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UNIVERSITY OF SAN DIEGO
Hahn School of Nursing and Health Science
DOCTOR OF PHILOSOPHY IN NURSING

TRAUMA RECIDIVISM: THREAT ORIENTATIONS AND RECURRENT INJURY
PERCEPTIONS

by

Molly Ann Bauer

A dissertation presented to the
FACULTY OF THE HAHN SCHOOL OF NURSING AND HEALTH SCIENCE
UNIVERSITY OF SAN DIEGO

In partial fulfillment of the
Requirements for the degree
DOCTOR OF PHILOSOPHY IN NURSING
April 2022

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UNIVERSITY OF SAN DIEGO
Hahn School of Nursing and Health Science
DOCTOR OF PHILOSOPHY IN NURSING

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TITLE OF

DISSERTATION: TRAUMA RECIDIVISM: THREAT ORIENTATION
AND RECURRENT INJURY PERCEPTIONS

DISSERTATION

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Abstract

Purpose: To describe select sociodemographic and clinical variables, threat orientations, and the perceived likelihood of recurrent injury (PLRI) of individuals deemed at risk for trauma recidivism (TR).

Background: Injuries and violence are the leading cause of traumatic death among persons aged 1 to 44 in the United States. Trauma recidivism occurs when an individual experiences more than one significant injury requiring hospital care in a five-year period. The relationship between a trauma recidivist's perception of recurrent injury and orientation towards a threat remains unclear.

Conceptual Basis: Trauma recidivism risk factors contribute to forming an individual's PLRI. When individuals acknowledge the likelihood of recurrent injury, a specific threat orientation is formed based on their perceived risk. A person will either accept their risk for injury and take preventative action or ignore their risk and avoid preventative measures. As a result, the likelihood of TR either decreases or increases.

Designs and Methods: A quantitative cross-sectional study was conducted with Level II trauma inpatients (N = 84) in Southern California from October 2021-January 2022. Paper surveys containing sociodemographic information and three instruments were administered to participants before discharge. Clinical variables were later extracted from electronic health records.

Findings: The TR rate in this sample was 31%. The presence of mental illness (MI), the total number of MIs, depression, length of hospital stay (LOS), and the response of how likely one may experience TR were significant clinical variables associated with TR. In individuals with two or more diagnoses of MI, the odds of TR were approximately 6.5

times higher when controlling for LOS and participants' awareness of how likely they may experience TR (PLRI item 1).

Implications for Research: There are currently no instruments to measure TR risk. This study suggests the PLRI and Threat Orientation Scale (TOS) instruments are not ready to measure perceived susceptibility and threat orientations in trauma recidivism research. Further testing of the PLRI and TOS is recommended to endorse their use in future TR studies. Trauma and public health nursing researchers are prime advocates for primary injury prevention and are encouraged to facilitate this instrumentation work.

Keywords: trauma recidivism, injury perception, risk perception, threat orientation, perceived likelihood of recurrent injury, perceived susceptibility

Dedication

To my husband Adam, who patiently endured two years of long-distance marriage to support me in my pursuit of higher education.

To my parents who provided unconditional love and support and always believed I could achieve whatever I set my mind to.

To my church family and friends who prayed for me and walked with me through the ups and downs, thank you!

To Dr. Wintz for introducing me to the phenomenon of trauma recidivism.

To my participants who made this study possible by helping me generate new knowledge about injury perceptions.

And last, certainly not least, to my Lord and Savior Jesus Christ, the God of abundance who equipped me with the abilities, opportunities, resources, and amazing people who made this all possible. “Now to him who is able to do far more abundantly than all that we ask or think, according to the power at work within us” (Ephesians 3:20).

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I would like to express my utmost appreciation to my dissertation committee; Dr. Ann Mayo, Dr. Ruth Bush, Dr. Kathleen Stacy, and Dr. Michelle Hamel. Your endless encouragement, guidance, mentorship, and wisdom were instrumental in my successful completion of this research. Especially my chair, Dr. Ann Mayo. You fostered a safe environment to learn and grow and spent countless hours writing letters of recommendation for my scholarship applications, responding promptly to any of my questions, and providing in-depth feedback, all helping to improve the quality of my work. There are no words to express my gratefulness adequately. Thank you for allowing me to challenge myself with this study and grow as a nurse scientist. Dr. Bush, I am grateful for your guidance during my data analysis where I felt the full effect of gravity of having my “statistical training wheels” removed.

To the University of San Diego Hahn School of Nursing and Health Science faculty and my fellow Ph.D. colleagues- thank you for imparting your knowledge wisdom, and encouragement, “As iron sharpens iron, so one person sharpens another” (Proverbs 27:17). Thank you to Dean Georges for providing generous financial aid through the Dean’s Merit Scholarship and Research Award. Thank you to Sharp Healthcare and the Caster Institute for Nursing Excellence for recognizing the value of nursing education and providing significant scholarship support. Moreover, thank you to the National, California, and San Diego Emergency Nurses’ Association and the Golden State Nursing Foundation for repeated professional and financial aid support and to Kaiser Permanente for the provision and honor of the Deloras Jones Scholarship.

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Chapter 1

Introduction

Injuries and violence are the leading causes of death among persons aged 1 to 44 in the United States (CDC, 2020b). Indeed, over 192,000 patients in the United States die annually secondary to unintentional injuries (CDC, 2020a). Most people perceive physical injury as unpredictable, undesirable, and unwelcome, leading them to take prudent measures to prevent injury from occurring. Therefore, it is inexplicably challenging to conclude why some individuals continue with behaviors that result in recurrent injuries.

Nevertheless, Reiner et al. (1990) coined the term trauma recidivism (TR) after recognizing a high frequency of recurrent injuries among a specific patient population. Comparably, after observing a history of substantial injury among recent trauma victims, Poole et al. (1993) described trauma as a recurrent disease claiming traumatic injuries are not necessarily random events. Poole et al. (1993) further asserted that repeat trauma offenders embody a "gladiator syndrome" and are "victims of their high-risk behaviors" (p.610). The purpose of this study is to describe threat orientations and the perceived likelihood of recurrent injury of individuals who are deemed at risk for TR.

Researchers acknowledge the importance of primary and secondary intervention programs to reduce the rate of traumatic injuries and TR (Bassan et al., 2013; Cordovilla-Guardia et al., 2018; Kao et al., 2019; Keough et al., 2001; Roding et al., 2016; Rogers et al., 2014). Nevertheless, before a person at risk for TR can enter a therapeutic course of prevention or treatment, they must first identify and acknowledge their susceptibility to injury (Rosenstock, 1974), a process healthcare providers can likely influence.

Background

Trauma recidivism is a significant healthcare concern. Rates of TR have been recorded as high as 44% of emergency department admissions and sustain a high mortality incidence (Kao et al., 2019). Several sociodemographic, high-risk behavior, and injury patterns have been identified among the trauma recidivist population; however, the relationship between a trauma recidivist's perception and orientation towards the threat of injury remains unclear.

Patterns in Trauma Recidivism

Trauma clinicians and researchers acknowledge the following risk factors in TR: (a) male gender, (b) under the age of 30, (c) African American descent, (d) unemployment, (e) uninsured, (f) history of sustaining a violent injury, (g) criminal history, (h) substance abuse, and (i) presence of mental illness (Claassen et al., 2007; Cordovilla-Guardia et al., 2014; Keough et al., 2001; McCoy et al., 2013; Morrissey et al., 1991; Poole et al., 1993; Reiner et al., 1990; Wan et al., 2006). Another characteristic of TR is the timeframe of occurrence. Persons with a history of TR frequently experience a repeat injury within five years from their initial injury (Griffin et al., 2014; Morrissey et al., 1991; Poole et al., 1993; Reiner et al., 1990; Tellez et al., 1995).

