Crow, 1994, p. 234). The SPS total score has been reported as having a reliability index of .92 and has been shown to correlate with satisfaction with support (r = .35), number of supportive persons (r = .40), number of helping behaviors (r = .35), and attitudes toward support (r = .46; Cutrona & Russell, 1987).

The SPS questionnaire consists of 24 Likert-type items ranging from "Strongly disagree" (1) to "Strongly Agree" (4) and yields a total score, as well as subscale scores on the six dimensions of social support. Total SPS scores, ranging from 24 to 96, were used in the current study. Half of the items are negatively worded and were therefore reverse coded so that higher total scores indicate more self-perceived social support. Social support, like resilience, was measured both prior to hospital discharge (Time1) and at 12 months post-discharge (Time4). In the current study, these items had alpha internal reliability coefficients of .94 at Time1 (n = 416) and .94 at Time4 (n = 237).

Resilience and social support change scores. Resilience and social support change scores (a.k.a., difference scores, gain scores) were computed for participants who had scores on the respective measures at both time points (i.e., Time1 and Time4). A simple difference score was calculated as $D = Y - X$, where X is the (CD-RISC 10 or SPS) total score at Time1 and Y is the (CD-RISC 10 or SPS) total score at Time4.

Several authors have criticized the use of simple difference scores (Cronbach & Furby, 1970; Linn & Slinde, 1977; Lord, 1956; Lord & Novick, 1968) and advocated for alternatives such as residual change scores (Williams, Zimmerman, & Mazzagatti, 1987). The use of simple difference scores was justified on two counts. First, the arguments against simple difference scores have been primarily based on a theory (Gulliksen, 1950) that assumes the measurement's reliability and standard deviation is identical for the two time points (as cited in Gollwitzer, Christ, & Lemmer, 2014). Recent research has indicated that these assumptions are rarely accurate in practice and that simple difference scores are in fact reliable, valid, and useful, particularly when standard deviations differ between the measurement occasions (Gollwitzer et al., 2014; Williams & Zimmerman, 1996; Zimmerman & Williams, 1982; Zimmerman & Williams, 1988). The standard deviations of the CD-RISC 10 and SPS scores increased over time in the current study (see p. 66), supporting the use of simple difference scores.

Second, residual change scores assume "that a person's test score at T2 would have been a linear function of his or her test score at T1 if there had been no treatment and that this linear function applies to all (untreated) persons" (Gollwitzer et al., 2014, p. 676). Therefore, residual change scores model the final score as a function of the initial score, which controls for the effect of the initial score (Williams et al., 1987). In the current study, there is no theoretical support for assuming resilience and social support would change *independent* of "treatment." Resilience and social support change in response to internal or external events such as traumatic injury but should not change in a predictable and universal way without reason or cause, and it is this latter assumption on which residual change scores are based. Furthermore, initial resilience and social support scores will be included in the models when testing for the significance of the change scores, which will control for the effect of initial scores. Using residual change scores in model testing would essentially *over* control for the effect of the initial scores.

Demographic variables. Six demographic variables were extracted from the larger BTOP protocol and included in the current study: age, gender, racial/ethnic minority status, marital status, employment status, and education. Age was the participant's chronological age when he or she was admitted for hospitalization. Gender was coded as "0" for female and "1" for male. A racial/ethnic minority status variable was created by coding all participants who were Caucasian *and* non-Hispanic as "0" (non-minority status) and all other participants as "1" (minority status). Marital status was coded as "1" for married and "0" as any other marital category (e.g., divorced, widowed). Participants who were employed when they were admitted to the hospital were coded as "1" and unemployed participants were coded as "0." An educational variable was created by coding participants with any degree above a high school degree as "1" and participants with a high school degree or less as "0." These demographic variables were measured only at Time1.

Injury-related variables. Two injury-related variables were included in the current study: injury severity and presence (i.e., co-occurrence) of mild traumatic brain injury (mTBI). Injury severity was assessed using the Injury Severity Score (ISS; Baker, O'Neill, Haddon, & Long, 1974). The ISS provides an overall score of injury severity, can account for multiple injuries on the body, is routinely used in emergency settings, and correlates strongly with mortality and length of hospital stay (Baker et al., 1974;

Semmlow & Cone, 1976). ISS scores range from 0 to 75, with 75 indicating a fatal injury. Individuals with ISS scores greater than 50 were not included in the study.

Although patients with moderate and severe TBI were excluded from the study, participants were coded as either positive or negative for mild traumatic brain injury (mTBI) based on International Classification of Diseases (ICD) diagnostic codes that were assigned to them during their hospitalization. Patients who received a diagnosis indicative of mTBI were coded as "1" (positive for mTBI), and patients who did not were coded as "0" (negative for mTBI). Both injury severity and mTBI status were assessed only at Time1.

Outcome Variable

Emotional well-being. Emotional well-being was the outcome variable for the current study. Emotional well-being was measured using the Mental Health (MH) scale of the Veterans RAND 12-Item Health Survey (VR-12). The VR-12 is a widely used and nonproprietary self-report measure of physical and mental health-related quality of life (Kazis et al., 2006). The VR-12 provides scale scores for eight health domains: physical functioning (PF), role limitations due to physical problems (RP), bodily pain (BP), general health perceptions (GH), energy and vitality (VT), social functioning (SF), role limitations due to emotional problems (RE), and mental health (MH). Empirically derived weights are applied to the scores on these eight scales to yield two summary scores—a physical component score (PCS) and a mental component score (MCS; Kazis et al., n.d.). The emotional well-being variable was measured at all four time points.

Development of the VR-12. The VR-12 was developed from the Veterans RAND 36-Item Health Survey (VR-36) which was developed from the RAND SF-36 Version 1.0 (RAND 36; Kazis et al., 2006; Iqbal et al., 2007). All of these instruments have their roots in the Medical Outcomes Study (MOS). The MOS was a two-year (1986-1988) longitudinal study that examined the impact of patient, provider, and health system characteristics on health outcomes using a sample of 2,471 adults (ages 18 and older) who had one or more of four chronic diseases (hypertension, diabetes, heart disease, and depression; Hays, Sherbourne, & Mazel, 1993; Hays, Sherbourne, & Mazel, 1995). The RAND Corporation developed a *Health-Related Quality of Life (HRQOL) Survey* consisting of 116 core items for use in the MOS (Hays, Prince-Embury, & Chen, 1998; Hays et al., 1995). Shortly thereafter, MOS researchers published a 36-item short-form version of the MOS HRQOL survey known as the SF-36® (Ware & Sherbourne, 1992). The SF-36® and its derivatives (i.e., SF-36® version 2, SF-12® version 1, SF-12® version 2) remain proprietary as registered trademarks of the Medical Outcomes Trust, governed by QualityMetric (Ware, 2000). However, the RAND Corporation maintains a non-proprietary copy of the SF-36® known as the RAND 36 (a.k.a., RAND 36-Item Health Survey 1.0, RAND-36 Health Status Inventory, or RAND SF-36 Version 1.0) in the public domain (Hays et al., 1993).

The RAND 36 “consists of the same 36 items as the SF-36 but incorporates a sophisticated scaling methodology based on item response theory (IRT), factor-based composite scores, and national norms closely stratified by age, race/ethnicity, education level, sex, and geographic region according to the U.S. census data” (Hays et al., 1998,

p. 1). The RAND 36 was normed using a sample 800 respondents representative of the U.S. adult population (ages 18-89) based on 1993 U.S. Census data (Hays et al., 1998). Item response weights within each item and item weights within each scale were calculated using IRT methodology and serve as the basis for calculating standardized *T* scores (with a score distribution mean of 50 and standard deviation of 10) for the eight scales and two composites (Hays et al., 1998). The RAND 36 has been widely used as a self-report measure of physical, mental, and social HRQOL and boasts strong psychometric properties (Brazier et al., 1992).

The VR-36 (a.k.a., SF-36V or Veterans Short Form 36) and VR-12 were developed by the Veterans Health Administration (VHA) for use in the Veterans Health Study (VHS; Kazis et al., 2006). The VHS followed 2,425 VA patients for up to two years and sought to modify the RAND 36 for use in the veteran ambulatory population (Kazis et al., 2004). The VR-36 was modified from the RAND 36 in two ways: (1) the number of response choices for the role physical (RP) and role emotional (RE) items was increased from a two-point (yes/no) choice to a five-point Likert scale, and (2) two change items (one for physical health, one for mental health) were included instead of only one change item assessing health change generally (Iqbal et al., 2007). The VR-12 was derived using psychometric evaluations of normative data from the VR-36, consists of the 12 most important items for construction of the PCS and MCS summary scales (Iqbal et al., 2007), and explains 90% of the reliable variance of the VR-36 (Jones et al., 2001). The VR-12 has strong psychometric properties (Ware, 1993) and has been widely used by both the VA and Medicare for monitoring health outcomes and quality of care (Kazis et al., 2006; Selim et al., 2009).

The VR-12 MH scale. The MH scale of the VR-12 was used as an indicator of the individual's emotional well-being in the current study. This scale comprises two items: (6a) "How much of the time during the past 4 weeks have you felt calm and peaceful?" and (6c) "How much of the time during the past 4 weeks have you felt downhearted and blue?" Responses are Likert-type, ranging from "All of the time" (1) to "None of the time" (6). Item 6a is reversed coded so that higher scores on the MH subscale indicate the respondent "feels peaceful, happy and calm" most of the time (Ware, 1993, p. 35). In the current study, these items had alpha internal reliability coefficients of .70 at Time1 ($n = 486$), .74 at Time2 ($n = 345$), .81 at Time3 ($n = 267$), and .80 at Time4 ($n = 244$).

It is important to note that the items in the MH scale focus on the frequency of relatively low-intensity positive and negative emotions rather than high-intensity (or "peak") emotional experiences. This is consistent with Deiner's (1984, 1994) conceptualization of affective well-being and the body of research indicating that intense positive emotions may actually have a negative long-term net impact on emotional well-being (Diener et al., 1991). The low-intensity quality of the MH scale stands in contrast to the Positive and Negative Affect Schedule (PANAS) scales (Watson, Clark, & Tellegen, 1988), which focuses on more intense positive and negative emotions:

> High [Positive Affect] is a state of high energy, full concentration, and pleasurable engagement, whereas low PA is characterized by sadness and

> lethargy. In contrast, Negative Affect (NA) is a general dimension of subjective distress and unpleasant engagement that subsumes a variety of aversive states, including anger, contempt, disgust, guilt, fear, and nervousness, with low NA being a state of calmness and serenity. (p. 1063)

In the MH scale, "calm and peaceful" is conceptualized as representing low-intensity positive affect as opposed to low negative affect, and "downhearted and blue" is conceptualized as representing low-intensity negative affect rather than low positive affect.

The VR-12 and similar measures (e.g., SF-12® version 1 and 2) were developed in order to estimate PCS and MCS summary scores only, and the authors of these measures have discouraged the analysis of individual scale scores because scales comprised of only a few items have been shown to lack measurement precision (Hays et al., 1998; Ware, Kosinski, & Keller, 1995). However, the two items comprising the MH scale capture the construct of emotional well-being as it is operationalized in the SWB literature, that is, as the presence of positive affect (Item #6a reverse coded) and absence of negative affect (Item #6c) over time (Diener, 1984; Diener, 1994). In fact, the MH scale in the VR-36 is equivalent to the Emotional Well-Being Scale (EWB) in the RAND 36. The items comprising the MH scale in the VR-36 and VR-12 are identical to the items comprising the EWB scale in the RAND 36 and RAND 12, respectively (Hays et al., 1998; Hays & Morales, 2001; Hays et al., 1993). Furthermore, the MCS summary score would be an inappropriate measure of emotional well-being because it includes measures of functioning as well as well-being; while the measurement of well-being relies almost exclusively on the respondent's subjective perceptions, functioning is considered to be more objective and therefore outside the umbrella of SWB research (Hayes & Morales, 2001). Previous researchers have examined individual scales and items from the SF-12®, setting a precedent for the current study's use of the MH scale (Givens, Prigerson, Jones, & Mitchell, 2011; Whitehurst, Engel, & Bryan, 2014).

Scoring the MH scale. There are two scoring algorithms for the VR-12 scales and summary scores based on standardized U.S. population norms (Fleishman, Selim, & Kazis, 2010; Selim et al., 2009). The first algorithm is based off of 1990 U.S. population sample data collected for version 1 of the SF-36® and SF-12® (Ware, Snow, Kosinski, & Gandek, 1993; Ware, Kosinski, & Keller, 1994). The second algorithm is based off of 1998 U.S. population sample data collected for the SF-12® version 2 (Ware, Kosinski, Turner-Bowker, & Gandek, 2002). Selim and colleagues (2009) published new norms for the VR-12 using data collected from the Medical Expenditure Panel Survey (MEPS) between 2000 and 2002, but unfortunately normative data for only the PCS and MCS summary scores were provided. Fleishman and colleagues (2010) published means for the VR-12 scales using MEPS data collected between 2003 and 2005 but failed to indicate standard deviations for these means.

Therefore, the 1998 U.S. population norms represented the most recent normative data available for standardizing the MH scale score and were used in calculating the MH scores in the current study (Ware et al., 2002). Out of range values for Item #6a and #6c were re-coded as missing, and Item #6a was reverse coded. The two items were summed and then converted to a 0 to 100 scale through linear transformation. The transformed MH scores were then converted into *Z*-scores using the 1998 U.S. general population mean (70.182) and standard deviation (20.506) for the MH scale score distribution. Finally, the MH scores were transformed into *T*-scores so that the sample's MH score distribution would have a mean of 50 and a standard deviation of 10.

Variable Level Classification

All of the predictor variables used in the current study were analyzed as time-invariant (i.e., at Level-2) and therefore conceptualized as variables of "individual difference." While resilience and social support were measured both prior to hospital discharge (Time1) and at 12 months post-discharge (Time4), the follow-up measurements at Time4 were taken only for the purpose of calculating change scores and were themselves not included as predictors. Therefore, resilience (measured at Time1), social support (measured at Time1), and the resilience and social support change scores were all treated as time-invariant predictors. The demographic and injury-related variables were also time-invariant because they were measured only at the first time point. The outcome variable, emotional well-being, was time-varying because it was administered at all four measurement occasions. Therefore, emotional well-being was the only variable measured at Level-1.

Data Preparation

Raw data for this study was maintained in a Microsoft Excel document using a "wide" data structure (i.e., each participant received a single row of data on four separate Excel sheets, one for each of the four measured time points). The data was converted from its original wide format to "long" format, where each row represented one measured time point per person. With this data structure, a participant with fewer than four rows of data indicates missing data on the outcome variable of interest (emotional well-being) for one or more measured time points.

The data was imported into IBM SPSS Statistics 24 software. Invalid entries were recoded into valid entries if there was sufficient information contained in the Excel file to do so. Those that could not be recoded were converted to missing data. Three new demographic variables were created by dichotomizing the raw data: racial/ethnic minority status, marital status, and educational attainment. Total scores for the MH scale, SPS, and CD-RISC 10 were computed. The MH scale total score was transformed into the recommended *T* score format using normative data. Change scores for the SPS and CD-RISC 10 measurements were created for participants who had the respective scores at both necessary time points.

A time variable (Time12) was created to represent the effect of time on the outcome variable. Time12 was centered on 12 months so that each predictor's fixed effect would indicate its effect on emotional well-being at 12 months post-injury, and was therefore coded as number of months from the 12-month reference point. To illustrate, data collected at the first time point (i.e., prior to hospital discharge) was coded as -12, data collected at the second time point (i.e., three months post-discharge) was coded as -9, data collected at the third time point (i.e., six months post-discharge) was coded as -6, and data collected at the forth and final time point (i.e., 12 months post-discharge) was coded as 0.

Eight participants were missing data for specific items on the CD-RISC and SPS questionnaires. For these participants, an attempt was made to impute data for the missing items in order to calculate total scores. If respondents answered at least 70% of the items in the questionnaire (i.e., seven items on the CD-RISC 10; 17 items on the SPS), missing scores were imputed using the mean of completed item scores. Questionnaires with less than 70% complete data were considered invalid and coded as missing. Imputation of missing values on the MH scale was not required because there were no participants who had data for only one of the two items comprising the scale.

Extreme values for continuous variables in the data set were explored using skewness and kurtosis values, box plots, and *Z* scores. For all continuous variables, skewness values fell within the acceptable range for a normal distribution (±2) and kurtosis values were also within normal range (±5). However, visual analysis of box plots pointed to several potential outliers according to SPSS specifications. Given the large sample size used in the current study, values at the far upper and lower ends of distributions were expected. Therefore, a conservative approach to managing extreme values was used. Variables were converted to standardized *Z* values, and then a cutoff *Z*-value of ±4 was applied to identify true outliers. This procedure identified three true outliers, one from each of the following continuous predictor variables: resilience at Time4, social support at Time1, and resilience change. These outliers were windsorized by replacing the extreme value with the next highest or lowest value in the variable's score distribution.

After raw descriptive statistics were recorded for all variables, linear transformations were applied to the continuous predictor variables to simplify the interpretations of their fixed effects. First, because the CD-RISC 10 and SPS measures had different score ranges, the initial resilience, initial social support, resilience change, and social support change scores were converted to a 0-100 scale so that apples-to-apples comparisons could be made. Then, all of the continuous predictors used in the current study (i.e., initial resilience, initial social support, resilience change, social support change, age, and injury severity) were centered around their respective grand means so that their fixed effects could be interpreted in terms of single units of change.

Data Analysis

Rationale for the Use of Multilevel Modeling

Hierarchical linear modeling (HLM), also known as "multilevel" or "mixed" modeling (MLM), was used to investigate individual trajectories of emotional well-being over time using variables of individual difference (i.e., demographic variables, injury characteristics, resilience and social support). In longitudinal studies such as the current one, the repeated measurements within individuals are usually strongly correlated

(Quené & van den Bergh, 2004). This correlation, known as the intra-class correlation (ICC), is due to the design effect of the study and must be accounted for (Quené & van den Bergh, 2004). HLM takes into account this correlation by grouping the repeated measurements for each participant (Raudenbush & Bryk, 2002). HLM estimates an average growth trend for the sample but allows the growth trajectories for individuals to vary based on growth parameters (i.e., variables of individual difference) specified by the researcher. This approach reveals characteristics of the data and relationships between variables that might be missed when aggregating across individuals. In addition, it allows researchers to investigate both the between- and within-individual variation in growth rates (Wallace & Green, 2002) and determine if between-individual variation is "systematically related to various contextual factors" (Willett, Singer, & Martin, 1998, p. 398). In the current study, the aim was to examine relationships between the individually varying growth trajectories and demographic, injury-related, resilience, and social support factors.

HLM yields many important advantages over repeated-measures analysis of variance (ANOVA), a widely used alternative technique, that are relevant for the current study. With ANOVA, "all participants are assumed to have the same number of assessments (balanced data) and the intervals between time periods are assumed to be equal (equal spacing)" (Kwok et al., 2008, p. 4). Due to the assumption of balanced data in ANOVA, missing data is not permitted, so if a participant is missing data at even one measurement occasion, that participant is removed and all of his or her data is lost (Hox, 2010; Kwok et al., 2008; Quené & van den Bergh, 2004). This substantially reduces statistical power and estimation precision (Kwok et al., 2008; Quené & van den Bergh, 2004). In contrast, HLM does not assume an equal number of observations for participants, so all cases and all available data can remain in the analysis (Hox, 2010; Kwok et al., 2008). Also unlike ANOVA, HLM readily accommodates unequally spaced intervals such as those used in the current study (i.e., measurements at 0, 3, 6, and 12 months post-discharge; Kwok et al., 2008).

Finally, HLM is flexible in regards to specifying the variance-covariance structure (Hox, 2010; Kwok et al., 2008; Quené & van den Bergh, 2004). In longitudinal data, the structure of the variance at every measurement occasion and the covariance between any two measurement occasions need to be specified in a variance-covariance matrix. ANOVA assumes *compound symmetry* for the variance-covariance matrix: all variances are assumed to be equal and all covariances are assumed to be equal (Hox, 2010; Kwok et al., 2008; Quené & van den Bergh, 2004). This assumption is very restrictive and often unrealistic for longitudinal studies (Hox, 2010; Kwok, West, & Green, 2007). HLM does not assume compound symmetry and instead allows the researcher to specify alternative variance-covariance structures (Hox, 2010).

Modeling Strategy and Procedures

The data was imported from SPSS into Hierarchical Linear Modeling-7 (HLM-7) for analysis. HLM-7 was used for model estimation, building/selection, and evaluation. SPSS was used to test for potential assumption violations and obtain graphical information. The outcome variable and predictor variables were initially selected for testing based on review of the literature and availability from the BTOP protocol. Data-driven procedures were then used to identify statistically significant variables at each step in model development.

First, an unconditional means model (Model 1) was specified:

(1) Level-1: $EW_{ti} = \pi_{0i} + e_{ti}$
Level-2: $\pi_{0i} = \beta_{00} + r_{0i}$

where t represents the measurement occasion and i represents the individual participant. This model indicates that a participant's emotional well-being at a specific time point (EW_{ti}) is modeled as his or her estimated mean emotional well-being (π_{0i}), plus an error for that time point (e_{ti}); at Level-2, the participant's mean emotional well-being (π_{0i}) is further modeled as the emotional well-being grand mean (i.e., the estimated emotional well-being mean for all participants across all measurement occasions; β_{00}), plus a random effect for that participant (r_{0i}). This model was used to calculate the ICC (i.e., the proportion of variance in the outcome measure that was due to individual differences).

Research Questions #1 and 2. Research questions #1 and 2 were answered using an unconditional growth model (Model 2). In order to build this model, alternative growth patterns and error covariance structures for the Level-1 data were compared and selected based on data-driven procedures. Assuming the simplest structure by default often leads to model misspecification, which "may lead to incorrect statistical inferences for the fixed effects" and also lead to more variance explained (Kwok et al., 2008, p. 14). Results indicated that the unconditional growth model was best represented by a cubic growth pattern and heterogeneous error covariance structure (see Chapter IV). Therefore, Model 2 was specified as:

(2) Level-1: $EW_{ti} = \pi_{0i} + \pi_{1i}*(Time12_{ti}) + \pi_{2i}*(Time12Sq_{ti}) + \pi_{3i}*(Time12Cb_{ti}) + e_{ti}$
Level-2: $\pi_{0i} = \beta_{00} + r_{0i}$
$\pi_{1i} = \beta_{10} + r_{1i}$
$\pi_{2i} = \beta_{20}$
$\pi_{3i} = \beta_{30}$

with a heterogeneous error covariance matrix. Model 2 indicates that a participant's emotional well-being at a specific time point (EW_{ti}) is modeled as his or her estimated emotional well-being at Time4 (i.e., 12 months post-injury; π_{0i}); plus a linear (π_{1i}), quadratic (π_{2i}), and cubic effect of time (π_{3i}); plus an error for that time point (e_{ti}). The participant's estimated emotional well-being at Time4 (π_{0i}) is further modeled as the sample's mean emotional well-being at Time4 (β_{00}), plus a random effect for that participant (r_{0i}). In addition, the linear effect of time is freely estimated for each participant, so a participant's linear effect of time (π_{1i}) is further modeled as the sample's mean linear effect of time (β_{10}), plus a random effect for that participant (r_{1i}). The quadratic (π_{2i}) and cubic (π_{3i}) effects of time are modeled simply as the mean quadratic (β_{20}) and cubic (β_{30}) effects of time for the sample.

Research Question #1 asks, "What is the average growth trajectory of emotional well-being for individuals after sustaining a traumatic injury?" The fixed effects for the linear (β_{10}), quadratic (β_{20}), and cubic (β_{30}) components collectively represent the average growth trajectory of emotional well-being for the current sample.

Research Question #2 asks, “Is there statistically significant variation between individuals’ emotional well-being growth trajectories?” This question was answered by examining the variance for the random linear effect of time (σ^2_{r1}).

Research Question #3. Research Question #3 asks, “Which (if any) demographic and injury-related variables significantly predict emotional well-being at 12 months and/or the growth trajectory?” The six demographic and two injury-related variables were entered into a transitional model (Model 3) as potential predictors of the Level-2 random intercept (i.e., emotional well-being at Time4) and random linear effect of time:

(3) Level-1: $EW_{ti} = \pi_{0i} + \pi_{1i}*(Time12_{ti}) + \pi_{2i}*(Time12Sq_{ti}) + \pi_{3i}*(Time12Cb_{ti}) + e_{ti}$

Level-2: $\pi_{0i} = \beta_{00} + \beta_{01}*(AgeC_i) + \beta_{02}*(Gender_i) + \beta_{03}*(RacMin_i) + \beta_{04}*(Married_i) + \beta_{05}*(Employed_i) + \beta_{06}*(Educ_i) + \beta_{07}*(ISSC_i) + \beta_{08}*(mTBI_i) + r_{0i}$

$\pi_{1i} = \beta_{10} + \beta_{11}*(AgeC_i) + \beta_{12}*(Gender_i) + \beta_{13}*(RacMin_i) + \beta_{14}*(Married_i) + \beta_{15}*(Employed_i) + \beta_{16}*(Educ_i) + \beta_{17}*(ISSC_i) + \beta_{18}*(mTBI_i) + r_{1i}$

$\pi_{2i} = \beta_{20}$

$\pi_{3i} = \beta_{30}$

P-values were used to determine which variables from Model 3 significantly predicted emotional well-being at 12 months and/or the linear effect of time. Variables with non-significant effects were removed from the model.

Research Question #4. Research Question #4 asks, “Controlling for any significant demographic and injury-related variables, do resilience and social support variables significantly predict emotional well-being at 12 months and/or the growth trajectory?” The four resilience and social support variables (i.e., initial resilience, resilience change, initial social support, and social support change) were entered into a second transitional model (Model 4) as potential predictors of the Level-2 random intercept and random linear effect of time:

(4) Level-1: $EW_{ti} = \pi_{0i} + \pi_{1i}*(Time12_{ti}) + \pi_{2i}*(Time12Sq_{ti}) + \pi_{3i}*(Time12Cb_{ti}) + e_{ti}$

Level-2: $\pi_{0i} = \beta_{00} + \beta_{01}*(RIS1LinC_i) + \beta_{02}*(RISPerChgC_i) + \beta_{03}*(SS1LinC_i) + \beta_{04}*(SSPerChgC_i) + \beta_{05}*(Educ_i) + r_{0i}$

$\pi_{1i} = \beta_{10} + \beta_{11}*(RIS1LinC_i) + \beta_{12}*(RISPerChgC_i) + \beta_{13}*(SS1LinC_i) + \beta_{14}*(SSPerChgC_i) + \beta_{15}*(Educ_i) + r_{1i}$

$\pi_{2i} = \beta_{20}$

$\pi_{3i} = \beta_{30}$

P-values were used to determine which variables from Model 4 should be preserved for subsequent model testing.

Research Question #5. A final model (Model 5) with all significant predictors was tested:

(5) Level-1: $EW_{ti} = \pi_{0i} + \pi_{1i}*(Time12_{ti}) + \pi_{2i}*(Time12Sq_{ti}) + \pi_{3i}*(Time12Cb_{ti}) + e_{ti}$

Level-2: $\pi_{0i} = \beta_{00} + \beta_{01}*(RIS1LinC_i) + \beta_{02}*(RISPerChgC_i) + \beta_{03}*(SS1LinC_i) + \beta_{04}*(SSPerChgC_i) + r_{0i}$

$\pi_{1i} = \beta_{10} + \beta_{11}*(RISPerChgC_i) + \beta_{12}*(SSPerChgC_i) + r_{1i}$

$\pi_{2i} = \beta_{20}$

$\pi_{3i} = \beta_{30}$

At Level-1, a participant's emotional well-being at a specific time point (EW_{ti}) is modeled as his or her estimated emotional well-being at Time4 (π_{0i}); plus a linear (π_{1i}), quadratic (π_{2i}), and cubic effect of time (π_{3i}); plus an error for that time point (e_{ti}). At Level-2, the participant's estimated emotional well-being at Time4 (π_{0i}) is further modeled as the sample's mean emotional well-being at Time4 (β_{00}), plus a random effect for that participant (r_{0i}); the participant's estimated linear effect of time (π_{1i}) is further modeled as the sample's mean linear effect of time (β_{10}), plus a random effect for that participant (r_{1i}); and the quadratic (π_{2i}) and cubic (π_{3i}) effects of time are modeled as the sample's mean quadratic (β_{20}) and cubic (β_{30}) effects of time.

Research Question #5 asks, "What proportion of the between-individual variance in emotional well-being is explained by resilience and social support variables?" The Pseudo-R^2 proposed by Raudenbush and Bryk (2002) was used to evaluate the predictive ability of the resilience and social support variables included in the final model.

CHAPTER IV

RESULTS

Preliminary Analyses

Descriptive Statistics

The sample for this study comprised 488 participants with data on the outcome variable, emotional well-being, for at least one time point. Descriptive statistics for the sample of participants on demographic and injury-related variables used in the study are presented in Table 1. The racial/ethnic minority status variable indicated that about half (48.2%) of the sample identified themselves as a racial/ethnic minority (e.g., African American, Hispanic, Multiracial). About one-third (33.2%) identified as married versus not married. Over half (57%) of the sample was employed at the time of injury. There were slightly more participants with a high school degree or less (56.8%) than participants with advanced degrees (43.2%). The injury severity scores, measured with the ISS, ranged from 0 to 50, with a mean of 11.92 ($SD = 8.28$), which falls in the moderate range of severity. Most participants (71.7%) were negative for mild traumatic brain injury (mTBI).

Table 1. Demographic and injury-related descriptives for sample

	N	Mean	Standard deviation
Age	488	44.41	16.93
ISS	466	11.92	8.28
	N	Frequency	Percent
Gender	488		
Female		174	35.7
Male		314	64.3
Racial/ethnic minority status	482		
No		247	50.6
Yes		235	48.2
Marital status	485		
Other		323	66.2
Married		162	33.2
Employment status	488		
Unemployed		210	43.0
Employed		278	57.0
Education	488		
High school degree or less		277	56.8
Any advanced degree		211	43.2
mTBI status	481		
No		350	71.7
Yes		131	26.8

The outcome variable, emotional well-being, was the only variable in the current study measured at all four time points. A total of n = 1,342 measurements of emotional well-being was obtained. The mean emotional well-being score across all participants and all measurement occasions was 48.96 (SD = 12.73). The mean emotional well-being score at each of the four measurement occasions is presented in Table 2. On average, there was a large decrease in emotional well-being from Time1 to three months post-discharge, followed by smaller increases from three to six months and again from six to 12 months post-discharge. The variance in emotional well-being scores increased over time, which suggests that participants' emotional well-being levels were differentially affected after sustaining a traumatic injury.

The mean resilience and social support scores at Time1 and Time4 are also presented in Table 2. Both resilience and social support decreased slightly, on average, over the 12-month period. For the 233 participants with resilience scores at both Time1 and Time4, the mean percent change was -.58% (*SD* = 17.60) and the mean absolute percent change was 13.05%. For the 202 participants with social support scores at both Time1 and Time4, the mean percent change was -4.81% (*SD* = 15.18) and the mean absolute percent change was 11.94%.

Table 2. Means and standard deviations for repeated measurement variables

Time	Emotional well-being			Resilience			Social support		
	Mean	SD	*n*	Mean	SD	*n*	Mean	SD	*n*
T1	51.33	11.30	486	31.96	6.44	469	79.14	11.06	416
T2	46.99	13.17	345	--	--	--	--	--	--
T3	47.61	13.49	267	--	--	--	--	--	--
T4	48.51	13.25	244	31.28	7.39	239	76.23	11.16	237

T1 = Prior to hospital discharge, T2 = 3 months post-discharge, T3 = 6 months post-discharge, T4 = 12 months post-discharge

Correlations

Correlations for the continuous variables used in the study are presented in Table 3. Emotional well-being scores were significantly correlated for all pairs of time points. In addition, there were significant correlations between resilience at Time1 and Time4, $r(232) = .45$ ($p < .01$); and social support at Time1 and Time4, $r(201) = .48$ ($p < .01$).

At Time1, emotional well-being was significantly correlated with resilience [$r(465) = .37$] and social support [$r(413) = .34$], and resilience and social support were significantly correlated with each other, $r(415) = .31$. At Time4, emotional well-being was still correlated with resilience [$r(238) = .44$] and social support [$r(236) = .39$], and resilience and social support were still correlated as well, $r(235) = .39$. A small but significant relationship between ISS and emotional well-being indicated that individuals with more severe injury scores tended to report less emotional well-being twelve months post-discharge, $r(234) = -.15$. There was no significant relationship between age and the other variables.

Table 3. Correlations for continuous variables

	1	2	3	4	5	6	7	8	9	10
1. Emotional well-being at T1	--									
2. Emotional well-being at T2	.41**	--								
3. Emotional well-being at T3	.45**	.76**	--							
4. Emotional well-being at T4	.41**	.64**	.71**	--						
5. Resilience at T1	.37**	.19**	.14*	.20**	--					
6. Resilience at T4	.27**	.39**	.47**	.44**	.45**	--				
7. Social support at T1	.34**	.26**	.24**	.14*	.31**	.22**	--			
8. Social support at T4	.21**	.37**	.37**	.39**	.25**	.39**	.48**	--		
9. Age	-.05	-.02	.04	.05	-.01	.02	-.03	-.11	--	
10. Injury severity (ISS)	-.02	-.07	.00	-.15*	-.03	-.10	.02	-.02	-.07	--

T1 = Prior to hospital discharge, T2 = 3 months post-discharge, T3 = 6 months post-discharge, T4 = 12 months post-discharge
**$p < .01$
*$p < .05$

Variable Descriptives by Factor

Table 4 displays the mean emotional well-being score for each measurement occasion by gender, racial/ethnic minority status, marital status, employment status, education, and mTBI status. ANOVA analyses indicated that, at Time1, emotional well-being scores were significantly predicted by marital status [$F(1, 481) = 4.95$, $p = .03$] and employment status, $F(1, 484) = 18.68$, $p < .01$. This indicates that, at the beginning of the study, married and employed individuals reported greater emotional well-being on average than unmarried and unemployed individuals. In addition, at Time4, emotional well-being scores were significantly predicted by baseline employment status [$F(1, 242)$

= 4.36, *p* = .04] and education, *F*(1, 242) = 13.35, *p* < .01. This indicates that, 12 months following discharge, individuals who were employed and had higher levels of education reported greater emotional well-being on average than unemployed individuals and individuals with lower educational attainment. Gender, racial/ethnic minority status, and mTBI status did not significantly predict emotional well-being at any time point.

Table 4. Emotional well-being means and standard deviations by variable factor

	T1	T2	T3	T4
Gender				
Female	50.08 (11.66)	46.96 (12.65)	46.30 (12.62)	48.48 (12.33)
Male	52.01 (11.06)	47.00 (13.50)	48.45 (13.98)	48.53 (13.89)
Racial/ethnic minority status				
No	50.92 (11.08)	48.04 (12.63)	48.82 (13.14)	49.77 (12.58)
Yes	51.81 (11.49)	45.91 (13.62)	46.15 (13.86)	46.87 (14.01)
Marital status				
Other	50.52 (11.88)*	46.14 (13.49)	46.50 (13.60)	47.47 (14.23)
Married	52.94 (9.99)	48.62 (12.59)	49.71 (13.25)	50.27 (11.57)
Employment status				
Unemployed	48.81 (12.75)**	45.45 (13.46)	46.67 (13.88)	46.60 (14.36)*
Employed	53.21 (9.70)	48.23 (12.83)	48.47 (13.11)	50.13 (12.05)
Education				
High school degree or less	51.49 (11.48)	46.16 (13.49)	46.68 (13.81)	45.61 (14.10)**
Any advanced degree	51.11 (11.10)	48.01 (12.73)	48.71 (13.07)	51.66 (11.52)
mTBI status				
No	51.69 (11.12)	47.45 (13.01)	48.31 (13.21)	49.08 (13.22)
Yes	50.47 (11.25)	45.79 (13.80)	46.25 (14.15)	47.68 (13.25)

T1 = Prior to hospital discharge, T2 = 3 months post-discharge, T3 = 6 months post-discharge, T4 = 12 months post-discharge
***p* < .01
**p* < .05

Table 5 provides the mean resilience and social support scores at Time1 and Time4 by gender, racial/ethnic minority status, marital status, employment status, education, and mTBI status. ANOVA analyses indicated that resilience at Time1 was significantly predicted by employment status [*F*(1, 467) = 16.39, *p* < .01] and mTBI status, *F*(1, 460) = 9.01, *p* < .01. This indicates that, at the beginning of the study, individuals who were unemployed and/or who had sustained an mTBI reported lower levels of resilience on average than individuals who were employed and/or had no occurrence of mTBI. Gender, racial/ethnic minority status, marital status, and education did not significantly predict resilience at either time point.