Threat Orientations

Threat orientations are approaches individuals take in response to a potential threat and how they will choose to protect themselves (Thompson et al., 2006). The orientations consist of control-based, heightened sensitivity-based, optimistic-denial, and avoidance-denial. Measurements of threat orientations can provide guidance in examining a trauma recidivist's evaluation of future injury.

Perceived Likelihood of Recurrent Injury

Perceived susceptibility to recurrent injury (or perceived likelihood, or perceived vulnerability, or perceived risk) is an individual's acceptance of the subjective risks and consequences of continued injury (Rosenstock, 1974). Identifying the causal behaviors of traumatic injury may assist in awareness of actual risk, leading to increased perceptions of susceptibility to, or likelihood of recurrent injury.

Statement of the Problem

It is unknown if threat orientations or risk perceptions towards recurrent injury contribute to TR because there have been no studies to date that have examined these concepts in trauma recidivism. Despite extensive research and identification of risk markers for TR, there exists a gap in knowledge about an individual's threat orientation and perceived likelihood of recurrent injury (PLRI). Understanding a trauma victim's threat and susceptibility to recurrent injury perception is crucial before providing any education or intervention. Knowing the variation in orientations and perceptions will help healthcare providers tailor individualized interventions relevant to each trauma patient and potential trauma recidivist.

Study Purpose

Although there have been many studies addressing the risk factors and patterns of trauma recidivism, there have been no studies to date that have examined the threat orientations and risk perceptions of trauma recidivists. Therefore, the purpose of this study was to describe select sociodemographic and clinical variables, threat orientations, and the PLRI of individuals who were deemed at risk for TR.

Study Aims

Aim 1 was to describe select sociodemographic and clinical variables, threat orientations, PLRI, the likelihood of an individual's return to high-risk behavior, and TR. Aim 2 was to describe the differences in select sociodemographic and clinical variables, threat orientations, and perceived likelihood to recurrent injury between groups with and without history of TR. Aim 3 was to describe the relationships among select sociodemographic and clinical variables, threat orientations, perceived likelihood of recurrent injury (PLRI), and TR. And finally, aim 4 was to identify the odds of TR accounted for by select sociodemographic and clinical variables, threat orientations, and PLRI.

Theoretical Model

The health belief model (HBM) is commonly used in research studies to predict health behavior and therefore was the theoretical model underpinning this study. The main concepts in the HBM include: (a) sociodemographic variables, (b) perceived susceptibility, (c) perceived severity, (d) perceived benefits and barriers to taking action, (e) cues to action, and (f) likelihood of taking preventative action towards a perceived threat (Rosenstock, 1974).

Sociodemographic Variables

According to the HBM, specific sociodemographic factors, particularly educational level, are believed to indirectly affect behavior by influencing the perception of susceptibility and perceived severity of a threat (Strecher & Rosenstock, 1997). A few of the sociodemographic variables identified as risk factors for TR specifically include: (a) male gender, (b) under the age of 30, and (c) ethnic minorities.

Perceived Susceptibility of Risk

According to the HBM, perceived susceptibility to risk, or in the case of TR, recurrent injury, is an individual's opinion and acceptance of the subjective hazards of contracting a condition or experiencing a threat (Rosenstock, 1974; Strecher & Rosenstock, 1997). In TR, trauma victims may have decreased risk perception to future injury secondary to a previous head injury, a denial-based orientation, or an underlying "gladiator syndrome" (Poole et al., 1993).

Perceived Severity of Consequences

Perceived severity of consequences is an individual's assessment of the seriousness of a threat and the costs that ensue. Consequences can include death, disability, pain, and social drawbacks (Strecher & Rosenstock, 1997). Perceived severity of consequences also applies to specific repercussions of the threat and the emotional arousal that follows (Rosenstock, 1974). With regards to TR, the consequences of injury will affect the degree of severity a trauma victim perceives.

Perceived Benefits and Barriers to Taking Action

Perceived benefit of taking action is the cognitive understanding of how beneficial and effective preventative measures will be if an individual chooses to participate or engage (Rosenstock, 1974). However, the perceived benefit of taking action is heavily influenced by social norms and peer pressure. For instance, if alcohol and drugs are recognized to mitigate anxiety and depression and lead to social acceptance among the trauma recidivist population, the risk of injury is overlooked by the immediate and overwhelming perceived benefits of the negative behavior.

Perceived barriers to taking action are an individual's opinion of the tangible and psychological costs of the proposed preventative measure (Strecher & Rosenstock, 1997). Conflicting motives (i.e. inconvenience, expense, fear, anxiety, and unpleasant side effects) are common barriers individuals experience when implementing change (Rosenstock, 1974). For example, persons with a history of TR may experience fear, anxiety, or unpleasant side effects when attempting sobriety or entering rehabilitation for substance addiction.

Cues to Action

Cues to action are external stimuli that trigger a response to a condition and activate one's readiness for change (Rosenstock, 1974; Strecher & Rosenstock, 1997). Examples include how-to information, awareness promotion, reminder systems (Strecher & Rosenstock, 1997), or something as simple as a physical ache or pain or a billboard advertisement noticed while driving.

Likelihood of Taking Preventative Action Towards a Perceived Threat

Also, referred to as "self-efficacy," the likelihood of taking recommended preventative action is one's ability and confidence to carry the action out (Strecher & Rosenstock, 1997). Ultimately, perceived benefits minus perceived barriers to change will determine an individual's likelihood of behavior change. HBM concepts utilized for the purpose of this study include distinct sociodemographic variables, perceived threat, and perceived susceptibility to risk.

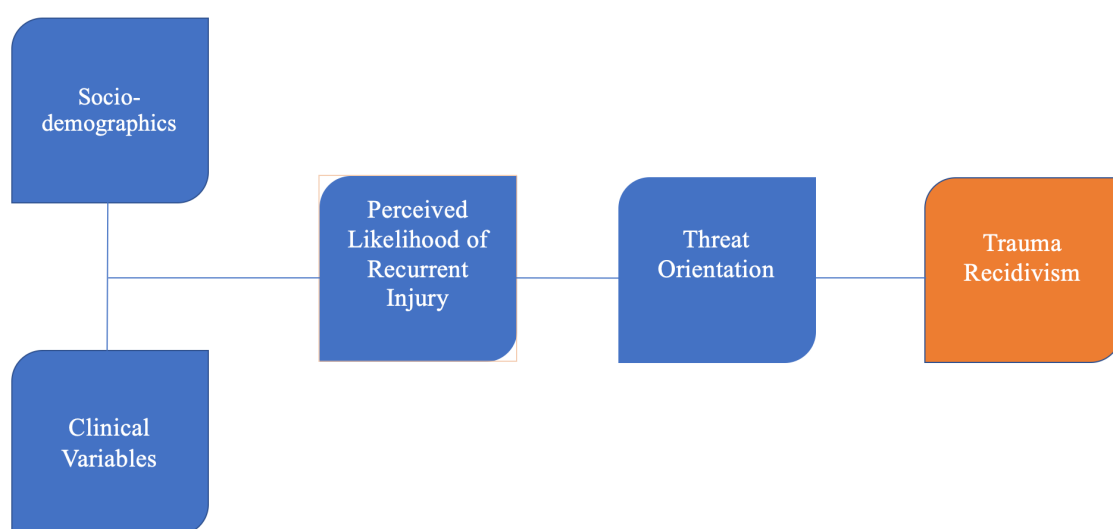
Research Conceptual Framework

This study's research conceptual framework began with the sociodemographic and clinical variables that are identified risk factors for TR. These variables contribute to

the formation of an individual's PLRI. When the likeliness of recurrent injury is acknowledged by an individual, a specific threat orientation is formed based on their perceived risk. In this stage, a person will either accept their risk for injury and take preventative action or deny and ignore their risk for injury and avoid preventative measures. As a result, the likelihood of TR either decreases or increases (see Figure 1).