Table 5. Resilience and social support means and standard deviations by variable factor

	Resilience		Social support	
	T1	T4	T1	T4
Gender				
Female	31.45 (6.55)	30.42 (7.59)	80.10 (11.14)	77.57 (10.91)
Male	32.24 (6.38)	31.86 (7.21)	78.63 (11.00)	75.32 (11.28)
Racial/ethnic minority status				
No	32.33 (6.23)	31.93 (6.89)	79.74 (11.26)	77.57 (11.14)
Yes	31.72 (6.43)	30.77 (7.64)	78.82 (10.84)	74.70 (11.08)
Marital status				
Other	31.73 (6.75)	31.39 (7.04)	77.90 (11.05)**	75.15 (11.31)
Married	32.40 (5.80)	30.95 (7.92)	81.68 (10.72)	77.93 (10.88)
Employment status				
Unemployed	30.58 (6.78)**	30.37 (7.73)	76.56 (11.13)**	74.29 (11.71)*
Employed	32.98 (6.00)	32.04 (7.02)	81.07 (10.62)	77.83 (10.47)
Education				
High school degree or less	31.69 (6.81)	30.48 (8.20)	77.88 (10.83)**	72.80 (10.27)**
Any advanced degree	32.33 (5.92)	32.10 (6.36)	80.77 (11.16)	79.75 (10.99)
mTBI status				
No	32.52 (5.94)**	31.71 (7.36)	79.14 (11.20)	76.59 (11.16)
Yes	30.54 (7.26)	30.32 (7.47)	79.37 (10.62)	75.77 (11.26)

T1 = Prior to hospital discharge, T4 = 12 months post-discharge
**$p < .01$
*$p < .05$

In addition, social support at Time1 was significantly predicted by marital status [$F(1, 413) = 10.92$, $p < .01$], employment status [$F(1, 414) = 17.62$, $p < .01$], and education, $F(1, 414) = 7.11$, $p = .01$; while social support at Time4 was significantly predicted by employment status [$F(1, 235) = 6.03$, $p = .02$] and education, $F(1, 235) = 25.34$, $p < .01$. This indicates that, at the beginning of the study, being married, being employed, and having more educational attainment was related to greater self-reported social support. Twelve months following discharge, the same relationships were maintained except marital status no longer significantly predicted social support, $F(1, 232) = 3.49$, $p = .06$. Gender, racial/ethnic minority status, and mTBI status did not significantly predict social support at either time point.

Missing Data

Of the 488 participants in the study, 109 (22%) had emotional well-being scores for only one time point, 93 (19%) had scores for two time points, 97 (20%) had scores for three time points, and 189 (39%) had scores for all four time points. In other words, 299 participants (61% of the sample) were missing data on the emotional well-being variable for at least one time point. Missing data tended to increase over time (see Table 6), which can be attributed to panel dropout. Of the 299 participants with incomplete data, 232 (78%) were due to panel dropout (attrition). Panel dropout is common in longitudinal research studies and refers to the tendency for participants to drop out of a study after one or more measurement occasions (Hox, 2010). The other 22% of participants with incomplete data were not measured at one of the measurement occasions but did return at one or more subsequent occasions.

Table 6. Number of missing data points for repeated measurement variables

Measurement occasion	Emotional well-being	Resilience	Social support
T1	2 (.4%)	19 (3.9%)	72 (14.8%)
T2	143 (29.3%)	--	--
T3	221 (45.3%)	--	--
T4	244 (50.0%)	249 (51.0%)	251 (51.4%)

T1 = Prior to hospital discharge, T2 = 3 months post-discharge, T3 = 6 months post-discharge, T4 = 12 months post-discharge

HLM has the capacity to make use of all available data, including incomplete cases, by assuming that the data are missing at random (MAR) and using a maximum likelihood (ML) estimation method. When the assumption is that data are MAR, "the missingness may depend on other variables in the model, and through these be correlated with the unobserved values" (Hox, 2010, p. 106). Attrition analyses were conducted to compare the participants with complete data (*N* = 189) against the participants with incomplete data (*N* = 299) on demographic and injury-related variables (see Table 7) and on emotional well-being (see Table 8).

Table 7. Demographic and injury-related statistics for participants with complete versus incomplete data

	***N* = 189** (Participants with complete data)	***N* = 299** (Participants with incomplete data)	***p*-value***
Age mean (standard deviation)	49.48 (16.85)	41.21 (16.21)	<.01
Gender			
Female	79 (41.8%)	95 (31.8%)	.02
Male	110 (58.2%)	204 (68.2%)	
Racial/ethnic minority status			
No	106 (56.1%)	141 (47.2%)	.07
Yes	82 (43.4%)	153 (51.2%)	
Marital status			
Other	110 (58.2%)	213 (71.2%)	<.01
Married	77 (40.7%)	85 (28.4%)	
Employment status			
Unemployed	84 (44.4%)	126 (42.1%)	.62
Employed	105 (55.6%)	173 (57.9%)	
Education			
High school degree or less	94 (49.7)	183 (61.2%)	.01
Any advanced degree	95 (50.3%)	116 (38.8%)	
mTBI status			
No	136 (72.0%)	214 (71.6%)	.89
Yes	50 (26.5%)	81 (27.1%)	
ISS mean (standard deviation)	12.01 (8.18)	11.87 (8.63)	.86

**p*-values < .05 indicate the variable is significantly related to data missingness

Table 8. Emotional well-being scores for participants with complete versus incomplete data

Measurement occasion	***N* = 189** (Participants with complete data)			***N* = 299** (Participants with incomplete data)			***p*-value***
	Mean	SD	*n*	Mean	SD	*n*	.05
T1	52.57	10.53	189	50.54	11.72	297	<.01
T2	48.72	12.16	189	44.88	14.05	156	<.01
T3	49.11	12.24	189	43.97	15.61	78	.17
T4	49.14	12.64	189	46.36	15.09	55	.05

T1 = Prior to hospital discharge, T2 = 3 months post-discharge, T3 = 6 months post-discharge, T4 = 12 months post-discharge
**p*-values < .05 indicate the emotional well-being scores are significantly related to data missingness

Whether an individual had complete data on the outcome variable was related to age [$F(1, 486) = 29.16$, $p < .01$], gender [$\chi^2(1, N = 488) = 5.07$, $p = .02$], marital status [$\chi^2(1, N = 485) = 8.27$, $p < .01$], and education, $\chi^2(1, N = 488) = 6.21$, $p = .01$. This indicates that being older, female, married, and having more educational attainment tended to increase, on average, the chance that the participant would have complete data. There were no significant associations between racial/ethnic minority status [$\chi^2(1, N = 482) = 3.26$, $p = .07$], employment status [$\chi^2(1, N = 488) = .25$, $p = .62$], mTBI status [$\chi^2(1, N = 481) = .02$, $p = .89$], or injury severity [$F(1, 464) = .03$, $p = .86$], and whether an individual was missing data on the outcome variable.

In addition, there were significant relationships between data missingness and emotional well-being scores at Time2 [$F(1, 343) = 7.43$, $p < .01$] and Time3, $F(1, 265) = 8.24$, $p < .01$. Generally, participants with complete data tended to have higher emotional well-being scores than participants with incomplete data. However, there were no significant associations between emotional well-being scores at Time1 [$F(1, 484) = 3.76$,

$p = .05$] or Time4 [$F(1, 242) = 1.87$, $p = .17$] and whether an individual was missing data.

The associations between missingness and several other variables in the study indicate that, conditional on those variables, the missing data mechanism was, at minimum, not missing completely at random (MCAR). It is possible that the current data was missing not at random (MNAR). However, there is no formal test to empirically verify MNAR data missingness for the current study. Overall, given the associations between data missingness and other variables in the study, it is reasonable to assume the data are MAR.

Model Analyses

Unconditional Means Model (Model 1)

The unconditional means model (Model 1) was analyzed in order to determine if there was systemic variation in the outcome variable worth exploring and, if so, partition that variance into between-individual and within-individual variation. Model 1 was estimated using restricted maximum likelihood (RML). Results indicated that the between-individual variance (σ^2_r) for emotional well-being was 83.29 and the within-individual variance (σ^2_e) was 78.21. The between-individual variance was statistically significant [$\chi^2(487) = 1{,}918.42$, $p < .01$], which indicates that participants differed significantly in their average emotional well-being scores. The intra-class correlation (ICC) for the current study was calculated as the proportion of the between-individual variance over the total variance, $\rho = \sigma^2_r / (\sigma^2_r + \sigma^2_e) = .516$. This ICC indicates that individual differences accounted for 51.6% of the total outcome variance.

Growth Function Over Time

The optimal functional form, or shape, of emotional well-being scores over time was determined by comparing model fit of three unconditional growth models (linear, quadratic, cubic). The models were nested and estimated using full maximum likelihood (FML) in order to conduct likelihood ratio tests. The time variable was centered at the midpoint of the study to reduce collinearity between the linear, quadratic, and cubic components. In order to increase by only one parameter when comparing the models, the linear slope was allowed to vary across individuals but the quadratic and cubic slopes were not allowed to vary. The linear model was specified as:

(6) Level-1: $EW_{ti} = \pi_{0i} + \pi_{1i}*(Ctime_{ti}) + e_{ti}$
Level-2: $\pi_{0i} = \beta_{00} + r_{0i}$
$\pi_{1i} = \beta_{10} + r_{1i}$

The quadratic model was specified as:

(7) Level-1: $EW_{ti} = \pi_{0i} + \pi_{1i}*(CTime_{ti}) + \pi_{2i}*(CTimeSq_{ti}) + e_{ti}$
Level-2: $\pi_{0i} = \beta_{00} + r_{0i}$
$\pi_{1i} = \beta_{10} + r_{1i}$
$\pi_{2i} = \beta_{20}$

The cubic model was specified as:

(8) Level-1: $EW_{ti} = \pi_{0i} + \pi_{1i}*(CTime_{ti}) + \pi_{2i}*(CTimeSq_{ti}) + \pi_{3i}*(CTimeCb_{ti}) + e_{ti}$
Level-2: $\pi_{0i} = \beta_{00} + r_{0i}$
$\pi_{1i} = \beta_{10} + r_{1i}$
$\pi_{2i} = \beta_{20}$
$\pi_{3i} = \beta_{30}$

Results for growth model testing are presented in Table 9. Likelihood ratio tests revealed that the increase in model fit from the linear model to the quadratic model was statistically significant [$\chi^2(1) = 31.94$, $p < .01$], and that the increase in model fit from the quadratic model to the cubic model was also statistically significant, $\chi^2(1) = 10.37$, $p < .01$. This suggested that individual change in emotional well-being over time was best represented by a cubic growth pattern.

Table 9. Comparison of linear, quadratic, and cubic growth models

Fixed effects	**Parameter**	**Linear model**	**Quadratic model**	**Cubic model**
Intercept	β_{00}	48.68**	46.98**	46.50**
CTime	β_{10}	-.33**	-.63**	.08
CTimeSq	β_{20}		.09**	.20**
CTimeCb	β_{30}			-.03**
Random effects				
Within-individual	σ^2_e	71.69	68.09	66.74
Between-individual (intercept)	σ^2_{r0}	89.50**	90.46**	91.14**
Between-individual (linear change)	σ^2_{r1}	.20**	.23**	.25**
Model statistics				
Deviance (-2LL)		10236.50	10204.56	10193.83
Number of parameters estimated		6	7	8

**$p < .01$

Level-1 Error Covariance Structure

The optimal Level-1 error covariance structure was determined by comparing model fit of alternative structures. Common error covariance structures include unrestricted, homogeneous, heterogeneous, and first-order auto-regressive. With the unrestricted error covariance structure, random variation between individuals cannot be estimated, so this structure was automatically eliminated from consideration (Raudenbush, Bryk, Cheong, Congdon, & du Toit, 2011). The first-order auto-regressive structure was also not an option for the current study due to unequally spaced measurement intervals. Therefore, only homogeneous and heterogeneous level-1 error covariance structures were compared. The model used for comparing homogenous and heterogeneous error covariance structures was:

(9) Level-1: $EW_{mi} = (IND1_{mi})*EW_{1i}^* + (IND2_{mi})*EW_{2i}^* + (IND3_{mi})*EW_{3i}^* + (IND4_{mi})*EW_{4i}^*$

$$EW_{ti}^* = \pi_{0i} + \pi_{1i}*(Time12_{ti}) + e_{ti}$$

Level-2: $\pi_{0i} = \beta_{00} + r_{0i}$

$$\pi_{1i} = \beta_{10} + r_{1i}$$

In the homogeneous model, the error covariance matrix was characterized by $\sigma_2\mathbf{I}$:

$$V(e_i) = \begin{bmatrix} \sigma^2 & 0 & 0 & 0 \\ 0 & \sigma^2 & 0 & 0 \\ 0 & 0 & \sigma^2 & 0 \\ 0 & 0 & 0 & \sigma^2 \end{bmatrix}$$

This model assumes that the within-individual residuals are independent with a constant variance, σ^2. The heterogeneous model still assumes that within-individual residuals are independent but allows a unique level-1 variance to be estimated for each measurement occasion:

$$V(e_i) = \begin{bmatrix} {\sigma_1}^2 & 0 & 0 & 0 \\ 0 & {\sigma_2}^2 & 0 & 0 \\ 0 & 0 & {\sigma_3}^2 & 0 \\ 0 & 0 & 0 & {\sigma_4}^2 \end{bmatrix}$$

The homogenous and heterogeneous models were estimated using FML and compared using a χ^2 test of -2LL values. The heterogeneous model yielded a statistically significant improvement over the homogeneous model [$\chi^2(3) = 25.35$ $p < .01$], so a heterogeneous error covariance matrix was specified in subsequent model testing.

Unconditional Growth Model (Model 2)

The unconditional growth model (Model 2) with a heterogeneous level-1 error covariance structure was tested. Results for Model 2 are presented in Table 10. Because the Hierarchical Linear Modeling 7 (HLM-7) software cannot test a heterogeneous model using RML estimation, Model 2 was estimated using FML. It should be noted that variance components estimated using FML are biased, but the effect of this bias is usually trivial, particularly when the number of clusters is large as it is in the current study (Hox, 2010). In addition, due to the heterogeneous error covariance structure specified, a within-individual variance component is no longer provided in the output.

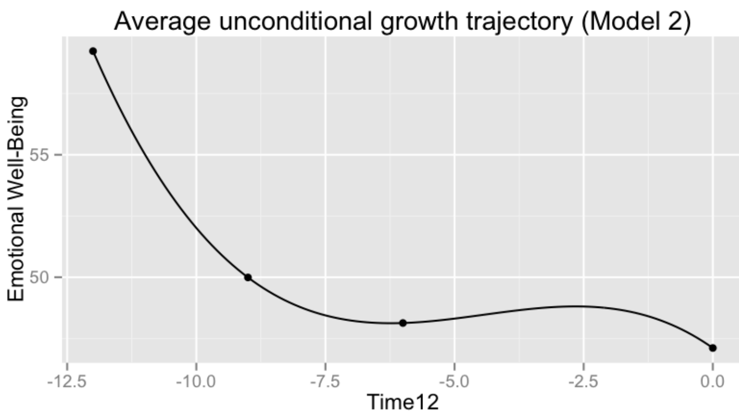
Research Question #1 asked: "What is the average growth trajectory of emotional well-being for individuals after sustaining a traumatic injury?" The average growth pattern of emotional well-being for the current sample was a cubic change consisting of a linear component (-1.50), a quadratic component (-.40), and a cubic component (-.03). A graphic representation of this average trajectory is presented in Figure 1. The fixed effects for all three functional components were statistically significant, indicating that the functional changes in emotional well-being over time were significantly different from 0 (i.e., no functional change).

Research Question #2 asked: "Is there statistically significant variation between individuals' emotional well-being growth trajectories?" The variance for the linear growth component (σ^2_{r1}) had a significant p-value, indicating that there was statistically significant variation in participants' emotional well-being linear rate of change.

Table 10. Results for Model 2

Fixed effects	Parameter	Coefficient	Standard error	*d.f.*	*t*-ratio	*p*-value
Intercept	β_{00}	47.11	.82	487	57.51	<.01
Time12	β_{10}	-1.49	.64	487	-2.33	.02
Time12Sq	β_{20}	-.40	.14	364	-2.85	<.01
Time12Cb	β_{30}	-.03	.01	364	-3.43	<.01
Random effects	**Parameter**	**Variance component**	**Standard deviation**	***d.f.***	χ^2	***p*-value**
Intercept	σ^2_{r0}	181.51	13.47	378	1714.07	<.01
Time12	σ^2_{r1}	.39	.62	378	563.26	<.01

Figure 1. Average unconditional growth trajectory



Transitional Models (Models 3 & 4)

The first transitional model (Model 3) included all demographic and injury-related variables as potential predictors of the random intercept (i.e., emotional well-being at Time4) and the random linear effect of time. As with Model 2, Model 3 was estimated using FML so that a heterogeneous level-1 error covariance structure could be specified. Results for Model 3 are presented in Table 11.

Research Question #3 asked: “Which (if any) demographic and injury-related variables significantly predict emotional well-being at 12 months and/or the growth trajectory?” Education was a significant predictor of emotional well-being at 12 months

[t(447) = 2.70, p = <.01] and the linear effect of time [t(447) = 2.85, p = <.01], controlling for other demographic and injury-related variables. All other demographic and injury-related variables were non-significant and subsequently removed from the model.

Table 11. Results for Model 3

Fixed effects	Parameter	Coefficient	Standard error	*d.f.*	*t*-ratio	*p*-value
Intercept	β_{00}	45.19	1.99	447	22.72	<.01
AgeC	β_{01}	-.05	.05	447	-.89	.37
Gender	β_{02}	.36	1.64	447	.22	.82
RacMin	β_{03}	-2.39	1.71	447	-1.40	.16
Married	β_{04}	1.61	1.81	447	.89	.37
Employed	β_{05}	1.26	1.68	447	.75	.45
Educ	β_{06}	4.59	1.70	447	2.70	<.01
ISSC	β_{07}	-.16	.11	447	-1.52	.13
mTBI	β_{08}	-1.27	2.06	447	-.61	.54
Time12	β_{10}	-1.65	.60	447	-2.76	<.01
AgeC	β_{11}	-.00	.00	447	-.55	.58
Gender	β_{12}	-.05	.13	447	-.40	.69
RacMin	β_{13}	-.17	.13	447	-1.30	.19
Married	β_{14}	-.06	.14	447	-.39	.70
Employed	β_{15}	-.15	.13	447	-1.17	.24
Educ	β_{16}	.38	.13	447	2.85	<.01
ISSC	β_{17}	-.02	.01	447	-1.69	.09
mTBI	β_{18}	.02	.16	447	.14	.89
Time12Sq	β_{20}	-.43	.13	350	-3.38	<.01
Time12Cb	β_{30}	-.03	.01	350	-3.91	<.01
Random effects	**Parameter**	**Variance component**	**Standard deviation**	***d.f.***	χ^2	***p*-value**
Intercept	σ^2_{r0}	164.60	12.83	348	1469.76	<.01
Time12	σ^2_{r1}	.31	.55	348	506.34	<.01

The second transitional model (Model 4) included the four resilience and social support variables (i.e., initial resilience, initial social support, resilience change, and social support change) as potential predictors of the random intercept (i.e., emotional well-being at Time4) and the random linear effect of time. As with previous models, Model 4 was estimated using FML so that a heterogeneous level-1 error covariance structure could be specified. Results for Model 4 are presented in Table 12.