Figure 1

Research Conceptual Framework



Methods Overview

This study took place at a Level II Trauma Center in Southern California and employed a quantitative cross-sectional research design with 21 independent sociodemographic and clinical variables and one dependent variable (trauma recidivism). A convenience sample ($N = 84$) of major trauma patients was recruited to participate. Inclusion criteria included: (a) being over the age of 18, (b) meeting the trauma criteria deemed by county standards (see Figure 2), (c) meeting the criteria for high-risk trauma (HRT), (d) being treated at the designated Level II trauma center, (e) being able to

respond to questions, (f) being alert and oriented to person, place, time, and situation, (g) not being impaired by sedating medications, (h) being agreeable to the informed consent, and (i) being able to speak English.

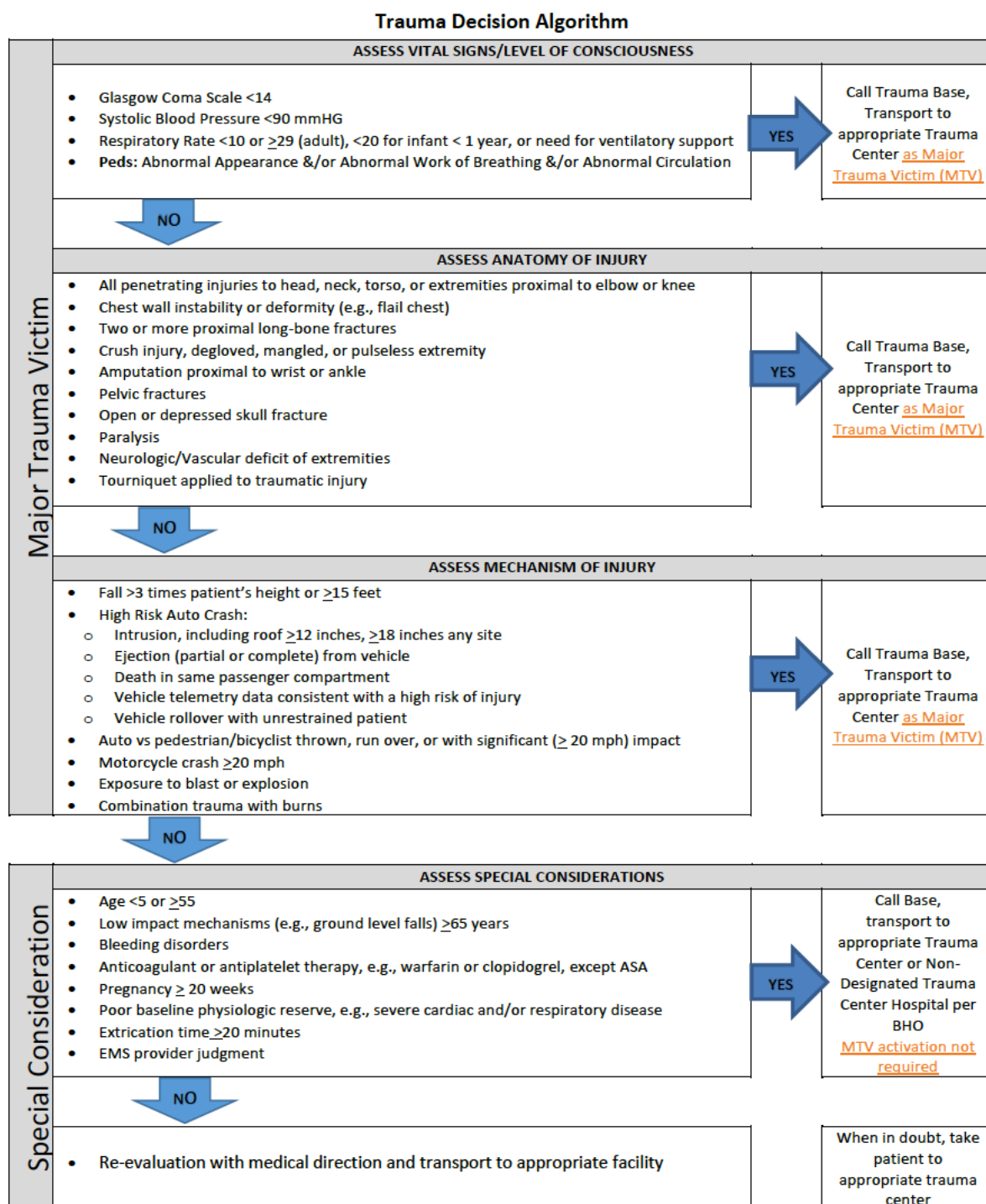
Participants were recruited from the trauma progressive care unit prior to discharge home. The two sources of data for this study were the medical record and three investigator-administered participant surveys. The two instruments administered included the 20-item Threat Orientation Scale (TOS) and the 3-item Perceived Likelihood of Recurrent Injury (PLRI). Incorporated in the investigator developed 29-item survey was a 4-item sociodemographic survey measuring highest degree of education, annual household income, shift worked, total number of hours worked per week in addition to 2-items measuring past trauma history (PTHx).

The PI collected consents before enrolling participants. The participants were permitted to exit the study at any point. No personal identifiers were collected as study data and only the PI had access to participant data.

The data were analyzed using SPSS version 28.0 software program. Descriptive and multivariate statistics were used to address the research aims. Statistical significance was defined as a p -value $< .05$.

Figure 2

Trauma Decision Algorithm



Reference. Health and Human Services Agency (2018). The algorithm applies to specific Southern Californian Level I and II Trauma Centers, including the trauma center in this study.

Study Significance

Carelessness, a lack of knowledge, and failure to realize that a risk exists lead to injury (American College of Surgeons, n.d.). This study will describe the potential role that risk perceptions of recurrent injury and threat orientations have in TR. The use of helmets and seat belts, tourniquets for bleeding interventions, safe ladder utilization, and firearm safety have been previously implemented in injury prevention campaigns. The above-mentioned physical interventions do help, but there is a gap in understanding and providing psychological-based injury prevention.

With injuries being deemed a public health problem and the leading cause of death in persons under the age of 44 in the United States (CDC, 2020b), this study was designed to identify how persons with recent injuries perceive their risk for recurrent injury. The findings of this study provide awareness of the various ways an individual perceives and responds to a threat. This awareness can allow healthcare professionals (HCP) to tailor specific injury prevention education for each patient. For example, if a patient possesses an avoidance denial-based threat orientation and experiences overwhelming anxiety with the thought of a potential threat, the HCP can address the underlying anxiety before delivering the customized education. Tailored communications crafted to appeal to everyone's threat perception/orientation style will be more effective in addressing the underlying issues of TR (Thompson and Schlehofer, 2008).

Summary

Although there have been many studies addressing the risk factors and patterns of TR, there have been no studies to date that have examined the threat orientations and risk perceptions of trauma recidivists. Addressing this gap is essential. Before intervening, a

person at risk for TR must acknowledge their high-risk behaviors and the potential association with the likelihood of recurrent injury. Without perceived threat, a trauma recidivist is less likely to participate in recommended preventative action. An injury prevention program will most likely not be accessed or utilized if a person at risk for TR does not see the value.

The purpose of this descriptive quantitative correlational study was to describe the characteristics of individuals with a history of TR, compare the relationship between threat orientations and PLRI among trauma patients, and determine the odds for TR based on threat orientations, perceived likelihood, select demographics, and clinical variables. The findings from this study may assist the HCP in tailoring appropriate warnings, education, and injury prevention education based on a trauma recidivist's threat orientation and perceived susceptibility to recurrent injury.

Chapter 2

Literature Review

Trauma recidivism (TR), or recurrent injury, is a significant healthcare concern. Rates of TR have been recorded as high as 44% of emergency department admissions and account for a high rate of mortality (Kao et al., 2019). In 2013, non-fatal injuries accrued over 3 million hospitalizations and accounted for \$456 billion in United States healthcare costs (Centers for Disease Control and Prevention [CDC], 2020a). Indeed, over 192,000 patients die annually secondary to unintentional injuries (CDC, 2020a); noting injuries and violence are the leading cause of death among persons aged 1–44 (CDC, 2020b). Most people perceive physical injury as unpredictable, undesirable, and unwelcome, leading them to take prudent measures to prevent injury from occurring. Therefore, it is inexplicably challenging to conclude why some individuals continue in behaviors that result in recurrent injuries.

Despite extensive research and identification of risk markers for TR, there exists a gap in knowledge about an individual's threat orientation and perceived susceptibility towards recurrent injury. Understanding a trauma victim's threat and susceptibility perception is crucial before providing any intervention and education. Acknowledging the variation in perceptions will help healthcare providers tailor individualized interventions relevant to each trauma patient and potential trauma recidivist.

Historical Background of Trauma Recidivism

Reiner et al. (1990) coined the term TR after recognizing a high frequency of recurrent injuries among a specific patient profile. Comparably, after observing a history of substantial injury among recent trauma victims, Poole et al. (1993) described trauma as

a recurrent disease claiming traumatic injuries are not necessarily random events. Poole et al. (1993) further asserted repeat trauma offenders embody a "gladiator syndrome" and are "victims of their high-risk behaviors" (p.610).

Patterns in Trauma Recidivism

Sociodemographic risk markers for TR include (a) young age (Alghnam et al., 2016; Harmon et al., 2019; Kauffman et al., 1998; Poole et al., 1993; Reiner et al., 1990; Roding et al., 2016); (b) male (Cordovilla-Guardia et al., 2013; Irani et al., 2014; Koleszar et al., 2016; McCoy et al., 2013; Nygaard et al., 2017; Poole et al., 1993; Roding et al., 2016); (c) racial minority (Griffin et al., 2014; Keough et al., 2001; Madden et al., 1997; Morrissey et al., 1991; Poole et al., 1993; Tellez et al., 1998); (d) lower education level (Keough et al., 2001; Mangus et al., 2004; Tellez et al., 1998); (e) single relationship status (Alghnam et al., 2016; Cordovilla-Guardia et al., 2014; Keough et al., 2001; Koleszar et al., 2016; McCoy et al., 2013); (f) lower socioeconomic status (Williams et al., 1997); (g) uninsured or Medicaid insurance (Keough et al., 2001; Koleszar et al., 2016; McCoy et al., 2013; Morrissey et al., 1991); and (h) unemployment (McCoy et al., 2013; Morrissey et al., 1991; Sims et al., 1989; Tellez et al., 1991). In summary, the stereotypical trauma recidivist is male, under the age of 30, of African American descent, with history of alcohol and substance abuse, mental illness, violent injury, or criminal history, and is uninsured and unemployed. (Claassen et al., 2007; Cordovilla-Guardia et al., 2014 ; Keough et al., 2001; McCoy et al., 2013; Morrissey et al., 1991; Poole et al., 1993; Reiner et al., 1990; Wan et al., 2006).

Trauma Recidivism 5-year Window

Persons with a history of TR frequently experience a repeat injury within five years of their initial injury (Griffin et al., 2014; Morrissey et al., 1991; Poole et al., 1993; Reiner et al., 1990; Tellez et al., 1995). In a post-mortem study, Griffin et al. (2014) used coroner data to examine the relationship between TR and homicide. After evaluating 532 homicide and 532 control cases, Griffin et al. (2014) observed a significant association between homicide and injury recidivism. For example, individuals who sustained a previous injury requiring admission to a trauma center were twice as likely to have been a victim of homicide. Griffin et al. (2014) concluded that injury peaked within five years prior to death, most commonly observed within two years of a previous assault injury.

Morrissey et al. (1991) used a window of five years for defining the recurrence rate of penetrating trauma. Remarkably, Morrissey et al. (1991) observed that 33% of penetrating trauma victims became trauma recidivists by the same penetrating mechanism within only one year of their first injury. Moreover, seminal work by Reiner et al. (1990) revealed 66% of trauma recidivist's repeat admissions occurred within a five-year period, while Tellez et al. (1995) reported an alarming 94% five-year recidivism rate.

In a study investigating previous traumatic injuries requiring hospitalization, Poole et al. (1993) noted previous traumatic injuries most likely occurred within the past five years. It is evident patients who sustain a traumatic injury, will most likely experience their second injury within a short, five-year time frame. Identifying this key time interval can assist in designing longer-term follow-up care to reduce the costly and debilitating consequences of TR.

Implications of Trauma Recidivism

The magnitude of consequences stemming from TR is impossible to translate fiscally, especially a figure that accurately represents the pain, suffering, and loss of life resulting from debilitating injury and death. While trauma is the second most costly medical condition in the United States, reimbursement rates and hospital economics may not sufficiently represent this public health crisis (Scott et al., 2017). For example, trauma centers are reimbursed over 130% by private insurance companies. In contrast, trauma centers recover less than 20% of costs when patients are uninsured (Scott et al., 2017). Unemployment and lack of insurance coverage were measured as high as 81% in TR studies (Morrissey et al., 1991). As a public interest, 93% of initial trauma admissions were paid for by taxpayers (Tellez et al., 1995). Similarly, Hedges et al. (1995) reported public funds often paid 52% of trauma recidivists' hospital charges. Conceivably, if public funds contributed to primary and secondary injury prevention programs, trauma and TR rates may decrease (Griffin et al., 2014).

Secondary Prevention

In response to increasing TR rates, several researchers and hospital teams implemented various interventional programs. Although improvements were noted in subpopulations immediately after intervention, TR rates continue to rise.

In response to a high rate of adolescent violent crime recidivism, Scott et al. (2002) developed a multiagency four-step program targeting first time violent offenders. The first stage focused on the trauma experience where the adolescent violent crime offenders (AVCOs) witnessed in-hospital resuscitations, were given tours of the morgue, and observed autopsies to gain awareness of the devastating effects of violence. The next

step of the program invited the AVCO and their family to sessions called the “Victim Impact”. Here, the AVCO and their family members were exposed to other families who lost their children to violence and learned of the extensive consequences of the AVCO’s actions. After the victim impact sessions, AVCO’s participated in a roleplaying and group therapy sessions to address aggressive emotional triggers and to practice healthy conflict resolution. Before leaving the program, each AVCO and family were given mental health referrals in their local community. Compared to the control-group of AVCO’s who received six months of court-ordered community service, the trauma experience group had a recidivism rate of only 5% compared to 33% in the control group (Scott et al., 2012).

Gomez et al. 2012 noted the inadequacy of primary prevention programs and rehabilitation resources available to persons with a history of TR. Therefore, Gomez et al. (2012) established the Project Prescription for Hope (RxH), a local community project created to reduce violent injury recidivism. This evidence-based RxH program focused on reducing the threat of repeated violent injury while also helping individuals and their families make life-changing and life-saving choices. As a result of the program, participants’ injury recidivism rate dropped by 67%.

To reduce motorcycle injury recidivism rates of nearly 45%, Irani et al. (2014) implemented secondary prevention through the concept of a “teachable moment”. As inpatients, participants completed a riding history survey along with a pre-test focusing on the risks of riding, crash causes, safe riding habits, and use of alcohol. After completing a 30-minute motorcycle safety presentation as an inpatient, participants completed an outpatient post-test after three months, indicating high retention of safety

information translating to a decreased likelihood of motorcycle crash recidivism (Irani et al., 2014).

Considering substance abuse is present in 45% of the trauma recidivist population (Keough et al., 2001), Cordovilla-Guardia et al. (2014) examined trauma risk perceptions related to alcohol, cannabis, and cocaine. Only 13% of the trauma patients who tested positive for drugs acknowledged that substance abuse contributed to their traumatic injury. Additionally, 63% of the participants who tested positive for substances reported previous trauma history (Cordovilla-Guardia et al., 2014). In response, Cordovilla-Guardia et al. (2017) evaluated the performance of a Screening, Brief Intervention, and Referral to Treatment (SBIRT) hospital program designed to treat individuals with substance abuse problems and reduce TR rates. After reporting a higher cumulative risk for TR among those who screened positive for substances, those who participated in the SBIRT program demonstrated a 52% reduction in TR rates after a 52-month follow-up.