Research Question #4 asked: "Controlling for any significant demographic and injury-related variables, do resilience and social support variables significantly predict emotional well-being at 12 months and/or the growth trajectory?" Controlling for education; initial resilience [$t(195) = 3.91$, $p = <.01$], initial social support [$t(195) = 2.43$, $p = .02$], resilience change [$t(195) = 4.94$, $p = <.01$], and social support change [$t(195) = 4.07$, $p = <.01$] all significantly predicted emotional well-being at 12 months. In addition, resilience change [$t(195) = 3.32$, $p = <.01$] and social support change [$t(195) = 2.52$, $p = .01$] significantly predicted the linear effect of time, controlling for education. Because they were not significant, initial resilience and initial social support were removed as predictors of the linear effect of time. In addition, education, which no longer significantly predicted the random intercept or the random linear effect of time, was also removed from the model.

Table 12. Results for Model 4

Fixed effects	Parameter	Coefficient	Standard error	*d.f.*	*t*-ratio	*p*-value
Intercept	β_{00}	48.38	1.13	195	42.75	<.01
RIS1LinC	β_{01}	.23	.06	195	3.91	<.01
RISPerChgC	β_{02}	.27	.05	195	4.94	<.01
SPS1LinC	β_{03}	.17	.07	195	2.43	.02
SPSPerChgC	β_{04}	.27	.07	195	4.07	<.01
Educ	β_{05}	1.78	1.65	195	1.08	.28
Time12	β_{10}	-1.55	.77	195	-2.02	.05
RIS1LinC	β_{11}	-.00	.00	195	-.51	.61
RISPerChgC	β_{12}	.01	.00	195	3.32	<.01
SPS1LinC	β_{13}	-.00	.01	195	-.08	.93
SPSPerChgC	β_{14}	.01	.01	195	2.52	.01
Educ	β_{15}	.23	.13	195	1.78	.08
Time12Sq	β_{20}	-.39	.17	349	-2.30	.02
Time12Cb	β_{30}	-.02	.01	349	-2.70	<.01
Random effects	**Parameter**	**Variance component**	**Standard deviation**	***d.f.***	χ^2	***p*-value**
Intercept	σ^2_{r0}	95.13	9.75	195	860.37	<.01
Time12	σ^2_{r1}	0.16	0.40	195	255.89	<.01

Final Model (Model 5)

The final model (Model 5), with a heterogeneous Level-1 error covariance structure, was estimated using FML. Results for Model 5 are presented in Table 13. The average estimated emotional well-being score at Time4 (i.e., 12 months post-injury) was 49.27. There was statistically significant between-individual variation in this intercept [$\chi^2(196) = 859.49$, $p < .01$], which was significantly predicted by initial resilience [$t(196) = 5.76$, $p < .01$], resilience change [$t(196) = 5.39$, $p < .01$], initial social support [$t(196) = 3.43$, $p < .01$], and social support change, $t(196) = 4.60$, $p < .01$. On average, participants who had higher scores on these variables had higher emotional well-being *T*-scores at Time4. Controlling for the effect of all other variables in the model, a 1% increase in initial resilience yielded a .25-point increase, a 1% increase in resilience change yielded a .27-point increase, a 1% increase in initial social support yielded a .17-point increase, and a 1% increase in social support change yielded a .27-point increase.

All of the growth components were negative, which indicated that on average emotional well-being decreased over time. The quadratic [$t(349) = -2.31$, $p = .02$] and cubic [$t(349) = -2.71$, $p = <.01$] growth components significantly predicted the intercept. While the linear growth component did not significantly predict the intercept [$t(198) = -1.88$, $p = .06$], there was statistically significant between-individual variation in its random effect [$\chi^2(198) = 259.84$, $p < .01$], indicating that individuals differed significantly in their linear growth trajectories. The random linear growth trajectory was significantly predicted by resilience change [$t(198) = 4.03$, $p = <.01$] and social support change, $t(198) = 3.30$, $p = <.01$. Controlling for the effect of all other variables in the model, a 1% increase in resilience change yielded a 1% increase in the linear trajectory of emotional well-being, and a 1% increase in social support change also yielded a 1% increase in the linear trajectory of emotional well-being.

Table 13. Results for Model 5

Fixed effects	**Parameter**	**Coefficient**	**Standard error**	***d.f.***	***t*-ratio**	***p*-value**
Intercept	β_{00}	49.27	.80	196	61.41	<.01
RIS1LinC	β_{01}	.25	.04	196	5.76	<.01
RISPerChgC	β_{02}	.27	.05	196	5.39	<.01
SPS1LinC	β_{03}	.17	.05	196	3.43	<.01
SPSPerChgC	β_{04}	.27	.06	196	4.60	<.01
Time12	β_{10}	-1.44	.77	198	-1.88	.06
RISPerChgC	β_{11}	.01	.00	198	4.03	<.01
SPSPerChgC	β_{12}	.01	.00	198	3.30	<.01
Time12Sq	β_{20}	-.39	.17	349	-2.31	.02
Time12Cb	β_{30}	-.02	.01	349	-2.71	<.01
Random effects	**Parameter**	**Variance component**	**Standard deviation**	***d.f.***	χ^2	***p*-value**
Intercept	σ^2_{r0}	95.74	9.78	196	859.49	<.01
Time12	σ^2_{r1}	.17	.41	198	259.84	<.01

Research Question #5 asked: "What proportion of the between-individual variance in emotional well-being is explained by resilience and social support variables when controlling for significant demographic and injury-related variables?" The Pseudo-R^2 proposed by Raudenbush and Bryk (2002) is an R^2 analogue statistic adapted for multilevel models. The Pseudo-R^2 measures the proportional modeled variance for the variance components (Luo & Kwok, 2010). Two Pseudo-R^2 statistics were calculated for the current study, one to evaluate the ability of the final model to predict between-individual differences in emotional well-being at Time4 (i.e., 12 months post-injury), and one to evaluate its ability to predict between-individual differences in the emotional well-being linear growth over time.

The Pseudo-R^2 statistics were calculated by estimating two nested models using FML. The unconditional growth model (Model 2) served as the restricted model, and the final model (Model 5) served as the full model. Both models were estimated using the same sample of $n = 753$ Level-1 units and $N = 201$ Level-2 units in order to yield a fair comparison. Table 14 provides the variance components and model fit statistics for the nested models used in calculating Pseudo-R^2.

The Pseudo-R^2 for the random intercept (r_0) was .332, which indicates that the final model predicted 33.2% of the between-individual differences in the emotional well-being scores at Time4 (i.e., 12 months post-injury). The Pseudo-R^2 for the random linear component (r_1) was .469, which indicates that the final model predicted 46.9% of the between-individual differences in the linear change in emotional well-being over time.

Table 14. Comparison of the restricted model (Model 2) and full model (Model 5)

Random effects	**Parameter**	**Restricted (Model 2)**	**Full (Model 5)**
Intercept	σ^2_{r0}	143.39**	95.74**
Time12	σ^2_{r1}	.32**	.17**
Model statistics			
Deviance (-2LL)		5560.43	5462.84
Number of parameters estimated		9	15

**$p < .01$

Unique Predictive Ability of Primary Variables

A supplementary analysis was conducted to examine each resilience and social support variable individually, determine which of these variables uniquely predicted emotional well-being, and compare their respective Pseudo-R^2 values. The unconditional growth model (Model 2) was compared to "full" models, one for each predictor variable: initial resilience, initial social support, resilience change, and social support change. All models were estimated using the same sample of $n = 753$ Level-1 units and $N = 201$ Level-2 units. Results are presented in Table 15.

Emotional well-being at Time4 was uniquely predicted by initial resilience [$t(199) = 2.52$, $p = .01$], resilience change [$t(199) = 4.08$, $p = <.01$], and social support change, $t(199) = 4.24$, $p = <.01$. The linear change in emotional well-being over time was also uniquely predicted by initial resilience [$t(199) = -2.30$, $p = .02$], resilience change [$t(199) = 4.81$, $p = <.01$], and social support change, $t(199) = 4.15$, $p = <.01$. Initial social support was not a significant unique predictor of the random intercept [$t(199) = 1.64$, $p = .10$] or the random linear effect of time, $t(199) = -1.66$, $p = .10$.

Pseudo-R^2 calculations indicated that initial resilience uniquely explained 4.6% of the variance in emotional well-being scores at Time4 (σ^2_{r0}), while initial social support explained 2.3%, resilience change explained 10.0%, and social support change explained 10.3%. In addition, initial resilience uniquely explained 9.4% of the variance in emotional well-being linear change over time (σ^2_{r1}), initial social support explained 3.2%, resilience change explained 31.3%, and social support change explained 21.9%.

Table 15. Unique predictive abilities of primary variables

		Variable			
Fixed effects	**Parameter**	**Initial resilience**	**Initial social support**	**Resilience change**	**Social support change**
[Variable] on Intercept	β_{01}	.14*	.10	.21**	.25**
[Variable] on *Time12*	β_{11}	-.01*	-.01	.02**	.02**
Random effects					
Intercept	σ^2_{r0}	136.77	140.15	129.00	128.59
Time12	σ^2_{r1}	.29	.31	.22	.25
Pseudo-R^2					
r_0		.046	.023	.100	.103
r_1		.094	.032	.313	.219

**$p < .01$
*$p < .05$

Checking Assumption Violations

Level-1 and Level-2 residual files were created in SPSS in order to check for potential violations of common assumptions in multilevel models. The assumptions of the current study were normality of the Level-1 residuals, heterogeneity of the Level-1 residual variance, multivariate normality of the Level-2 random effects, and homogeneity of the Level-2 residual variances.

Graphical information and skewness and kurtosis values of the Level-1 residuals were used to assess the assumption of normally distributed Level-1 residuals. A frequency distribution of the Level-1 residuals (Figure 2) indicates that the residuals are approximately normal. Figure 3 displays a normal Q-Q plot of the Level-1 residuals for the 753 repeated measurements on which the final model was based. The plot is approximately linear except for the upper and lower extremes of the distribution. In addition, the skewness (-.47) and kurtosis (1.73) values for the Level-1 residual distribution are within the acceptable range for a normal distribution. These results suggest there is not a serious departure from a normal distribution.

Figure 2. Frequency distribution of Level-1 residuals

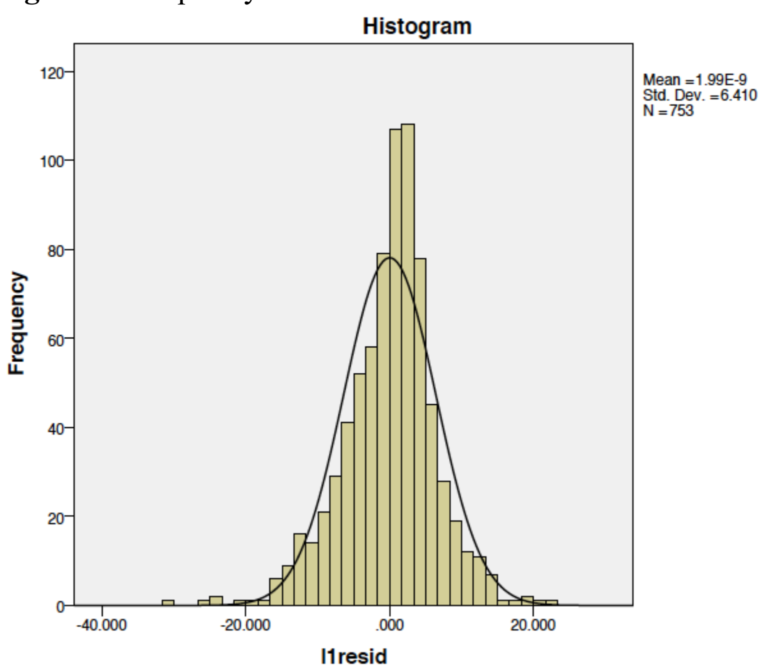
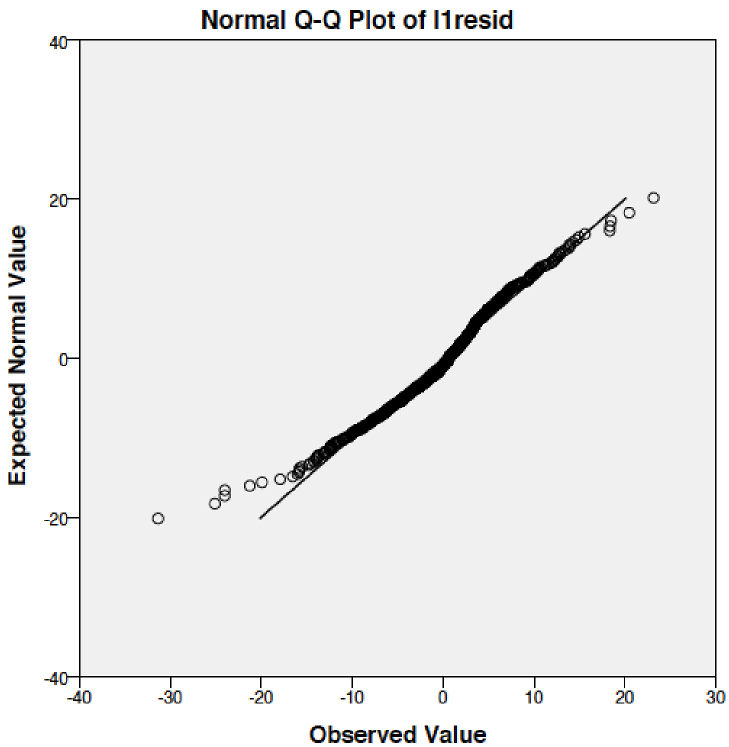


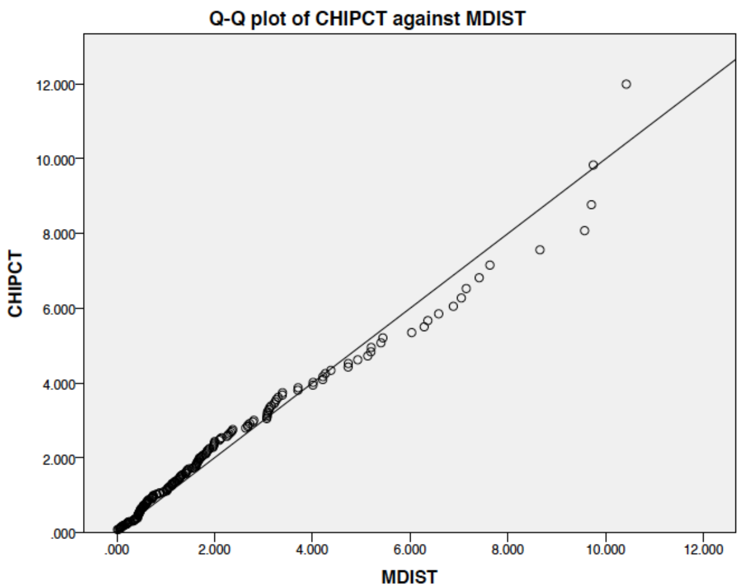
Figure 3. Q-Q plot of Level-1 residuals



When building the unconditional growth model (Model 2), it was determined that a heterogeneous Level-1 error covariance structure should be specified, but this assumption needed to be tested again with the final model (Model 5). The superiority of a heterogeneous error covariance structure was maintained in final model [$\chi^2(1) = 11.92$ $p < .01$], indicating the assumption of heterogeneous Level-1 residual variances is tenable.

Multivariate normality of the Level-2 random effects was assessed by examining a Q-Q plot (Figure 4) of two variables in the Level-2 residual file: MDIST [the squared Mahalanobis distance (MD), or chi-square values for each unit based on the two Level-2 random effects] and CHIPCT [the expected value in a chi-squared distribution with two (i.e., the number of random effects per individual) degrees of freedom]. The MDIST values fall close to the $Y = X$ reference line, suggesting that the distribution of the Level-2 random effects is multivariate normal.

Figure 4. Q-Q plot of Level-1 random effects



Finally, homogeneity of the Level-2 residual variances was assessed by plotting the Level-2 residuals of the random intercept (r_{0i}) and the random linear effect of time (r_{1i}) against the Level-2 predictor variables (initial resilience, resilience percent change, initial social support, social support percent change). These graphs are presented in Figure 5. When the Level-2 variances are homogeneous, the height between the highest and lowest residual value for each value of the predictor variable should be approximately equal across all values of the predictor variable. The results do not appear to violate the assumption of homogeneous Level-2 residual variances.