There is extensive effort and research devoted to reducing TR. However, a clear majority of these interventions are reactive rather than proactive. Primary prevention programs targeting known risk factors for TR are recommended to screen communities and intervene before injury patterns develop.

Theoretical Model

The health belief model (HBM) is used to predict health behavior and is the theoretical model underpinning this study. The main concepts in the HBM include: perceived susceptibility, perceived seriousness, perceived benefits and barriers to taking action, cues to action, and the likelihood of taking preventative action (Rosenstock, 1974).

The HBM hypothesizes health-related action depends on (a) existence of motivation or health concern that yields relevance to the subject, (b) self-belief one is susceptible to a health threat or sequelae of that condition, and (c) self-belief that following a health recommendation will reduce the perceived threat and cost (Rosenstock et al., 1988). Rosenstock et al. (1988) added subjective and acceptable costs to the list of perceived barriers a person must overcome to follow a health recommendation. These “cost barriers” expand beyond financial expenses and can include such things as loss of (a) time by implementing preventative measures, (b) personal relationships, (c) work opportunities, and (d) social status.

Role of Health Belief Model in Trauma Recidivism

The HMB permits researchers to understand the relationship between injury (condition), select sociodemographics (social norms), consequences of injury (perceived severity), and perceived susceptibility to a perceived threat of trauma (Rosenstock, 1974). Van Horn (2005) summarized the HBM as guiding healthcare providers in recognizing which individuals perceive themselves at risk for a particular threat, what barriers individuals face in implementing preventative measures, and what external factors motivate them to change (likelihood of taking action). Identifying mental, emotional, social, environmental, and physical barriers will enable healthcare providers to deliver patient-centered care and allocate appropriate resources (cues to action).

Perceived Threat

Perceived susceptibility, perception of severity, and feelings concerning the extent of the consequences of injury all combine to create an individual’s perception of threat (Strecher & Rosenstock, 1997). To expound on threat perception, Thompson and

Schlehofer (2008) proposed three orientations an individual takes in response to a threat: control-based, denial-based, and heightened sensitivity-based. In 2011, Thompson et al. divided the denial-based threat orientation into two distinct categories: avoidance-denial and optimistic denial. Measurements of threat orientations can provide guidance in examining a trauma recidivist's evaluation of future injury.

Perceived Susceptibility of Risk

Perceived susceptibility of risk is an individual's opinion and acceptance of the subjective hazards of contracting a condition or experiencing a threat (Rosenstock, 1974; Strecher & Rosenstock, 1997). To address perceived susceptibility of risk, Strecher & Rosenstock (1997) stress the importance of defining the risk levels for an at-risk population while also personalizing the risk for specific characteristics or behavior. Using TR as an example, trauma victims may have decreased risk perception of future injury. Identifying the causal behaviors of traumatic injury may assist in awareness of actual risk, leading to increased perceptions of susceptibility to, or perceived likelihood of recurrent injury.

Perceived Severity of Consequences

Perceived severity of consequences is an individual's assessment of the seriousness of a threat and the costs that ensue. Consequences can include death, disability, pain, and social drawbacks (Strecher & Rosenstock, 1997). Perceived severity of consequences also applies to specific repercussions of the threat and the emotional arousal that follows (Rosenstock, 1974). With regards to TR, the consequences of injury will affect the degree of severity a trauma victim perceives.

Perceived Benefits and Barriers of Taking Action

Perceived benefit of taking action is the cognitive understanding of how beneficial and effective preventative measures will be if an individual chooses to participate or engage in an action (Rosenstock, 1974). However, perceived benefit of taking action is heavily influenced by social norms and peer pressure. For instance, if alcohol and drugs are recognized to mitigate anxiety and depression and lead to social acceptance among the trauma recidivist population, the risk of injury is overlooked by the immediate and overwhelming perceived benefits of the negative behavior.

Perceived barriers to taking action are an individual's opinion of the tangible and psychological costs of the proposed preventative measure (Strecher & Rosenstock, 1997). Conflicting motives (i.e. inconvenience, expense, fear, anxiety, and unpleasant side effects) are common barriers individuals experience when implementing change (Rosenstock, 1974). As a current application, Mikhail et al. (2018) described the social and physical environment barriers serving as catalysts for trauma disparities. Among those traumatically injured, injury outcomes depend on birth location, where an individual grew up, geographical occurrence of injury, and treatment location (Mikhail et al., 2018). In summation, individuals who face low socioeconomic status (SES) barriers demonstrate worse outcomes than those with higher SES.

Cues to Action

Cues to action are external stimuli that trigger a response to a condition and activate one's readiness for change (Rosenstock, 1974; Strecher & Rosenstock, 1997). Examples include how-to information, awareness promotion, reminder systems (Strecher & Rosenstock, 1997), or something as simple as a physical ache or pain or a billboard

advertisement noticed while driving. As a prompt to healthcare practitioners, Van Horn (2005) advocated for cues to action through increased injury prevention education after reporting only 17% of study participants received appropriate instruction before hospital discharge. Exposure to external stimuli, as Scott et al. (2002) introduced through the trauma experience, assisted in activating at-risk youth's readiness for change.

Likelihood of Taking Recommended Preventative Action

Also referred to as “self-efficacy,” the likelihood of taking recommended preventative action is one's ability and confidence to carry the action out (Strecher & Rosenstock, 1997). To encourage individuals to take preventative measures, Strecher and Rosenstock (1997) suggested providing personalized training, guiding preventative action, demonstrating desired behaviors, using progressive goal setting, applying positive reinforcement, and implementing measures to reduce anxiety. Ultimately, perceived benefits minus perceived barriers to change will determine an individual's likelihood of behavior change. For example, if a motorcycle crash victim perceives the emotional benefit of riding as greater than the physical consequences of injury, the likelihood of abstaining from motorcycles is doubtful.

Other Factors within the Health Belief Model

Distinct demographic, sociopsychological, and socioeconomic factors serve as catalysts to form an individual's threat perceptions and hence, indirectly influence health-related behaviors (Strecher & Rosenstock, 1997). In TR, gender, race, age, employment status, insurance coverage, criminal history, substance abuse, and education heavily influenced the incidence of repeat injury (Keough et al., 2001) and should continue to be addressed in future studies.

Trauma Recidivism

Perceived Susceptibility to Recurrent Injury

Perceived susceptibility to recurrent injury (or perceived likelihood, or perceived vulnerability, or perceived risk) is an individual's acceptance of the subjective risks and consequences of continued injury (Rosenstock, 1974). Specific personality antecedents of perceived susceptibility were identified by Gerend et al. (2004a) and included neuroticism, extraversion, optimism, worry, self-deception enhancement, internal locus of control, and cognitive heuristics. Gerend et al. (2004a) proposed personality factors influence perceptions of susceptibility to threat by affecting the threat's perceptions through cognitive heuristics. In other words, if an individual scores high in self-deception, they may use dismissive heuristics to reject a potential threat. Conversely, if the individual scores high in neuroticism, they may use obsessive and fear-driven heuristics to conceive an illusory threat. Ultimately, whether an individual with a history of traumatic injury adopts preventative measures to protect against future injury most likely depends on their perceived susceptibility to the future threat of injury (Gerend et al., 2004a).

Instrumentation

Using the key search terms, “recurrent injury,” “trauma recidivism,” “injury recidivism,” and “perceived susceptibility or vulnerability to injury,” identified the Perceived Susceptibility to Sports Injury (PSSI) (Deroche et al., 2007) as the only currently available instrument designed to measure the proposed study dependent variable. Other search results targeted injury assessments, accidents, and injuries among youth, domestic violence, and perceived susceptibility to chronic illnesses.