Figure 5. Plots of Level-2 predictors against Level-2 residuals

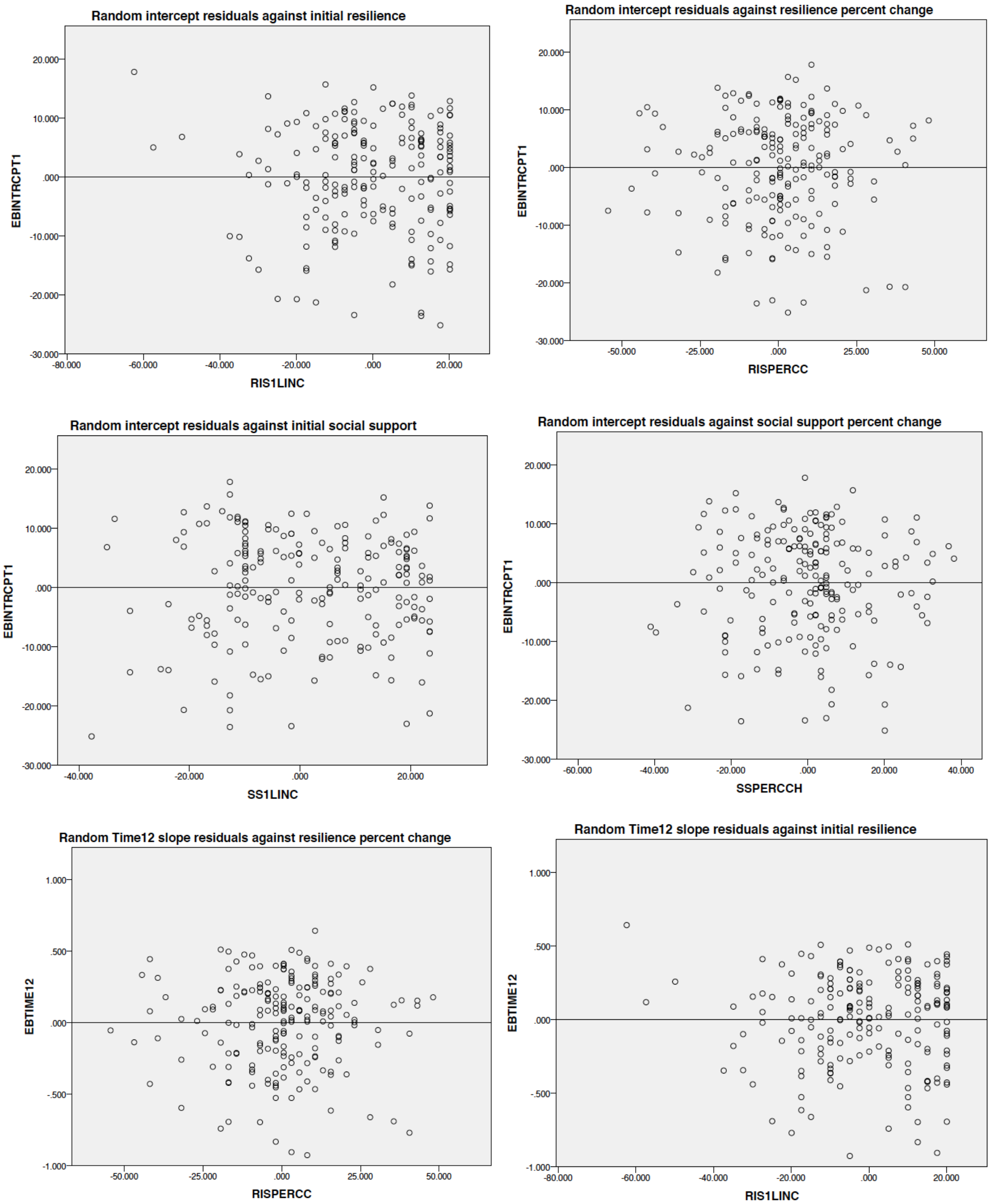
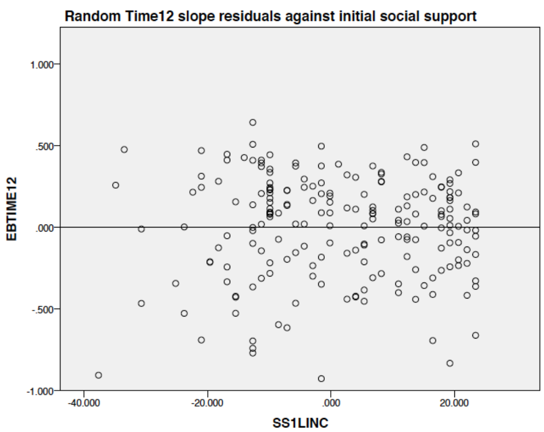
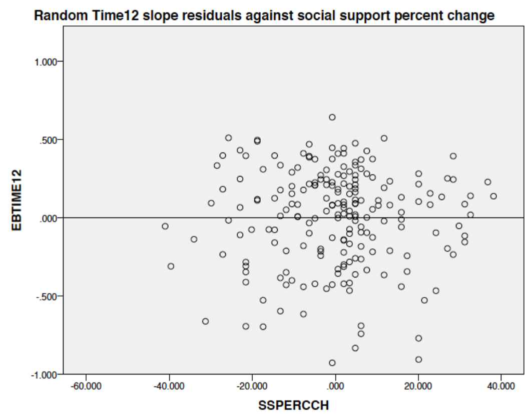


Figure 5. Continued





CHAPTER V

SUMMARY

Summary and Implications of Major Findings

Emotional Well-Being

The average emotional well-being score at baseline (i.e., prior to hospital discharge) was 51.33 (*SD* = 11.30), which is comparable to that of the general U.S. population according to 1998 data (*M* = 50, *SD* = 10; Ware et al., 2002). The intra-class correlation (ICC) of .52 indicates that over half of the total variance in emotional well-being scores can be attributed to differences between participants, that is, the grouping structure of having repeated measurements. This ICC is large in comparison to most cross-sectional research, where ICCs typically range from .05 to .20 (Snijders & Bosker, 1999), but is commensurate with longitudinal studies that typically have much larger ICCs.

Descriptive statistics revealed that, on average, there was a sharp drop in emotional well-being from baseline to three months post-discharge, followed by small increases from three to 12 months. The increase in emotional well-being from three to 12 months may be interpreted as supporting theories of hedonic adaptation. However, several facts can be pointed out that undermine this interpretation. First, the average emotional well-being score 12 months post-discharge (*M* = 48.51, *SD* = 13.25) remained below the baseline level. This suggests that sustaining a traumatic injury had a fairly long-lasting negative impact on emotional well-being for the sample as a whole. This is consistent with similar studies that have found that SWB suffers following negative life events such as traumatic injury (Dijkers, 2004; Krause, 1997; Patterson et al., 2000; Post & van Leeuwen, 2012).

Second, emotional well-being followed, on average, a cubic growth trajectory rather than a quadratic trajectory that might have represented hedonic adaptation. The descriptive statistics, which indicated that the scores increased from three to 12 months post-discharge, did not account for the longitudinal data structure. By using a multilevel model, repeated data points were grouped within each individual participant, resulting in new, estimated average emotional well-being scores for the four time points. Emotional well-being was estimated to be lower at each consecutive time point, suggesting that, on average, participants' emotional well-being actually decreased continuously over the 12-month period, with the sharpest drop occurring between baseline and three months post-discharge. The negative fixed effects of the growth components (i.e., linear, quadratic, and cubic) also supports this interpretation that emotional well-being decreased over time for the sample as a whole. Interestingly, the cubic growth function estimated a small, temporary increase in emotional well-being around nine months post-injury. Though it is unclear how to interpret this "bump up" in predicted emotional well-being, researchers should continue to test complex (i.e., non-linear) growth trajectories, as this reduces the chance of obtaining biased or spurious results. Overall, the cubic growth trajectory in the current study, characterized by decreasing emotional well-being at each measured time point, challenges the assumption of hedonic adaptation following traumatic injury.

Third, even when the optimal (i.e., cubic) growth trajectory was modeled, the linear growth component still varied significantly between individuals. This significant variability was maintained even in the final model when resilience and social support predictors explained a large proportion of between-individual variance. This finding provides compelling evidence for individual variability in the effect of traumatic injury on emotional well-being over time, and contributes to the growing body of literature focuses on individually varying trajectories of SWB following traumatic injury (Johnson et al., 2010; Mortenson et al., 2010; Post & van Leeuwen, 2012; Resch et al., 2009; Stensman, 1994).

In addition to challenging assumptions of hedonic adaptation, the current study's focus on emotional well-being as the outcome variable provides new information on the relationship between SWB and traumatic injury. The lack of research on emotional well-being despite numerous studies of life satisfaction may be motivated by a desire to obtain consistent results without having to control for individual variability. Several findings suggest that negative life events have a more consistent effect on cognitive well-being (i.e., life satisfaction) than emotional well-being, and that emotional well-being may have greater variability following traumatic injury because emotional well-being is more likely to be influenced by individual factors such as personality, coping strategies, and social support (Jovanovic, 2011; Lucas, 2007b; Luhmann et al., 2011). The results of the current study are consistent with these findings, and demonstrate that trajectories of emotional well-being following traumatic injury are best characterized, not by hedonic adaptation, but rather by individual variability shaped by important psychosocial factors. The following sections summarize which demographic, injury-related, resilience, and social support variables significantly predicted the emotional well-being trajectories.

Demographic and Injury-Related Variables

At baseline, emotional well-being was higher for participants who were married and/or employed; and 12 months post-discharge, emotional well-being was higher for participants who were employed and had higher educational attainment. However, when the demographic and injury-related variables were tested simultaneously using multilevel modeling, only education had a statistically significant impact on emotional well-being.

The non-significant effects of injury severity and gender are consistent with findings from similar studies. Several studies have indicated that injury severity, which coincides with level of impairment, has relatively little impact on SWB (Davis et al., 2012; Dikmen et al., 2003; Fuhrer et al., 1992; Pierce & Hanks, 2006). In the current study, the Injury Severity Score (ISS) assessed impairment only. It is likely that a measure of functional independence and/or ability to participate in meaningful activities would have had a stronger impact on emotional well-being. The lack of a significant relationship between gender and emotional well-being also supports prior research findings (Davis et al., 2012; Resch et al., 2009; Williamson et al., 2015).

Unlike studies that have found relationships between employment status and SWB following traumatic injury (Corrigan et al., 2001; Davis et al., 2012), employment status did not predict emotional well-being in the current study. Various reasons could account for this outcome. First, there was a disproportionate percent of unemployed participants in the current study compared to the U.S. general population. Second, only initial employment status was considered; some research suggests that change/loss of employment after injury, having gainful employment at the time of follow-up, and subjective indicators of employment may be more important predictors of SWB than employment status at the time of injury (Corrigan et al., 2001; Tsaousides, Ashman, & Seter, 2008). Third, the effect of employment status on SWB following traumatic injury may be attributed to the impact of other confounding demographic variables that were controlled for in the current study.

In contrast to studies that have found lower SWB following TBI (Braden et al., 2012; Bryant et al., 2015; Stålnacke, 2007), mTBI status did not significantly predict emotional well-being. The majority of comparable studies use samples comprised of individuals with TBI, while the current study used a heterogeneous traumatic injury sample comprised mostly of individuals without mTBI (71.7%). In the current study, emotional well-being for participants who were positive for mTBI was lower than for participants negative for mTBI, but this effect was not significantly greater than the effect of traumatic injury without mTBI. In other words, mTBI occurrence did not appear to predict lower emotional well-being levels above and beyond those predicted by the occurrence of traumatic injury generally. It is possible that the psychosocial variables that predict higher SWB levels among general populations are the same for individuals who sustain an mTBI. Researchers should continue to examine these individual difference variables in order to better understand SWB outcomes after mTBI.

While research has been mixed regarding the impact of race/ethnicity (Arango-Lasprilla et al., 2009; Davis et al., 2012; Perrin et al., 2014), age (Davis et al., 2012; Martz et al., 2005), and marital status (Davis et al., 2012; Patterson et al., 2000; Putzke, et al., 2001), these variables were not significant in the current study. Again, it is likely that these variables vary in their effects depending on whether any potentially confounding variables are controlled for during analysis. The large number of demographic and injury-related variables controlled for in the current study may have reduced the potential power for any single variable to have a significant effect.

In the current study, education significantly predicted emotional well-being in the context of other demographic and injury-related variables but not when controlling for resilience and social support variables. The relationship between education and emotional well-being in the current study may have been particularly strong due to the connection between education and variables relating to social class (e.g., income, occupational status; Argyle, 1999). Participants with more educational attainment may have had access to resources that made it easier to cope during and after hospitalization. However, psychosocial variables such as resilience and social support likely have a much larger influence on one's ability to cope, which may explain why education was no longer significant once resilience and social support variables were accounted for. These results are consistent with the mixed research findings on the relationship between education and SWB following traumatic injury (Davis et al., 2012; Dunn & Brody, 2008).

When no other predictors were included, the demographic and injury-related variables together predicted roughly 9% of the variance between individuals' emotional well-being scores 12 months post-discharge. This can be loosely compared with findings from Lyubomirsky and colleagues (2005b) that estimate approximately 10% of the variance in a person's happiness level is attributed to his or her life circumstance variables (e.g., demographic factors, income, health). Demographic and injury-related variables also predicted approximately 21% of the variance between individuals' emotional well-being linear change over time. This suggests that demographic and injury-related variables have a strong influence on individual trajectories following major life events.

Resilience

The average resilience (CD-RISC 10) scores at baseline ($M = 31.96$, $SD = 6.44$) and 12 months post-discharge ($M = 31.28$, $SD = 7.39$) were almost identical to those obtained by Connor and Davidson (2003) for a U.S. general population sample ($M = 32.1$, $SD = 5.8$). Initial resilience significantly predicted emotional well-being 12 months after discharge for traumatic injury, controlling for the effect of resilience change, initial social support, and social support change. The significant relationship between resilience and emotional well-being is consistent with prior research findings linking resilience and SWB outcomes (Dunn & Brody, 2008; White et al., 2010). The significant effect of resilience in the context of important social support variables is also important because it suggests that, despite the strong correlation between resilience and social support (Elliott et al., 2015; Farkas & Orosz, 2015), both variables seem to contribute uniquely to posttraumatic outcomes. Resilience seems to protect against negative emotions and promote the use of positive emotions in order to cope with negative events (Ong et al., 2010; Quale & Schanke, 2010; Tugade, 2011). Highly resilient individuals may also be more likely to find meaning or "silver linings" in negative events (Frederick & Loewenstein, 1999).

However, initial resilience did not significantly predict the emotional well-being change over time when controlling for the effect of resilience change, initial social support, and social support change. This is partially consistent with findings that suggest resilience may have a stronger impact on cross-sectional outcomes than on longitudinal effects over time. For example, Silverman and colleagues (2015) found that resilience was a significant predictor of depression and social satisfaction in a sample of individuals aging with disability, but the resilience variable predicted far less variance longitudinally (1-2%) than it did cross-sectionally (24-30%). In the current study, although initial resilience was not a significant predictor of the linear trajectory in the final contextual model, when examined separately, it uniquely explained 9.4% of the linear trajectory variance. This may indicate that resilience has a stronger impact on positive longitudinal outcomes than negative outcomes over time.

The non-significant effect of initial resilience on the emotional well-being change over time may be explained by a ceiling effect. Given the correlation between resilience and emotional well-being, it is possible that individuals with higher resiliency at the beginning of the study also had higher emotional well-being at the beginning of the study and, subsequently, less room for their emotional well-being scores to "improve" over time. Therefore, the lack of relationship between initial resilience and change over time may be caused by a ceiling effect for participants characterized by both high resilience and high emotional well-being.

The results of the current study support the body of research linking resilience and SWB, but also expand upon this research by measuring resilience change as a predictor of emotional well-being. The average resilience percent change score of -.58% was small, indicating that resilience did not increase or decrease substantially for the sample as a whole. However, the average absolute resilience percent change of 13.05% was much larger, equating to ±5.2 points on the CD-RISC 10 and revealing meaningful changes in resilience, both positive and negative, that occurred for participants individually. Although there are strong associations between the resilience construct measured by the CR-RISC and relatively stable personality traits (Farkas & Orosz, 2015), participants' self-reported resilience was notably influenced (for better or for worse) after traumatic injury. Furthermore, this change in self-perceived resilience had a significant impact on emotional well-being following traumatic injury. Resilience change significantly predicted emotional well-being 12 months post-discharge *and* the emotional well-being change over time, controlling for the effect of other resilience and social support variables. This suggests that the increase or decrease of resilience over time influences whether emotional well-being improves or worsens over time, even when controlling for the initial self-perceived resilience. While it is not known what led to the changes in resilience over the 12-month period, this finding may lend support to activity theories, which “propose that happiness arises from behaviors rather than from achieving endpoints” (Diener, 1984, p. 564). It is possible that participants who reported increased resilience over the 12-month period were engaging in intentional activities that increased their sense of resilience, and that their successful pursuit of these goals was at least as equally predictive of SWB as their initial level of resilience.

Social Support

The average social support (SPS) score at baseline ($M = 79.14$, $SD = 11.06$) was slightly below the mean found in the original sample used to develop the SPS ($M = 82.45$, $SD = 9.89$). This may be due to the disproportionate number of males in the sample, as males generally report lower overall levels of social support than females (Cutrona & Russell, 1987).

Initial social support significantly predicted emotional well-being 12 months post-discharge, controlling for the effect of initial resilience, resilience change, and social support change. This result is consistent with research that has found social support to be a strong and fairly reliable predictor of SWB outcomes following traumatic injury (Burleigh et al., 1998; Corrigan et al., 2001; Douglas, 2012; Dunn & Brody, 2008; Fuhrer et al., 1992; Halcomb et al., 2005; Hernandez et al., 2014; Lammel, 2004; Müller et al., 2012; Tomberg et al., 2005; Tomberg et al., 2007; van Leeuwen et al., 2012a). Surprisingly, the supplementary analysis showed that initial social support was not, by itself, a significant unique predictor of emotional well-being at 12 months nor the linear trajectory. This finding suggests that social support may be beneficial only in the context of other important variables. This prompts questions about potential interactions between social support and resilience. Social support may buffer against the stressful effects of traumatic injury and facilitate one's ability to cope by providing tangible, emotional, and informational support (Cohen & Wills, 1985; Dunn & Brody, 2008; Schaefer et al., 1981), but perhaps specific individual traits (e.g., skills, self-efficacy) are necessary for individuals to know how to benefit from the extra support (Elliott, Herrick, & Witty, 1992). There may also be a reciprocal interaction between social support and positive emotions. Kok and colleagues (2013) found that positive emotions promoted supportive relationships, while those supportive relationships, in turn, promoted more positive emotions in an upward spiral.

However, like initial resilience, initial social support did not significantly predict the emotional well-being change over time in the final model. Again, it is likely that individuals with higher levels of social support had higher emotional well-being scores at the beginning of the study, creating a ceiling effect and leaving less room for emotional well-being to "improve" over time.

While the evidence linking social support and SWB is strong, social support change has rarely been researched as a predictor of SWB. Yet prior research has shown that traumatic injury, on average, negatively impacts social functioning (McCarthy et al., 2006; O'Donnell et al., 2005; Sluys et al., 2005). In the current study, social support decreased by 4.81% on average, which supports these research findings. At the same time, the mean absolute percent change of 11.94%, equating to ±8.6 points on the SPS, suggests that some individuals actually reported increased social support during the 12-month period. These changes in social support were found to predict both emotional well-being at 12 months post-injury and the emotional well-being trajectory over time, controlling for the effect of other resilience and social support variables. This finding suggests that changes in perceived social support following traumatic injury influence emotional well-being trajectories over time even when controlling for initial social support. As was the case with self-reported resilience, participants who reported increased social support over the 12-month period may have been successfully engaging in intentional activities that increased their social support, which was at least as equally predictive of SWB as their initial levels of social support.

Final Model

The optimal model of emotional well-being was a random growth model characterized by cubic growth over time. Emotional well-being scores generally decreased over time but significant individual variability remained even in the final model. Four variables (initial resilience, resilience change, initial social support, and social support change) predicted emotional well-being 12 months post-discharge, and two variables (resilience change and social support change) predicted the linear change in emotional well-being over time. Each of these variables was a significant predictor, controlling for all other variables in the model. The predictive ability of this final model was large, explaining 33.2% of the between-individual variance in emotional well-being

12 months post-discharge and 46.9% of the between-individual variance in the linear change in emotional well-being over time. These results highlight the ability of a relatively small number of psychological and socioenvironmental factors to predict emotional well-being following traumatic injury. After sustaining a traumatic injury, therapeutic interventions that help individuals increase their sense of resilience and social support will likely lead to positive outcomes related to emotional well-being. For instance, Silverman and colleagues (2015, p. 1266) identified several "promising interventions to target resilience, such as well-being therapy, gratitude building, and relation skills training," while Elliott and colleagues (1992) identified several characteristics and relational skills affecting social support that could be shaped through counseling interventions.