Deroche et al. (2007) examined perceived susceptibility to injury among rugby players by adapting an existing instrument measuring perceived susceptibility for chronic illness (Gerend et al., 2004a; Gerend et al., 2004b). The items of the PSSI measure an athlete's beliefs about their chance of being injured during their sports season, perception of susceptibility for future injury, and the chance of getting injured compared to another athlete in the same league (Deroche et al., 2007). Deroche et al. (2007) found the PSSI instrument reliable ($\alpha = .81$). Validity and strict invariance across gender were also supported by factor analysis (Gnacinski et al., 2017).

Threat Orientation

Threat orientations are approaches individuals take in response to a potential threat and how they will choose to protect themselves (Thompson et al., 2006). As discussed in the HBM, perceived susceptibility precipitates threat orientation formation and can moderate an individual's reaction toward potential risk (Stretcher & Rosenstock, 1997).

In 2006, Thompson et al. developed the threat orientation scale (TOS) to measure different threat orientations and the responses to health behavior messages. The orientations consist of control-based, heightened sensitivity-based, and denial-based approaches. The TOS proved to have good internal reliability and construct validity. Two years later, Thompson and Schlehofer (2008) expanded the TOS to four threat reactions after discovering denial orientations consisted of two subgroups: optimistic denial and avoidance denial. Recognizing various threat orientation dispositions can assist change agents in creating effective messages that communicate high vulnerability and high severity for specific groups like trauma recidivists (Thompson et al., 2011).

Control-Based

A person who possesses a control-based threat orientation (CB) is motivated by personal control and the opportunity to protect themselves from harm (Thompson & Schlehofer, 2008). Thompson et al. (2006) reported CB to be significantly correlated with health-promoting and health detecting behaviors. Comparatively, Thompson et al. (2011) noted persons with CB exhibited a strong sense of self-efficacy, realistic evaluation of personal susceptibility, inclination to take appropriate preventative action, engage in more health-promoting practices, and have a strong reaction to threat messages. Because of habitual injuries, trauma recidivists are anticipated to have a weak reaction to threat messages, have an unrealistic evaluation of personal susceptibility, and score low in the CB threat orientation.

Heightened Sensitivity-Based

Heightened sensitivity-based orientations (HSB) involve an overestimation of perceived susceptibility to threat, increased anxiety levels, overactive preventative health measures, and pessimistic expectations for health outcomes (Thompson et al., 2006; Thompson et al., 2011). The HSB approach is associated with health-promoting behaviors, and early health detection yet leaves the person still feeling vulnerable to threats (Thompson et al., 2006). On grounds of high-risk behaviors, trauma recidivists are anticipated to score low in HSB threat orientation.

Optimistic Denial-Based

An optimistic denial-based orientation (ODB) is associated with a disproportionate estimation of perceived susceptibility, self-deception, denial of information, and minimization of concern leading to a lack of preventative action

(Thompson et al., 2011). Thompson and Schlehofer (2008) defined ODB by the presence of narcissistic and overly optimistic distortions to reduce threat perception. Optimistic denial-based orientation is negatively correlated with health promotion and health detection (Thompson et al., 2006) and is projected to be positively correlated with TR.

Avoidance Denial-Based

A person with avoidance denial-based orientation (ADB) is often aware of potential threats and pessimistic about personal risk, and avoids thoughts about the threat because it induces overwhelming anxiety (Thompson & Schlehofer, 2008). As a result, ADB individuals often resort to denial about seeing self-relevance in a threat and, therefore, disregard threatening health information and fail to implement protective measures (Thompson & Schlehofer, 2008; Thompson et al., 2011). Avoidance denial-based orientations are negatively correlated with health-promoting and health detecting behaviors (Thompson et al., 2006) and are foreseeably correlated with TR.

Instrumentation

After searching the key terms, “risk perception or perceived risk,” “threat, risk, or danger,” and “injury perception,” only two instruments were discovered addressing a person’s orientation toward injury or threat; the Injury Perceptions Questionnaire (InjPQ) (Heruti et al., 2017) and the Threat Orientation Scale (TOS) (Thompson et al., 2006).

InjPQ. The purpose of the InjPQ is to measure and describe the relationships between injury perceptions, illness perceptions, and injury outcomes (Heruti et al., 2017). The InjPQ consists of 69 total items encompassing 13 perception sub-scales: (a) injury identity, (b) post-traumatic stress disorder (PTSD) symptoms, (c) injury event, (d) injury-specific emotions, (e) injured self-image, (f) positive consequences, (g)

responsibility/guilt, (h) coping, (i) time distance, (j) dependency, (k) healthy self, (l) external attributions, and (m) injury risk factors. Items are listed on a Likert scale from 1 (*not related*) to 5 (*extremely related*) (Heruti et al., 2017). The instrument demonstrated adequate reliability, with Cronbach's α ranging from 0.43 to 0.93. Construct validity was not reported. An extensive literature review did not reveal the use of InjPQ in any subsequent research.

TOS. The TOS, however, has been used and found reliable in several studies. In 2006, Thompson et al. developed the threat orientation scale (TOS) to measure different threat orientations and the responses to health behavior messages. The orientations consist of control-based, heightened sensitivity-based, and denial-based approaches. The TOS demonstrated good internal reliability and construct validity. Two years later, Thompson and Schlehofer (2008) expanded the TOS to four threat reactions after discovering denial orientations consisted of two subgroups: optimistic denial and avoidance denial. Recognizing various threat orientation dispositions can assist change agents in creating effective messages that communicate high vulnerability and high severity for specific groups like trauma recidivists (Thompson et al., 2011).

Sociodemographic Characteristics as Factors of Trauma Recidivism

Age, gender, race and ethnicity, years of education, marital status, annual income, type of insurance, zip code, and employment status are known variables to have a significant association with TR (Keough et al., 2001; Mikhail et al., 2018; Newgard et al., 2011). Substance abuse, male, under the age of 30, African American descent, unemployment, uninsured, violent injury or criminal history, and mental illness are the most prevalent traits among trauma recidivists (Claassen et al., 2007; Cordovilla-Guardia

et al., 2014; Keough et al., 2001; McCoy et al., 2013; Morrissey et al., 1991; Poole et al., 1993; Reiner et al., 1990; Wan et al., 2006). Smoking is also prevalent among TR and is closely associated with substance abuse (Koleszar et al., 2016; Weinberger et al., 2017).

Clinical Characteristics as Factors of Trauma Recidivism

Mental illness, chronic disease, mechanism of injury, length of hospital stay, time of injury, positive toxicology results, history of previous traumatic injury, and injury severity score are principal clinical variables associated with TR (Cordovilla et al., 2014; Harmon et al., 2019; McCoy et al., (2013); Reiner et al., 1990; Wan et al., 2006).

History of Mental Illness

Mental illness is recognized as an independent risk factor for unintentional injury and injury recidivism (Wan et al., 2006). Individuals with mental illness were more likely to have more falls from heights, be struck by an automobile, and have longer hospital stays (Wan et al., 2006). Similarly, Alghnam et al. (2016) reported that persons with depression were 46% more likely to become trauma recidivists than persons without depression. Among patients with orthopedic trauma, Koleszar et al. (2016) reported that 28% of identified recidivists suffered a mental illness; depression, bipolar, and suicidal ideation were the most common.

Chronic Health History

Trauma recidivists are more likely to be smokers and have a prevalence of chronic health conditions (Alghnam et al., 2016). While older adults have lower incidences of TR compared to those in a younger cohort, senescence is associated with a higher degree of injury and poorer outcomes due to comorbidities, progressive loss of functional reserve, and decreased organ function (Bassan et al., 2013). Moreover, older

adults are more likely to be injured by falls, motorcycle crashes, and stabbings (Bassan et al., 2013). In evaluating trauma patient readmissions, Petrey et al. (2015) measured medical factors associated with hospital readmission rates. Diabetes, congestive heart failure, and septicemia were significantly associated with trauma patient readmissions, with diabetes increasing the odds by 322% (Petrey et al., 2015).