Limitations

The duration (scope) of the study and the timing of measurement intervals produced several limitations. First, in lieu of collecting true baseline data, emotional well-being, resilience, and social support were measured for the first time during participants' post-injury hospitalization. Participants' recollections may have been inaccurate or biased when completing these measures, which limits the ability of the current study to capture true changes in emotional well-being, resilience, and social support that occurred post-injury (Diener, 1994; Ross, 1989). Second, due to the one-year duration of the study, conclusions regarding the trajectory of emotional well-being are limited to this time frame, precluding comparisons with more long-term longitudinal studies of SWB. Third, the absence of an observed measurement occasion at nine months meant that an auto-regressive Level-1 error covariance structure could not be tested during model building. Given that an autocorrelated structure is common for longitudinal data (Campbell & Kenny, 1999), it is possible that an auto-regressive structure would have provided significantly better model fit than the heterogeneous structure specified. Fourth, measuring resilience and social support at only the first and final time point forced the resilience and social support change variables to be treated as time-invariant (i.e., Level-2) predictors. Given that no predictor variables were measured at all four time points, within-individual variation in emotional well-being scores could only be modeled as residual error. This likely limited the predictive ability of the final model.

Data on the emotional well-being outcome variable may have been limited by weaknesses of the VR-12 Mental Health (MH) scale. While positive emotion and negative emotion were assessed via separate items, these items were merged into an overall "affect balance" score; therefore, it was not possible to assess whether the various predictor variables had differential effects on the two types of emotions (Diener, 2000). (Similarly, using the SPS total score may have obscured potential relationships between specific types of social provisions and emotional well-being.) The small number of items comprising the MH scale may have restricted the amount of true variance and, subsequently, the statistical power and ability to detect meaningful differences in emotional well-being. Lastly, the inability to calculate the MH scores using more recent normative data represents a limitation for the current study.

Sample characteristics limit generalizability of the current findings. The results can be generalized only to individuals whose traumatic injuries are severe enough to warrant hospitalization at a designated trauma center. In addition, the sample had more males (64.3%), fewer married participants (33.2%), and more unemployed participants (43.0%) than would be expected given national averages (U.S. Census Bureau, 2012; 2014; 2015). Also, analysis of missing data indicated that missingness was systematically related to age, gender, marital status, and education, which suggests that the results may be less generalizable to young, male, unmarried individuals with less educational attainment.

Future Directions

Researchers should continue to explore positive mental health outcomes such as SWB. Having a positive evaluation of one's life is not only a respected individual right, but also an outcome that promotes additional health and well-being through self-care, healthier engagement with others, and more creative and productive behaviors (Argyle, 1997; Carstensen et al., 2011; Diener, 2000; Diener, 2012; Diener et al., 2006; Fredrickson et al., 2000; Fredrickson, 2013; Lyubomirsky et al., 2005a; Myers, 2000).

In order to better understand how SWB changes *over time*, researchers should conduct more longitudinal research studies and more frequently use statistical methods, such as HLM, that account for the inherent correlation of repeated measurements. Long-term, prospective longitudinal studies with equally spaced measurement intervals may provide an optimal research design for analyzing SWB outcomes following traumatic injury. Using equally space measurement intervals will allow longitudinal researchers to test for autoregressive error covariance structure within their data. Testing for complex growth functions (e.g., quadratic, cubic) and error covariance structures in general is an important step in multilevel modeling, as this reduces the chance that variable estimates will be biased. At the same time, researchers may find it useful to focus on either the immediate months following traumatic injury, as this seems to be the period when the most marked changes in SWB occur, or more long-term measurement intervals, as this would provide stronger evidence for or against the occurrence of hedonic adaptation. Both approaches may be combined, potentially, by analyzing a long-term longitudinal study using a piecewise model, segmenting the trajectory into one "short-term" trajectory that would capture the immediate (and likely large) changes in SWB and one "long-term" trajectory that would capture the more stable changes likely to occur later and over longer periods of time (Raudenbush & Bryk, 2002). This may generate interesting findings about whether short- and long-term time frames differ in their levels of SWB variability and whether predictors are significant at different times post-injury.

Given the disproportionate emphasis on cognitive well-being (i.e., life satisfaction) among studies of SWB following traumatic injury, more studies on emotional well-being are encouraged, as these will provide a more balanced understanding of SWB. However, better instruments of emotional well-being must be developed in order to meet this objective, and updated norms should be provided whenever possible.

In addition, while the current study included individual difference variables related to participants' self, environment, and injury, future research should attempt to include factors which may mediate the relationships between these individual and socioenvironmental factors and SWB outcomes. Several models of health-related quality of life suggest that individual and socioenvironmental factors influence outcomes through their effect on "process-linked" factors such as perception, appraisal, and coping that occur after a major life event (Bezner & Hunter, 2001; Elliott et al., 2002; Lazarus, 1993; Lazarus & Folkman, 1984; Martz et al., 2005). While reliable measurement of these process factors is challenging, their inclusion will likely provide a deeper understanding of mechanisms underlying SWB changes following traumatic injury. Clarifying the relationship between antecedent and process factors may be the next step in understanding *why* the changes in SWB vary for certain people and under certain circumstances.

REFERENCES

American Trauma Society. (n.d.) *Trauma Center Levels Explained*. Retrieved from http://www.amtrauma.org/?page=TraumaLevels

Arango-Lasprilla, J., Ketchum, J. M., Gary, K., Hart, T., Corrigan, J., Forster, L., & Mascialino, G. (2009). Race/ethnicity differences in satisfaction with life among persons with traumatic brain injury. *NeuroRehabilitation, 24*, 5-14. doi:10.3233/NRE-2009-0449

Archontaki, D., Lewis, G. J., & Bates, T. C. (2013). Genetic influences on psychological well-being: A nationally representative twin study. *Journal of Personality, 81*, 221-230. doi:10.1111/j.1467-6494.2012.00787.x

Argyle, M. (1999). Causes and correlates of happiness. In D. Kahneman, E. Diener, & D. Schwarz (Eds.), *Well-being: Foundations of hedonic psychology* (pp. 353-373). New York, NY: Russell Sage Foundation.

Argyle, M. (1997). Is happiness a cause of health? *Psychology & Health, 12*, 769-781. doi:10.1080/08870449708406738

Baird, B. M., Lucas, R. E., & Donnellan, M. B. (2010). Life satisfaction across the lifespan: Findings from two nationally representative panel studies. *Social Indicators Research*, *99*, 183-203. doi:10.1007/s11205-010-9584-9

Baker, S. P., O'Neill, B., Haddon, W., & Long, W. B. (1974). The Injury Severity Score: A method for describing patients with multiple injuries and evaluating emergency care. *Journal of Trauma*, *14*, 187-196.

Bezner, J. R., & Hunter, D. L. (2001). Wellness perception in persons with traumatic brain injury and its relation to functional independence. *Archives of Physical Medicine and Rehabilitation, 82*, 787-792. doi:10.1053/apmr.2001.23269

Bonanno, G. A. (2012). Uses and abuses of the resilience construct: Loss, trauma, and health-related adversities. *Social Science & Medicine*, *74*, 753-756. doi:10.1016/j.socscimed.2011.11.022

Bonanno, G. A., Galea, S., Bucciarelli, A., & Vlahov, D. (2007). What predicts psychological resilience after disaster? The role of demographics, resources, and life stress. *Journal of Consulting and Clinical Psychology, 75*, 671-682. doi:10.1037/0022-006X.75.5.671

Bonanno, G. A. (2008). Loss, trauma, and human resilience: Have we underestimated the human capacity to thrive after extremely aversive events? *Psychological*

Trauma: Theory, Research, Practice, and Policy, S, 101-113. doi:10.1037/1942-9681.S.1.101

Bonanno, G. A., Westphal, M., & Mancini, A. D. (2011). Resilience to loss and potential trauma. *Annual Review of Clinical Psychology, 7*, 511-535. doi:10.1146/annurev-clinpsy-032210-104526

Boyce, C. J., & Wood, A. M. (2011). Personality prior to disability determines adaptation: Agreeable individuals recover lost life satisfaction faster and more completely. *Psychological Science, 22*, 1397-1402. doi:10.1177/0956797611421790

Braden, C. A., Cuthbert, J. P., Brenner, L., Hawley, L., Morey, C., Newman, J., … Harrison-Felix, C. (2012). Health and wellness characteristics of persons with traumatic brain injury. *Brain Injury, 26*, 1315-1327. doi:10.3109/02699052.2012.706351

Brazier, J. E., Harper, R., Jones, N. M. B., O'Cathain, A., Thomas, K. J., Usherwood, T., & Westlake, L. (1992). Validating the SF-36 health survey questionnaire: New outcome measure for primary care. *British Medical Journal, 305*, 160-164.

Brickman, P., Coates, D., & Janoff-Bulman, R. (1978). Lottery winners and accident victims: Is happiness relative? *Journal of Personality and Social Psychology, 36*, 917-927.

Bryant, R. A., Nickerson, A., Creamer, M., O'Donnell, M., Forbes, D., Galatzer-Levy, I., … Silove, D. (2015). Trajectories of post-traumatic stress following traumatic injury: 6-year follow up. *The British Journal of Psychiatry*, *206*, 417-423.

Bryant, R. A., O'Donnell, M. L., Creamer, M., McFarlane, A. C., Clark, C. R., & Silove, D. (2010). The psychiatric sequelae of traumatic injury. *American Journal of Psychiatry, 167*, 312-320. doi:10.1176/appi.ajp.2009.09050617

Burleigh, S., A., Farber, R., S., & Gillard, M. (1998). Community integration and life satisfaction after traumatic brain injury: Long-term findings. *American Journal of Occupational Therapy, 52*, 45-52.

Burns, R. A., & Anstey, K. J. (2010). The Connor-Davidson Resilience Scale (CD-RISC): Testing the invariance of a uni-dimensional resilience measure that is independent of positive and negative affect. *Personality and Individual Differences, 48*, 527–531. doi:10.1016/j.paid.2009.11.026

Campbell, D. T, & Kenny, D. A. (1999). *A primer on regression artifacts*. New York, NY: Guilford.

Campbell-Sills, L., & Stein, M. B. (2007). Psychometric analysis and refinement of the Connor-Davidson Resilience Scale (CD-RISC): Validation of a 10-item measure of resilience. *Journal of Traumatic Stress, 20*, 1019-1028. doi:10.1002/jts.20271

Carstensen, L. L., Turan, B., Scheibe, S., Ram, N., Ersner-Hershfield, H., Samanez-Larkin, G., … Nesselroade, J. R. (2011). Emotional experience improves with age: Evidence based on over 10 years of experience sampling. *Psychology and Aging, 26*, 21-33. doi:10.1037/a0021285

Cassel, J. (1974). Social science in epidemiology: Psychosocial processes and stress theoretical formulation. *International Journal of Health Services*, *4*, 537-549.

Centers for Disease Control, National Center for Injury Prevention and Control. (2013). *Injury Prevention & Control*. Retrieved from http://www.cdc.gov/injury/wisqars/

Cohen, S., & Edwards, J. R. (1989). Personality characteristics as moderators of the relationship between stress and disorder. In R. W. J. Neufeld (Ed.), *Advances in the investigation of psychological stress* (pp. 235-283). New York, NY: John Wiley & Sons.

Cohen, S., & Wills, T. A. (1985). Stress, social support, and the buffering hypothesis. *Psychological Bulletin, 98*, 310-357. doi:10.1037/0033-2909.98.2.310

Cohn, M. A., Fredrickson, B. L., Brown, S. L., Mikels, J. A., & Conway, A. M. (2009). Happiness unpacked: Positive emotions increase life satisfaction by building resilience. *Emotion, 9*, 361-368. doi:10.1037/a0015952

Connor, K. M., & Davidson, J. R. (2003). Development of a new resilience scale: The Connor-Davidson Resilience Scale (CD-RISC). *Depression and Anxiety, 18*, 76-82. doi:10.1002/da.10113

Corrigan, J. D., Bogner, J. A., Mysiw, W. J., Clinchot, D., & Fugate, L. (2001). Life satisfaction after traumatic brain injury. *The Journal of Head Trauma Rehabilitation, 16*, 543-555.

Corrigan, J. D., Smith-Knapp, K., & Granger, C. V. (1998). Outcomes in the first 5 years after traumatic brain injury. *Archives of Physical Medicine and Rehabilitation, 79*, 298-305.

Cronbach, L. J., & Furby, L. (1970). How should we measure "change"—or should we? *Psychological Bulletin*, *74*, 68-80.

Cutrona, C. E. (1984). Social support and stress in the transition to parenthood. *Journal of Abnormal Psychology*, *93*, 378-390.

Cutrona, C. E., & Russell, D. W. (1987). The provisions of social relationships and adaptation to stress. In W. H. Jones & D. Perlman (Eds.), *Advances in personal relationships, Volume 1* (pp. 37-67). Greenwich, CT: JAI Press.

Daniels, J. K., Hegadoren, K. M., Coupland, N. J., Rowe, B. H., Densmore, M., Neufeld, R. W. J., & Lanius, R. A. (2012). Neural correlates and predictive power of trait resilience in an acutely traumatized sample: A pilot investigation. *The Journal of Clinical Psychiatry, 73*, 327-332. doi:10.4088/JCP.10m06293

Davis, L. C., Sherer, M., Sander, A. M., Bogner, J. A., Corrigan, J. D., Dijkers, M. P., … Seel, R. T. (2012). Preinjury predictors of life satisfaction at 1 year after traumatic brain injury. *Archives of Physical Medicine and Rehabilitation, 93*, 1324-1330. doi:10.1016/j.apmr.2012.02.036

Davydov, D. M., Stewart, R., Ritchie, K., & Chaudieu, I. (2010). Resilience and mental health. *Clinical Psychology Review, 30*, 479-495. doi:10.1016/j.cpr.2010.03.003

Dawson, D. R., Levine, B., Schwartz, M., & Stuss, D. T. (2000). Quality of life following traumatic brain injury: A prospective study. *Brain and Cognition*, *44*, 35-49. doi:10.1006/brcg.1999.1208

deRoon-Cassini, T. A., Mancini, A. D., Rusch, M. D., & Bonanno, G. A. (2010). Psychopathology and resilience following traumatic injury: A latent growth mixture model analysis. *Rehabilitation Psychology, 55*, 1-11. doi:10.1037/a0018601

Diener, E. (1984). Subjective well-being. *Psychological Bulletin, 95*, 542-575. doi:10.1037/0033-2909.95.3.542

Diener, E. (1994). Assessing subjective well-being: Progress and opportunities. *Social Indicators Research, 31*, 103-157.

Diener, E. (2000). Subjective well-being: The science of happiness and a proposal for a national index. *American Psychologist*, *55*, 34-43. doi:10.1037//0003-066X.55.1.34

Diener, E. (2012). New findings and future directions for subjective well-being research. *American Psychologist*, *67*, 590-597. doi:10.1037/a0029541

Diener, E., Colvin, C. R., Pavot, W. G., & Allman, A. (1991). The psychic costs of intense positive emotions. *Journal of Personality and Social Psychology*, *61*, 492-503. doi:10.1037/0022-3514.61.3.492

Diener, E., & Emmons, R. A. (1984). The independence of positive and negative affect. *Journal of Personality and Social Psychology*, *47*, 1105-1117. doi: 10.1037/0022-3514.47.5.1105

Diener, E., & Lucas, R. E. (1999). Personality and subjective well-being. In D. Kahneman, E. Diener, & N. Schwarz (Eds.), *Well-being: Foundations of hedonic psychology* (pp. 213-229). New York, NY: Russell Sage Foundation.

Diener, E., Lucas, R. E., & Scollon, C. N. (2006). Beyond the hedonic treadmill: Revising the adaptation theory of well-being. *American Psychologist, 61*, 305-314. doi:10.1037/0003-066X.61.4.305

Diener, E., Sandvik, E., & Pavot, W. (2009). Happiness is the frequency, not the intensity, of positive versus negative affect. In E. Diener (Ed.), *Assessing well-being: The collected works of Ed Diener* (pp. 213-231). New York, NY: Springer Science + Business Media.

Diener, E., & Seligman, M. E. P. (2004). Beyond money: Toward an economy of well-being. *Psychological Science in the Public Interest*, *5*, 1-31.

Diener, E., Suh, E. M., Lucas, R. E., & Smith, H. L. (1999). Subjective well-being: Three decades of progress. *Psychological Bulletin*, *125*, 276-302.

Dijkers, M. P. (1997). Quality of life after spinal cord injury: A meta analysis of the effects of disablement components. *Spinal Cord, 35*, 829-840.

Dijkers, M. P. (2004). Quality of life after traumatic brain injury: A review of research approaches and findings. *Archives of Physical Medicine and Rehabilitation, 85*, S21-S35. doi:10.1016/j.apmr.2003.08.119

Dikmen, S. S., Machamer, J. E., Powell, J. M., & Temkin, N. R. (2003). Outcome 3 to 5 years after moderate to severe traumatic brain injury. *Archives of Physical Medicine and Rehabilitation, 84*, 1449-1457. doi:10.1053/S0003-9993(03)00287-9

Dimopoulou, I., Anthi, A., Mastora, Z., Theodorakopoulou, M., Konstandinidis, A., Evangelou, E., … Roussos, C. (2004). Health-related quality of life and disability in survivors of multiple trauma one year after intensive care unit discharge. *American Journal of Physical Medicine and Rehabilitation, 83*, 171-176. doi:10.1097/01.PHM.0000107497.77487.C1

Douglas, J. M. (2012). Social linkage, self-concept, and well-being after severe traumatic brain injury. In J. Jetten, C. Haslam, & S. A. Haslam (Eds.), *The social cure: Identity, health and well-being* (pp. 237-254). London: Psychology Press.

Dunn, D. S., & Brody, C. (2008). Defining the good life following acquired physical disability. *Rehabilitation Psychology, 53*, 413-425. doi:10.1037/a0013749

Elliott, T. R. (2002). Defining our common ground to reach new horizons. *Rehabilitation Psychology*, *47*(2), 131-143.

Elliott, T. R., Herrick, S. M., & Witty, T. E. (1992). Problem-solving appraisal and the effects of social support among college students and persons with physical disabilities. *Journal of Counseling Psychology*, *39*, 219-226. doi:10.1037/0022-0167.39.2.219

Elliott, T. R., Hsiao, Y., Kimbrel, N. A., Meyer, E. C., DeBeer, B. B., Gulliver, S. B., … Morisette, S. B. (2015). Resilience, traumatic brain injury, depression, and posttraumatic stress among Iraq/Afghanistan war veterans. *Rehabilitation Psychology*, *60*, 263-276.

Elliott, T. R., Kurylo, M., & Rivera, P. (2002). Positive growth following acquired physical disability. In C. R. Snyder, & S. Lopez (Eds.), *Handbook of positive psychology* (pp. 687-699). New York, NY: Oxford University Press.

Elliott, T. R., Marmarosh, C., & Pickelman, H. (1994). Negative affectivity, social support, and the prediction of depression and distress. *Journal of Personality*, *62*, 299-319. doi:10.1111/j.1467-6494.1994.tb00299.x

Elliott, T. R., & Shewchuk, R. M. (1995). Social support and leisure activities following severe physical disability: Testing the mediating effects of depression. *Basic and Applied Social Psychology*, *16*, 471-487. doi:10.1207/s15324834basp1604_5

Erosa, N. A., Berry, J. W., Elliott, T. R., Underhill, A. T., & Fine, P. R. (2014). Predicting quality of life 5 years after medical discharge for traumatic spinal cord injury. *British Journal of Health Psychology, 19*, 688-700. doi:10.1111/bjhp.12063

Farkas, D., & Orosz, G. (2015). Ego-resiliency reloaded: A three-component model of general resiliency. *PLoS ONE*, *10*(3). doi:10.1371/journal.pone.0120883

Fleishman, J. A., Selim, A. J., & Kazis, L. E. (2010). Deriving SF-12v2 physical and mental health summary scores: A comparison of different scoring algorithms. *Quality of Life Research*, *19*, 231-241. doi:10.1007/s11136-009-9582-z

Fletcher, D., & Sarkar, M. (2013). Psychological resilience: A review and critique of definitions, concepts, and theory. *European Psychologist*, *18*, 12-23. doi:10.1027/1016-9040/a000124

Frederick, S., & Loewenstein, G. (1999). Hedonic adaptation. In D. Kahneman, E. Diener, & N. Schwarz (Eds.), *Well-being: Foundations of hedonic psychology* (pp. 302-329). New York, NY: Russell Sage Foundation.

Fredrickson, B. L. (2013). Positive emotions broaden and build. *Advances in Experimental Social Psychology, 47*, 1-53. doi:10.1016/B978-0-12-407236-7.00001-2

Fredrickson, B. L., Mancuso, R. A., Branigan, C., & Tugade, M. M. (2000). The undoing effect of positive emotions. *Motivation and Emotion, 24*, 237-258. doi:10.1023/A:1010796329158

Fuhrer, M. J., Rintala, D. H., Hart, K. A., Clearman, R., & Young, M. E. (1992). Relationship of life satisfaction to impairment, disability, and handicap among persons with spinal cord injury living in the community. *Archives of Physical Medicine and Rehabilitation, 73*, 552-557.

Fujita, F., & Diener, E. (2005). Life satisfaction set point: Stability and change. *Journal of Personality and Social Psychology, 88*, 158-164. doi:10.1037/0022-3514.88.1.158

Givens, J. L., Prigerson, H. G., Jones, R. N., & Mitchell, S. L. (2011). Mental health and exposure to patient distress among families of nursing home residents with advanced dementia. *Journal of Pain and Symptom Management*, *42*, 183-191. doi:10.1016/j.jpainsymman.2010.10.259

Grad, F. P. (2002). The Preamble of the Constitution of the World Health Organization. *Bulletin of the World Health Organization, 80*, 981-982.

Gollwitzer, M., Christ, O., & Lemmer, G. (2014). Individual differences make a difference: On the use of the psychometric properties of difference scores in social psychology. *European Journal of Social Psychology*, *44*, 673-682. doi:10.1002/ejsp.2042

Gulliksen, H. (1950). *Theory of mental tests*. New York, NY: John Wiley & Sons.

Halcomb, E., Daly, J., Davidson, P., Elliott, D., & Griffiths, R. (2005). Life beyond severe traumatic injury: An integrative review of the literature. *Australian Critical Care, 18*, 17-24. doi:10.1016/S1036-7314(05)80020-7

Hanks, R. A., Temkin, N., Machamer, J., & Dikmen, S. S. (1999). Emotional and behavioral adjustment after traumatic brain injury. *Archives of Physical Medicine and Rehabilitation, 80*, 991-997. doi:10.1016/S0003-9993(99)90049-7

Hartley, M. T. (2012). Assessing and promoting resilience: An additional tool to address the increasing number of college students with psychological problems. *Journal of College Counseling, 15*, 37-51. doi:10.1002/j.2161-1882.2012.00004.x

Hays, R. D., & Morales, L. S. (2001). The RAND-36 measure of health-related quality of life. *Annals of Medicine*, *33*, 350-357.

Hays, R. D., Prince-Embury, S., & Chen, H. (1998). *R-36 HIS: RAND-36 Health Status Inventory*. San Antonio, TX: The Psychological Corporation.

Hays, R. D., Sherbourne, C. D., & Mazel, R. M. (1993). The RAND 36-item Health Survey 1.0. *Health Economics*, *2*, 217-227. doi:10.1002/hec.4730020305

Hays, R. D., Sherbourne, C. D., & Mazel, R. M. (1995). *User's manual for the Medical Outcomes Study (MOS) core measures of health-related quality of life*. Santa Monica, CA: The RAND Corporation.

Headey, B., & Wearing, A. (1989). Personality, life events, and subjective well-being: Toward a dynamic equilibrium model. *Journal of Personality and Social Psychology, 57*, 731-739. doi:10.1037/0022-3514.57.4.731

Hernandez, C. L., Elliott, T. R., Berry, J. W., Underhill, A. T., Fine, P. R., & Lai, M. H. C. (2014). Trajectories of life satisfaction five years after medical discharge for traumatically acquired disability. *Rehabilitation Psychology, 59*, 183-192. doi:10.1037/a0035887

Herrick, S. M., Elliott, T. R., & Crow, F. (1994). Social support and the prediction of health complications among persons with spinal cord injuries. *Rehabilitation Psychology*, *39*, 231-250. doi:10.1037//0090-550.39.4.231

Hicken, B. L., Putzke, J. D., Novack, T., Sherer, M., & Richards, J. S. (2002). Life satisfaction following spinal cord and traumatic brain injury: A comparative study. *Journal of Rehabilitation Research and Development, 39*, 359-365.

Holtslag, H. R., van Beeck, E. F., Lindeman, E., & Leenen, L. P. H. (2007). Determinants of long-term functional consequences after major trauma. *Journal of Trauma, 62*, 919-927. doi:10.1097/01.ta.0000224124.47646.62

Hox, J. J. (2010). *Multilevel analysis: Techniques and applications*. New York, NY: Routledge.

Hunt, S. M. (1997). The problem of quality of life. *Quality of Life Research*, *6*, 205-212.

Iqbal, S. U., Rogers, W., Selim, A., Qian, S., Lee, A., Xinhua, X., … Kazis, L. E. (2007). The Veterans RAND 12 Item Health Survey (VR-12): What it is and how it is used. Retrieved from http://hosonline.org/surveys/hos/download/Veterans_RAND_12_Item_Health_Survey_VR-12_2007.pdf

Johnson, C. L., Resch, J. A., Elliott, T. R., Villarreal, V., Kwok, O., Berry, J. W., & Underhill, A. T. (2010). Family satisfaction predicts life satisfaction trajectories over the first 5 years after traumatic brain injury. *Rehabilitation Psychology, 55*, 180-187. doi:10.1037/a0019480

Jones, D., Kazis, L., Lee, A., Rogers, W., Skinner, K., Cassar, L., … Hendricks, A. (2001). Health status assessments using the Veterans SF-12 and SF-36: Methods for evaluating outcomes in the Veterans Health Administration. *Journal of Ambulatory Care Management*, *24*(3), 68-86.

Jovanovic, V. (2011). Personality and subjective well-being: One neglected model of personality and two forgotten aspects of subjective well-being. *Personality and Individual Differences, 50*, 631-635. doi:10.1016/j.paid.2010.12.008

Jumisko, E., Lexell, J., & Söderberg, S. (2009). The meaning of feeling well in people with moderate or severe traumatic brain injury. *Journal of Clinical Nursing, 18*, 2273-2281. doi:10.1111/j.1365-2702.2008.02738.x

Kalpinski, R. J., Williamson, M. L. C., Elliott, T. R., Berry, J. W., Underhill, A. T., & Fine, P. R. (2013). Modeling the prospective relationships of impairment, injury severity, and participation to quality of life following traumatic brain injury. *BioMed Research International, 2013,* 1-10. doi:10.1155/2013/102570

Kammann, R. (1983). Objective circumstances, life satisfactions, and sense of well-being: Consistencies across time and place. *New Zealand Journal of Psychology*, *12*, 14-22.

Kazis, L. E., Miller, D. R., Skinner, K. M., Lee, A., Ren, X. S., Clark, J. A., … Fincke, G. (2004). Patient-reported measures of health: The Veterans Health Study. *Journal of Ambulatory Care Management*, *27*(1), 70-83.

Kazis, L. E., Selim, A., Rogers, W., Ren, X. S., Lee, A., & Miller, D. R. Veterans RAND 12 Item Health Survey (VR-12): A white paper summary. (n.d.) Retrieved from https://www.researchgate.net/publication/237314426_Veterans_RAND_12_Item_Health_Survey_VR12_A_White_Paper_Summary

Kazis, L. E., Selim, A., Rogers, W., Ren, X. S., Lee, A., & Miller, D. R. (2006). Dissemination of methods and results from the Veterans Health Study: Final comments and implications for future monitoring strategies within and outside the veterans healthcare system. *The Journal of Ambulatory Care Management, 29*(4), 310-319. doi:00004479-200610000-00007

Kennedy, P., Lude, P., Elfström, M. L., & Smithson, E. (2010). Cognitive appraisals, coping and quality of life outcomes: A multi-centre study of spinal cord injury rehabilitation. *Spinal Cord, 48*, 762-769.

Kok, B. E., Coffey, K. A., Cohn, M. A., Catalino, L. I., Vacharkulksemsuk, T., Algoe, S. B., … Fredrickson, B. L. (2013). How positive emotions build physical health: Perceived positive social connections account for the upward spiral between positive emotions and vagal tone. *Psychological Science*, *27*, 1123-1132. doi:10.1177/0956797612470827

Kortte, K. B., Gilbert, M., Gorman, P., & Wegener, S. T. (2010). Positive psychological variables in the prediction of life satisfaction after spinal cord injury. *Rehabilitation Psychology, 55*, 40-47. doi:10.1037/a0018624

Krause, J. S. (1997). Adjustment after spinal cord injury: A 9-year longitudinal study. *Archives of Physical Medicine and Rehabilitation, 78*, 651-657.

Krause, J. S., Saladin, L. K., & Adkins, R. H. (2009). Disparities in subjective well-being, participation, and health after spinal cord injury: A 6-year longitudinal study. *NeuroRehabilitation, 24*, 47-56. doi:10.3233/NRE-2009-0453

Kreuter, M., Sullivan, M., Dahllöf, A. G., & Siösteen, A. (1998). Partner relationships, functioning, mood and global quality of life in persons with spinal cord injury and traumatic brain injury. *Spinal Cord, 36*, 252-261.

Kwok, O., Underhill, A. T., Berry, J. W., Luo, W., Elliott, T. R., & Yoon, M. (2008). Analyzing longitudinal data with multilevel models: An example with individuals living with lower extremity intra-articular fractures. *Rehabilitation Psychology, 53*, 370-386. doi:10.1037/a0012765

Kwok, O., West, S. G., & Green, S. B. (2007). The impact of misspecifying the within-subject covariance structure in multiwave longitudinal multilevel models: A monte carlo study. *Multivariate Behavioral Research*, *42*, 557–592.

Lammel, J. A. (2004). *Relationship between dimensions of leisure activity experience, sense of coherence, and psychological well-being for traumatic brain injury survivors*. (Doctoral dissertation, Pennsylvania State University). Retrieved from http://lib-ezproxy.tamu.edu:2048/login?url=http://search.ebscohost.com/login.aspx?direct=true&db=psyh&AN=2004-99006-225&site=eds-live (UMI No. 3106271)

Larsen, R. J., & Diener, E. (1985). A multitrait-multimethod examination of affect structure: Hedonic level and emotional intensity. *Personality and Individual Differences*, *6*, 631-636. doi:10.1016/0191-8869(85)90013-3

Larsen, R. J., Diener, E., & Emmons, R. A. (1985). An evaluation of subjective well-being measures. *Social Indicators Research*, *17*, 1-18.

Lazarus, R. S. (1991). *Emotion and adaptation*. New York, NY: Oxford University Press.

Lazarus, R. S. (1993). From psychological stress to the emotions: A history of changing outlooks. *Annual Review of Psychology, 44*, 1-21. doi:10.1146/annurev.ps.44.020193.000245

Lazarus, R., & Folkman, S. (1984). *Stress, appraisal, and coping*. New York, NY: Springer.

Lee, B., Chaboyer, W., & Wallis, M. (2008). Predictors of health-related quality of life 3 months after traumatic injury. *Journal of Nursing Scholarship, 40*, 83-90. doi:10.1111/j.1547-5069.2008.00210.x

Leoniuk, A. (2009). *Positive and negative emotions: Important aspects of resilience while coping with traumatic injury*. (Doctoral dissertation, Adler School of Professional Psychology). Retrieved from http://lib-ezproxy.tamu.edu:2048/login?url=http://search.ebscohost.com/login.aspx?direct=true&db=psyh&AN=2010-99060-125&site=eds-live (UMI No. 3377735)

Lin, M., Chiu, W., Chen, Y., Yu, W., Huang, S., & Tsai, M. (2010). Longitudinal changes in the health-related quality of life during the first year after traumatic brain injury. *Archives of Physical Medicine and Rehabilitation, 91*, 474-480. doi:10.1016/j.apmr.2009.10.031

Linn, R. L., & Slinde, J. A. (1977). The determination of the significance of change between pre- and posttesting periods. *Review of Educational Research*, *47*, 121-150.

Lippert-Grüner, M., Maegele, M., Haverkamp, H., Klug, N., & Wedekind, C. (2007). Health-related quality of life during the first year after severe brain trauma with and without polytrauma. *Brain Injury, 21*, 451-455. doi:10.1080/02699050701343961

Lord, F. M. (1956). The measurement of growth. *Educational and Psychological Measurement*, *16*, 421-437.

Lord, F. M., & Novick, M. R. (1968). *Statistical theories of mental test scores*. Reading, MA: Addison-Wesley.

Lucas, R. E. (2007a). Adaptation and the set-point model of subjective well-being: Does happiness change after major life events? *Current Directions in Psychological Science, 16*, 75-79. doi:10.1111/j.1467-8721.2007.00479.x

Lucas, R. E. (2007b). Long-term disability is associated with lasting changes in subjective well-being: Evidence from two nationally representative longitudinal studies. *Journal of Personality and Social Psychology, 92*, 717-730. doi:2007-05059-010

Lucas, R. E., Clark, A. E., Georgellis, Y., & Diener, E. (2003). Reexamining adaptation and the set point model of happiness: Reactions to changes in marital status. *Journal of Personality and Social Psychology, 84*, 527-539. doi:10.1037/0022-3514.84.3.527

Lucas, R. E., Diener, E., & Suh, E. (1996). Discriminant validity of well-being measures. *Journal of Personality and Social Psychology, 71*, 616-628.

Luhmann, M., Hofmann, W., Eid, M., & Lucas, R. E. (2011). Subjective well-being and adaptation to life events: A meta-analysis. *Journal of Personality and Social Psychology, 102*, 592-615. doi:10.1037/a0025948

Luo, W., & Kwok, O. (2010). Proportional reduction of prediction error in cross-classified random effects models. *Sociological Methods and Research, 39*, 188-205. doi:10.1177/0049124110384062

Lykken, D., & Tellegen, A. (1996). Happiness is a stochastic phenomenon. *Psychological Science*, 7, 186-189.

Lyubomirsky, S., King, L., & Diener, E. (2005a). The benefits of frequent positive affect: Does happiness lead to success? *Psychological Bulletin, 131*, 803-855.

Lyubomirsky, S., Sheldon, K. M., & Schkade, D. (2005b). Pursuing happiness: The architecture of sustainable change. *Review of General Psychology, 9*, 111-131. doi:10.1037/1089-2680.9.2.111

Mailhan, L., Azouvi, P., & Dazord, A. (2005). Life satisfaction and disability after severe traumatic brain injury. *Brain Injury, 19*, 227-238. doi:10.1080/02699050410001720149

Martz, E., Livneh, H., Priebe, M., Wuermser, L. A., & Ottomanelli, L. (2005). Predictors of psychosocial adaptation among people with spinal cord injury or disorder. *Archives of Physical Medicine and Rehabilitation, 86*, 1182-1192. doi:10.1016/j.apmr.2004.11.036

McCarthy, M. L., Dikmen, S. S., Langlois, J. A., Selassie, A. W., Gu, J. K., & Horner, M. D. (2006). Self-reported psychosocial health among adults with traumatic brain injury. *Archives of Physical Medicine and Rehabilitation, 87*, 953-961. doi:10.1016/j.apmr.2006.03.007

McCord, C. E., Elliott, T. R., Berry, J. W., Underhill, A. T., Fine, P. R., & Lai, M. H. (2016). Trajectories of happiness 5 years following medical discharge for traumatic disability: Differences between insider and outsider perspectives. *Journal of Happiness Studies*, *17*, 553-567. doi:10.1007/s10902-014-9610-8

McGiffin, J. N., Galatzer-Levy, I. R., & Bonanno, G. A. (2016). Is the intensive care unit traumatic? What we know and don't know about the intensive care unit and posttraumatic stress responses. *Rehabilitation Psychology*, *61*, 120-131.

Mortenson, W. B., Noreau, L., & Miller, W. C. (2010). The relationship between and predictors of quality of life after spinal cord injury at 3 and 15 months after discharge. *Spinal Cord, 48*, 73-79. doi:10.1038/sc.2009.92

Müller, R., Peter, C., Cieza, A., & Geyh, S. (2012). The role of social support and social skills in people with spinal cord injury--a systematic review of the literature. *Spinal Cord, 50*, 94-106. doi:10.1038/sc.2011.116

Myers, D. G. (1999). Close relationships and quality of life. In D. Kahneman, E. Diener, & N. Schwarz (Eds.), *Well-being: The foundations of hedonic psychology* (pp. 374-391). New York, NY: Russell Sage Foundation.