Mechanism of Injury

Penetrating trauma (i.e., cutting, piercing, stabbing, gunshot wound) is more frequently associated with TR than blunt trauma (i.e., fall, motor vehicle accident, contact sports) and accounts for up to 40% of hospital trauma activations (Gomez et al., 2011; Morrissey et al., 1991). Conversely, Kaufmann et al. (1998) noted that recidivists were at no more significant risk for blunt than for penetrating injuries. Regardless of injury classification, up to 52% of trauma recidivists were injured by the exact mechanism as their initial injury (Hedges et al., 1995; Kaufmann et al., 1998; Koleszar et al., 2016) and is a phenomenon requiring attention through injury prevention programs.

Length of Hospital Stay (LOS)

Findings vary among studies examining LOS and TR. Studies show recidivists have longer hospital stays than non-recidivists (Nygaard et al., 2017; Rogers et al., 2013). In contrast, Roding et al. (2016) found recidivists to have shorter stays than non-recidivists, while Kao et al. (2019) found no difference between recidivist groups. Further investigation is required to determine if LOS is a significant variable in TR.

Time of Injury

While not addressed in previous TR research, injury time patterns are a variable to be considered in future studies. Kieltyka et al. (2016) reported that traumatic injuries increased from a low at 06:00 to a peak at midnight before trending back downwards. Between 22:00 and 02:00, incidents of injury were 266% more likely than between the early morning hours from 05:00 to 08:00. Moreover, traumatic injury incidence on Fridays and Saturdays was significantly higher than on other days of the week along with the holidays of Martin Luther King Jr. Day, Independence Day, Halloween, and New Year's Eve (Kieltyka et al., 2016).

Positive Toxicology Results

Forty-five percent (45%) of trauma recidivists tested positive for high levels of alcohol (Keough et al., 2001) and were five times more likely to be recidivists than non-substance users (Wan et al., 2006). Of the trauma patients who tested positive for an illegal substance, 87% did not relate their consumption to their present injury (Cordovilla-Guardia et al., 2014). Alcohol is the most frequently abused substance, followed by benzodiazepines and cannabis (Cordovilla-Guardia et al., 2017). Opioids are another salient driving force behind TR. Harmon et al. (2019) reported that 55% of trauma recidivists testing positive on first injury admission were also positive on their second admission. Providing alcohol and drug-related education and intervention is essential in reducing TR rates (Cordovilla-Guardia et al., 2017).

Trauma History

In the earliest TR study, Reiner et al. (1990) explored a new phenomenon viewed as “trauma recidivism.” Twenty-three percent (23%) of trauma patients had previous

trauma admission classifying them as “trauma recidivists”. Of those trauma recidivists, 66% had a recurring injury within 60 months of their first admission. Moreover, Griffin et al. (2014) examined the effect of previous traumatic injury on homicide risk and discovered those with previous traumatic injuries were 81% more at risk of becoming homicide victims than those without a history of previous injury. Additionally, Griffin et al. (2014) concluded any history of sustaining previous assault or physical battery led an individual to be 344% more likely to become a homicide victim.

Trauma history can be challenging to quantify accurately because an individual does not always return to the same trauma center they were treated for their initial injury (Kaufmann et al., 1998; Rogers et al., 2013). To better establish the incidence of TR, McCoy et al. (2013) incorporated the past trauma history concept into the general trauma history collected upon hospital admission. In this questionnaire, patients were evaluated for the mechanism of injury, injuries requiring emergency department interventions, and injuries requiring hospital admissions occurring in the previous five years. As a result, McCoy et al. (2013) discovered that registry data only captured a TR rate of 17%, while the trauma history questionnaire captured 37%, more than double the registry data.

Injury Severity Score and Abbreviated Injury Scale

As background, the Injury Severity Score (ISS) was constructed from the Abbreviated Injury Scale (AIS) and measures the severity of injury for individual trauma victims. The American Medical Association created the AIS in 1971 to provide researchers with a numerical rating for injury severity resulting from motor vehicle accidents (Krischer, 1976). Linn (1995) summarized the AIS as a numerical scale that ranges from one to six, with six equating to nonsurvivable injury. Body regions are listed

from 1 to 9 and include head, face, neck, thorax, abdomen and pelvis, spine, upper extremities, lower extremities, and unspecified. Injuries are scored (1 to 6) for each body region (1 to 9) and prove helpful for blunt traumatic injuries, but not for multisystem trauma.

Previously, the AIS served as the gold standard in calculating injury severity because it corresponded with mortality rates; however, over time the AIS proved ineffective in yielding an accurate calculation when multiple injuries occurred (Baker et al., 1974).

Baker et al. (1974) developed the ISS to provide a more accurate numerical description of multisystem trauma's overall severity. Baker et al. (1974) noted that adding or averaging the AIS scores did not create a linear relationship and therefore, did not help predict mortality. Consequently, Baker et al. investigated squaring, then adding the three highest AIS injury ratings. The three AIS values are also known as triplet values, with the highest value listed first. The summation of squares produced a nonlinear quadratic relationship which Baker et al. asserted appropriately adjusted for multiple injuries. By controlling for the severity of the primary injury, Baker et al. made it possible to measure additional injuries' effect on mortality.

In response to Baker et al. (1974), Krischer (1976) questioned the ISS's validity due to its inability to fulfill the properties and assumptions of its analytic formula. For example, Krischer asserted the ISS only calculates 55 different injury profiles, of which many gave inaccurate depictions of a patient's condition post-injury. In other words, a patient with a severe head injury (AIS = 5, 0, 0) with no other injuries would have an ISS of 25; the same ISS as a patient who had multiple, yet less severe injuries (AIS = 4, 3, 0).

Krischer suggested that adding age and past medical history would represent a patient's injury and prognosis. Nevertheless, the ISS remains the most widely accepted injury scale (Linn, 1995).

Since the development of the ISS, other versions have been created in an attempt to find a more powerful predictor of outcomes in trauma patients (Singh et al., 2011).

One version is the New Injury Severity Scale (NISS) (Osler et al., 1997), consisting of the sum of squares of the three most severe injuries, regardless of body region injured, and will either be equal to or higher than the ISS (Javali et al., 2019). Another version is the Trauma and Injury Severity Score (TRISS) (Champion et al., 1989), consisting of a combination index based on the revised trauma score (RTS), injury severity score (ISS), and patient's age (Singh et al., 2011). For reference, the RTS is a physiological scoring system used to predict death by scoring a trauma patient's Glasgow Coma Scale, systolic blood pressure, and respiratory rate (Champion et al., 1989). Each category is given a score from 0 to 4, zero equating to death. The three scores are then multiplied by a weighted coefficient and added together to obtain the total RTS. Scores can range from 0 (worst) to 7.84 (best).

Injury Severity Score Calculation. The total ISS score is derived by taking the three highest AIS scores, squaring each of those scores, and then summing those squared scores (Baker et al., 1974). Only one injury per body region is permitted in the ISS calculation (Singh et al., 2011). For example, if a patient sustained two penetrating chest wounds and a femur fracture, only one of the chest injuries would be included in the ISS calculation (see Table 1).

Injury Severity Scores and Patient Outcomes. The AIS and ISS are instruments used worldwide (or globally) as standard descriptors of traumatic injuries. These indices yield ordinal data, contribute to motor vehicle research, and improve vehicles and highways that reduce trauma secondary to accidents (O'Neill, 1979). Semmlow and Cone (1976) conducted a study of 8,852 trauma patients to examine the relationship between ISS, mortality, length of hospital stay (LOS), and percentage of significant surgery performed. Semmlow and Cone discovered the mortality rate was insignificant for ISS values 0 to 20; however, LOS more than doubled over this range of ISS values. The ISS proved to be a good indicator of hospitalization demand from accident victims and demonstrated a strong linear relationship between LOS and major surgical procedures.