Myers, D. G. (2000). The funds, friends, and faith of happy people. *American Psychologist, 55*, 56-67. doi:10.1037//0003-066X.55.1.56

Nampiaparampil, D. E. (2008). Prevalence of chronic pain after traumatic brain injury: A systematic review. *Journal of the American Medical Association, 300*, 711-719.

National Trauma Institute. (2014). *Trauma Statistics*. Retrieved from http://nationaltraumainstitute.org/home/trauma_statistics.html

O'Donnell, M. L., Creamer, M., Elliott, P., Atkin, C., & Kossmann, T. (2005). Determinants of quality of life and role-related disability after injury: Impact of acute psychological responses. *Journal of Trauma, 59*, 1328-1335. doi:10.1097/01.ta.0000197621.94561.4e

Ong, A. D., Bergeman, C. S., & Boker, S. M. (2009). Resilience comes of age: Defining features in later adulthood. *Journal of Personality, 77*, 1777-1804. doi:10.1111/j.1467-6494.2009.00600.x

Ong, A. D., Zautra, A. J., & Reid, M. C. (2010). Psychological resilience predicts decreases in pain catastrophizing through positive emotions. *Psychology and Aging, 25*, 516-523. doi:10.1037/a0019384

Patterson, D. R., Ptacek, J. T., Cromes, F., Fauerbach, J. A., & Engrav, L. (2000). The 2000 Clinical Research Award. Describing and predicting distress and satisfaction with life for burn survivors. *The Journal of Burn Care and Rehabilitation, 21*, 490-498.

Perrin, P. B., Krch, D., Sutter, M., Snipes, D. J., Arango-Lasprilla, J. C., Kolakowsky-Hayner, S. A., . . . Lequerica, A. (2014). Racial/Ethnic disparities in mental health over the first 2 years after traumatic brain injury: A model systems study. *Archives of Physical Medicine and Rehabilitation, 95*, 2288-2295. doi:10.1016/j.apmr.2014.07.409

Peterson, C. (2006). *A primer in positive psychology*. New York, NY: Oxford University Press.

Pierce, C. A., & Hanks, R. A. (2006). Life satisfaction after traumatic brain injury and the World Health Organization model of disability. *American Journal of Physical Medicine and Rehabilitation, 85*, 889-898.

Pollard, C., & Kennedy, P. (2007). A longitudinal analysis of emotional impact, coping strategies and post-traumatic psychological growth following spinal cord injury: A 10-year review. *British Journal of Health Psychology, 12*, 347-362. doi:10.1348/135910707X197046

Ponsford, J., Willmott, C., Rothwell, A., Cameron, P., Kelly, A., Nelms, R., … Kim, N. G. (2000). Factors influencing outcome following mild traumatic brain injury in adults. *Journal of the International Neuropsychological Society, 6*, 568-579. doi:10.1017/S1355617700655066

Post, M. W. M., & van Leeuwen, C. M. C. (2012). Psychosocial issues in spinal cord injury: A review. *Spinal Cord, 50*, 382-389. doi:10.1038/sc.2011.182

Post, M. W. M., de Witte, L. P., & Schrijvers, A. J. P. (1999). Quality of life and the ICIDH: Towards an integrated conceptual model for rehabilitation outcomes research. *Clinical Rehabilitation, 13*, 5-15. doi:10.1191/026921599701532072

Powdthavee, N. (2009). What happens to people before and after disability? Focusing effects, lead effects, and adaptation in different areas of life. *Social Science and Medicine, 69*, 1834-1844. doi:10.1016/j.socscimed.2009.09.023

Powell, T., Gilson, R., & Collin, C. (2012). TBI 13 years on: Factors associated with post-traumatic growth. *Disability and Rehabilitation, 34*, 1461-1467. doi:10.3109/09638288.2011.644384

Powers, M. B., Warren, A. M., Rosenfield, D., Roden-Foreman, K., Bennett, M., Reynolds, M. C., … Smits, J. A. J. (2014). Predictors of PTSD symptoms in adults admitted to a Level I trauma center: A prospective analysis. *Journal of Anxiety Disorders, 28*, 301-309. doi:10.1016/j.janxdis.2014.01.003

Putzke, J. D., Elliott, T. R., & Richards, J. S. (2001). Marital status and adjustment 1 year post-spinal-cord-injury. *Journal of Clinical Psychology in Medical Settings, 8*, 101-107. doi:10.1023/A:1009555910604

Quale, A. J., & Schanke, A. (2010). Resilience in the face of coping with a severe physical injury: A study of trajectories of adjustment in a rehabilitation setting. *Rehabilitation Psychology, 55*, 12-22. doi:10.1037/a0018415

Quale, A. J., Schanke, A., Frøslie, K. F., & Røise, O. (2009). Severity of injury does not have any impact on posttraumatic stress symptoms in severely injured patients. *Injury, 40*, 498-505. doi:10.1016/j.injury.2008.11.006

Quené, H., & van den Bergh, H. (2004). On multi-level modeling of data from repeated measures designs: A tutorial. *Speech Communication*, *43*, 103-121. doi:10.1016/j.specom.2004.02.004

Rainey, E. E., Petrey, L. B., Reynolds, M., Agtarap, S., & Warren, A. M. (2014). Psychological factors predicting outcome after traumatic injury: The role of resilience. *American Journal of Surgery, 208*, 517-523. doi:10.1016/j.amjsurg.2014.05.016

Raudenbush, S. W., & Bryk, A. S. (2002). *Hierarchical linear models: Applications and data analysis methods* (2nd edition). Thousand Oaks, CA: Sage.

Raudenbush, S. W., Bryk, A. S., Cheong, Y. F., Congdon, R. T., & du Toit, M. (2011). *HLM 7: Hierarchical linear and nonlinear modeling*. Lincolnwood, IL: Scientific Software International.

Resch, J. A., Villarreal, V., Johnson, C. L., Elliott, T. R., Kwok, O., Berry, J. W., & Underhill, A. T. (2009). Trajectories of life satisfaction in the first 5 years following traumatic brain injury. *Rehabilitation Psychology, 54*, 51-59. doi:10.1037/a0015051

Rhee, P., Joseph, B., Pandit, V., Aziz, H., Vercruysse, G., Kulvatunyou, N., & Friese, R. S. (2014). Increasing trauma deaths in the United States. *Annals of Surgery, 260*, 13-21. doi:10.1097/SLA.0000000000000600

Rintala, D. H., Young, M. E., Hart, K. A., Clearman, R. R., & Fuhrer, M. J. (1992). Social support and the well-being of persons with spinal cord injury living in the community. *Rehabilitation Psychology, 37*, 155-163. doi:10.1037//0090-5550.37.3.155

Ross, M. (1989). Relation of implicit theories to the construction of personal histories. *Psychological Review*, *96*, 341-357.

Rothwell, P. M., McDowell, Z., Wong, C. K., & Dorman, P. J. (1997). Doctors and patients don't agree: Cross sectional study of patients' and doctors' perceptions and assessments of disability in multiple sclerosis. *British Medical Journal, 314*, 1580-1583.

Schaefer, C., Coyne, J. C., & Lazarus, R. S. (1981). The health-related functions of social support. *Journal of Behavioral Medicine, 4*, 381-406. doi:10.1007/BF00846149

Seligman, M. E. P. (2002). *Authentic happiness: Using the new positive psychology to realize your potential for lasting fulfillment*. New York, NY: Free Press.

Seligman, M. E. P., & Csikszentmihalyi, M. (2000). Positive psychology: An introduction. *The American Psychologist, 55*, 5-14. doi:10.1037/0003-066X.55.1.5

Selim, A. J., Rogers, W., Fleishman, J. A., Qian, S. X., Fincke, B. G., Rothendler, J. S., & Kazis, L. E. (2009). Updated U.S. population standard for the Veterans RAND 12-item Health Survey (VR-12). *Quality of Life Research*, *18*, 43-52. doi:10.1007/s11136-008-9418-2

Semmlow, J. L. & Cone, R. (1976). Utility of the Injury Severity Score: A confirmation. *Health Services Research, 11*, 45-52.

Sigurdardottir, S., Andelic, N., Roe, C., & Schanke, A. K. (2014). Identifying longitudinal trajectories of emotional distress symptoms 5 years after traumatic brain injury. *Brain Injury, 28*, 1542-1550. doi:10.3109/02699052.2014.934285

Silverman, A. M., Molton, I. R., Alschuler, K. N., Ehde, D. M., & Jensen, M. P. (2015). Resilience predicts functional outcomes in people aging with disability: A longitudinal investigation. *Archives of Physical Medicine and Rehabilitation*, *96*, 1262-1268. doi:10.1016/j.apmr.2015.02.023

Sluys, K., Häggmark, T., & Iselius, L. (2005). Outcome and quality of life 5 years after major trauma. *Journal of Trauma, 59*, 223-232. doi:10.1097/01.TA.0000173832.01547.CB

Snijders, T. A. B., & Bosker, R. J. (1999). *Multilevel analysis: An introduction to basic and advanced multilevel modeling*. Thousand Oaks, CA: Sage.

Somerfield, M. R., & McCrae, R. R. (2000). Stress and coping research: Methodological challenges, theoretical advances, and clinical applications. *American Psychologist, 55*, 620-625. doi:10.1037//0003-066X.55.6.620

Stålnacke, B. (2007). Community integration, social support and life satisfaction in relation to symptoms 3 years after mild traumatic brain injury. *Brain Injury, 21*, 933-942. doi:10.1080/02699050701553189

Stensman, R. (1994). Adjustment to traumatic spinal cord injury. A longitudinal study of self-reported quality of life. *Paraplegia, 32*, 416-422. doi:10.1038/sc.1994.68

Suarez, N. C., Levi, R., & Bullington, J. (2013). Regaining health and wellbeing after traumatic spinal cord injury. *Journal of Rehabilitation Medicine, 45*, 1023-1027. doi:10.2340/16501977-1226

Teasdale, T. W., & Engberg, A. W. (2005). Subjective well-being and quality of life following traumatic brain injury in adults: A long-term population-based follow-up. *Brain Injury, 19*, 1041-1048. doi:10.1080/02699050500110397

Tedeschi, R. G., & Calhoun, L. G. (1996). The Posttraumatic Growth Inventory: Measuring the positive legacy of trauma. *Journal of Traumatic Stress, 9*, 455-471.

Tedeschi, R. G., Park, C. L., & Calhoun, L. G. (1998). *Posttraumatic growth: Positive changes in the aftermath of crisis*. Mahwah, NJ: Routledge.

Tellegen, A., Bouchard, Jr., T. J., Wilcox, K. J., Segal, N. L., Lykken, D. T., & Rich, S. (1988). Personality similarity in twins reared apart and together. *Journal of Personality and Social Psychology, 54*, 1031-1039.

Tomberg, T., Toomela, A., Ennok, M., & Tikk, A. (2007). Changes in coping strategies, social support, optimism and health-related quality of life following traumatic brain injury: A longitudinal study. *Brain Injury, 21*, 479-488. doi:10.1080/02699050701311737

Tomberg, T., Toomela, A., Pulver, A., & Tikk, A. (2005). Coping strategies, social support, life orientation and health-related quality of life following traumatic brain injury. *Brain Injury, 19*, 1181-1190. doi:10.1080/02699050500150153

Tsaousides, T., Ashman, T., & Seter, C. (2008). The psychological effects of employment after traumatic brain injury: Objective and subjective indicators. *Rehabilitation Psychology*, *53*, 456-463. doi:10.1037/a0012579

Tugade, M. M. (2011). Positive emotions and coping: Examining dual-process models of resilience. In S. Folkman (Ed.), *The oxford handbook of stress, health, and coping* (pp. 186-199). New York, NY: Oxford University Press.

Tugade, M. M., Fredrickson, B. L., & Barrett, L. F. (2004). Psychological resilience and positive emotional granularity: Examining the benefits of positive emotions on coping and health. *Journal of Personality, 72*, 1161-1190.

U.S. Census Bureau. (2012). *Age and Sex*. Retrieved from https://www.census.gov/topics/population/age-and-sex.html

U.S. Census Bureau. (2014). *Industry and Occupation*. Retrieved from https://www.census.gov/people/io/

U.S. Census Bureau. (2015). *Families and Households*. Retrieved from https://www.census.gov/topics/families/families-and-households.html

van Leeuwen, C. M. C., Post, M. W. M., van Asbeck, F. W. A., Bongers-Janssen, H. M. H., van der Woude, L. H. V., de Groot, S., & Lindeman, E. (2012a). Life satisfaction in people with spinal cord injury during the first five years after discharge from inpatient rehabilitation. *Disability and Rehabilitation, 34*, 76-83. doi:10.3109/09638288.2011.587089

van Leeuwen, C. M. C., Post, M. W. M., Westers, P., van der Woude, L. H. V., de Groot, S., Sluis, T., . . . Lindeman, E. (2012b). Relationships between activities, participation, personal factors, mental health, and life satisfaction in persons with spinal cord injury. *Archives of Physical Medicine and Rehabilitation, 93*, 82-89. doi:10.1016/j.apmr.2011.07.203

Wallace, D. & Green, S. B. (2002). Analysis of repeated measures designs with linear mixed models. In D. S. Moskowitz & S. L. Hershberger (Eds.), *Modeling intraindividual variability with repeated measures data: Methods and applications* (pp. 103-134). Mahwah, NJ: Lawrence Erlbaum Associates.

Ware, J. E. (1993). *SF-36 health survey: Manual and interpretation guide*. Boston, MA: The Health Institute, New England Medical Center.

Ware, J. E. (2000). SF-36 health survey update. *Spine*, *25*, 3130-3139.

Ware, J. E., Kosinski, M., & Keller, S. D. (1994). *SF-36 physical and mental health summary scales: A user's manual*. Boston, MA: The Health Institute, New England Medical Center.

Ware, J. E., Kosinski, M., & Keller, S. D. (1995). *SF-12: How to score the SF-12 physical and mental health summary scales* (2nd ed.). Boston, MA: The Health Institute, New England Medical Center.

Ware, J. E., Kosinski, M., Turner-Bowker, D. M., & Gandek, B. (2002). *How to score version 2 of the SF-12 Health Survey*. Lincoln, RI: Quality Metric Incorporated.

Ware, J. E., & Sherbourne, C. D. (1992). The MOS 36-item Short-form Health Survey (SF-36): I. Conceptual framework and item selection. *Medical Care*, *30*, 473-483.

Ware, J. E., Snow, K. K., Kosinski, M., & Gandek, B. (1993). *SF-36 Health Survey: Manual and interpretation guide*. Boston, MA: The Health Institute.

Warren, L., & Wrigley, J. M. (1996). Factors associated with life satisfaction among a sample of persons with neurotrauma. *Journal of Rehabilitation Research and Development, 33*, 404-409.

Watson, D., Clark, L. A., & Tellegen, A. (1988). Development and validation of brief measures of positive and negative affect: The PANAS scales. *Journal of Personality and Social Psychology*, *54*, 1063-1070.

Waugh, C. E., Wager, T. D., Fredrickson, B. L., Noll, D. C., & Taylor, S. F. (2008). The neural correlates of trait resilience when anticipating and recovering from threat. *Social Cognitive and Affective Neuroscience, 3*, 322-332. doi:10.1093/scan/nsn024

Weiss, R. (1974). The provisions of social relationships. In Z. Rubin (Ed.), *Doing unto others* (pp. 17-26). Englewood Cliffs, NJ: Prentice Hall.

Weiter, P. A. (2014). *Traumatic brain injury: Model of quality of life outcomes*. (Doctoral dissertation, Spalding University) Retrieved from http://lib-ezproxy.tamu.edu:2048/login?url=http://search.ebscohost.com/login.aspx?direct=true&db=psyh&AN=2014-99100-271&site=eds-live (UMI No. 3588498)

White, B., Driver, S., & Warren, A. M. (2010). Resilience and indicators of adjustment during rehabilitation from a spinal cord injury. *Rehabilitation Psychology, 55*, 23-32. doi:10.1037/a0018451

Whitehurst, D. G., Engel, L., & Bryan, S. (2014). Short Form health surveys and related variants in spinal cord injury research: A systematic review. *The Journal of Spinal Cord Medicine*, *37*, 128-138. doi:10.1179/2045772313Y.0000000159

Willett, J. B., Singer, J. D., & Martin, N. C. (1998). The design and analysis of longitudinal studies of development and psychopathology in context: Statistical models and methodological recommendations. *Development and Psychopathology, 10*, 395-426. doi:10.1017/S0954579498001667

Williams, M. W., Rapport, L. J., Millis, S. R., & Hanks, R. A. (2014). Psychosocial outcomes after traumatic brain injury: Life satisfaction, community integration, and distress. *Rehabilitation Psychology, 59*, 298-305. doi:10.1037/a0037164

Williams, R. H., & Zimmerman, D. W. (1996). Are simple gain scores obsolete? *Applied Psychological Measurement*, *20*, 59–69.

Williams, R. H., Zimmerman, D. W., & Mazzagatti, R. D. (1987). Large sample estimates of the reliability of simple, residualized, and base-free gain scores. *Journal of Experimental Education*, *55*, 116-118.

Williamson, M. L. C., Elliott, T. R., Bogner, J., Dreer, L. E., Arango-Lasprilla, J. C., Kolakowsky-Hayner, S. A., … Perrin, P. B. (2015). Trajectories of life satisfaction over the first 10 years after traumatic brain injury: Race, gender, and functional ability. *The Journal of Head Trauma Rehabilitation,* 1-13. doi:10.1097/HTR.0000000000000111

Wiseman, T., Foster, K., & Curtis, K. (2012). Mental health following traumatic physical injury: An integrative literature review. *Injury, 44,* 1383-1390. doi:10.1016/j.injury.2012.02.015

Zatzick, D. F., Kang, S., Müller, H., Russo, J. E., Rivara, F. P., Katon, W., … Roy-Byrne, P. (2002). Predicting posttraumatic distress in hospitalized trauma survivors with acute injuries. *American Journal of Psychiatry, 159*, 941-946. doi:10.1176/appi.ajp.159.6.941

Zatzick, D. F., Jurkovich, G. J., Rivara, F. P., Wang, J., Fan, M., Joesch, J., & Mackenzie, E. (2008). A national US study of posttraumatic stress disorder, depression, and work and functional outcomes after hospitalization for traumatic injury. *Annals of Surgery, 248*, 429-437. doi:10.1097/SLA.0b013e318185a6b8

Zimmerman, D. W., & Williams, R. H. (1982). Gain scores in research can be highly reliable. *Journal of Educational Measurement*, *19*, 149–154.

Zimmerman, D. W., & Williams, R. H. (1998). Reliability of gain scores under realistic assumptions about properties of pretest and posttest scores. *British Journal of Mathematical and Statistical Psychology*, *51*, 343–351.