Geiger et al. (2011) described the relationship between the ISS and a patient's perceived injury severity score (PPISS) through grounded theory and quantitative correlation tests. Geiger et al. collected interview data from 120 adult trauma patients. The PPISS did not correlate with the ISS. Sixty-eight percent (68%) of patients reported an injury severity greater than the ISS, while 20.8% reported an ISS equal to the actual ISS. Only 11.7% reported an ISS value lower than calculated. The results showed that patients based their perceptions on their assessments, descriptions, and the amount of pain caused by their injury. Geiger et al. suggested the differences in scores between the ISS and PPISS demonstrated two distinct scales: the ISS as a numerical grade of injury events and the PPISS as a patient's perception of their injuries in categories such as all or nothing events.

Table 1*Injury Severity Score Calculation Example*

Region	Injury Description	Abbreviated Injury Scale (AIS) Score	Square of Top 3 Highest Scores
Head	Subdural Hematoma	3	9
Face	No Injury	0	
Neck	C2 Fracture	3	9
Thorax	No Injury	0	
Abdomen	Grade 5 Splenic Laceration	4	16
Spine	No Injury	0	
Upper Extremity	Humerus Fracture	2	
Lower Extremity	No Injury	0	
External and Other	No Injury	0	
AIS Score	Severity	Injury Severity Score (ISS)	34
1	Minor	1-8	Minor
2	Moderate	9-15	Moderate
3	Serious	16-24	Serious
4	Severe	25-49	Severe
5	Critical	50-74	Critical
6	Unsurvivable	75	Maximum

Note: Adapted from Linn (1995).

Summary

Although there have been many studies addressing the risk factors and patterns of TR, there have been no studies to date that have examined the threat orientations and risk perceptions of trauma recidivists. Addressing this gap is essential. Before intervening, a person at risk for TR must acknowledge their high-risk behaviors and correlation with the likelihood of recurrent injury. Without perceived threat, a trauma recidivist is less likely to participate in recommended preventative action. An injury prevention program will most likely serve as a barrier if a person at risk for TR does not see the value. Knowing a

trauma recidivist's threat orientation and risk perception will assist healthcare providers in tailoring appropriate warnings, education, and interventions.

Chapter 3

Methodology

This chapter includes a description of the study purpose, specific aims, design, population sample, instrumentation, data collection, and analytic procedures.

Study Purpose

This study employed a quantitative cross-sectional research design with 21 independent sociodemographic and clinical variables and one dependent variable (trauma recidivism). The purpose of this study was to describe select sociodemographic and clinical variables, threat orientations, and the perceived likelihood of recurrent injury (PLRI) of individuals who were deemed at risk for trauma recidivism (TR).

Specific Aims

Aim 1: To describe select sociodemographic and clinical variables, threat orientations, PLRI, and presence of TR.

Aim 2: To describe the differences in select sociodemographic and clinical variables, threat orientations, and PLRI between groups with and without a history of TR.

Aim 3: To describe the relationships among select sociodemographic and clinical variables, threat orientations, PLRI, and TR.

Aim 4: To identify the odds of TR accounted for by select sociodemographic and clinical variables, threat orientations, and PLRI.

Research Design

A descriptive quantitative correlational design was used for this study. Data included researcher administered instruments as well as sociodemographic and clinical data extracted from hospital electronic health records (EHR).

Setting

The setting of this study was a 650-bed Southern California Level II trauma center. In May 2021, there were over 300 trauma activations at this trauma center. This trauma center serves a specific section of the county which covers 1,246 square miles and includes a population of 464,125 (Schoenheit, 2016) with a majority between the ages of 45-64 (26.7%), female (50.8%), White (57.3%), married (48.5%), and having education of high school, or less (38.6%) (Live Well San Diego, 2020; San Diego County, 2013).

Regional residents recorded an income average of \$23, 828 per year with 7.1% reporting unemployment in 2016 (Live Well San Diego, 2020). Those aged between 18 to 64 lacked health insurance coverage (17.5%) in 2015, with ages 18 to 34 most likely to be uninsured (46.4%). Alcohol and drug use was reported to be among the top health problems in 2016 along with a cigarette smoking rate of 15.3% (Live Well San Diego, 2020).

Participant recruitment began in October 2021 and commenced when the goal minimum sample size (84) was achieved in January 2022. The specific location of participant recruitment and data collection took place in the trauma progressive care inpatient unit.

Sample

This study used a convenience sample. Participants were major trauma victims who sustained a high-risk injury mechanism and were treated at and admitted to the designated Southern California Level II trauma center for hospitalization. Participants were recruited and data collected before participants were discharged home from the trauma progressive care unit.

Inclusion Criteria

Participants incurring traumatic injuries from high-risk behavior or mechanism were included in this study. For the purpose of this study, *high-risk behavior* or *high-risk injury mechanism* is defined as activities or conduct that place a person at a higher risk for injury than the standard day-to-day activities. Major trauma patients were eligible to participate in this study if they (a) were over the age of 18, (b) met trauma criteria deemed by county standards (see Figure 2), (c) met the criteria for high-risk behavior or mechanism, (d) were treated at the designated Level II trauma center, (e) were able to respond to questions, (f) were alert and oriented to person, place, time, and situation, (g) were not impaired by sedating medications, (h) were agreeable to the informed consent, and (i) spoke English.

Exclusion Criteria

Patients incurring traumatic injuries not involving high-risk behavior were excluded from this study. For example, participants incurring injuries from ambulatory ground-level falls were excluded. Additionally, participants sustaining injuries from car accidents who were not under the influence of any drug or alcohol substance at the time of the accident, or who were not demonstrating reckless behavior, were excluded from the study (reckless behavior was determined by the PI after analyzing the trauma surgeon's dictation note). Ambulating and operating a car are routine activities that do not capture the high-risk behavior this study is designed to measure. Lastly, patients incurring traumatic injury from a suicide attempt were also excluded due to the intentional nature.

Sample Size

The sample size was calculated using G*power version 3.1.9.7. A Cohen's effect size of 0.3, an alpha of $p = .05$, and a power of .80 were selected to calculate the minimum sample size needed for two-tailed tests of association, tests of comparison, and logistic regression. The largest minimum sample size calculated was 84 and was the final sample size for this study.

Variables and Operational Definitions

Dependent Variable

Trauma recidivism is defined as more than one traumatic injury requiring hospitalization within a five-year time frame (McCoy et al., 2013). For further clarification, hospitalization is an inpatient care admission after sustaining a traumatic injury requiring further evaluation and treatment. In this study, a sample of major trauma victims was evaluated for TR. A major trauma victim is an individual with severe injury after a significant mechanism and is illustrated in the algorithm in Figure 2 (Health and Human Services Agency, 2018). High-risk behavior or mechanism included, but were not limited to, motorcycle crashes, motor vehicle accidents involving substance abuse or reckless behavior, all-terrain vehicle accidents, horse-related accidents, falls from a height greater than 15ft, sports-related injuries, skateboard accidents, assaults, gunshot wounds, stabbings, and other penetrating trauma-related injuries.

For the purposes of this study, TR was measured by the presence of traumatic injury requiring hospitalization in the past five years. A past trauma history (PTHx) questionnaire (see Figure 3) was used to collect the TR information and was embedded within the 29-item survey.

Figure 3

Past Trauma History Questionnaire

Please circle yes/no

If yes, indicate how many times and which mechanism caused your most serious injury

1. In the last 5 years, have you been admitted to the hospital for an injury?

Yes No If yes, how many times? _____

Car accident / Motorcycle accident / Shot, beaten, stabbed, or other assault / Fall /

Work or industrial accident / Other accident/trauma _____

2. In the last 5 years, have you been evaluated and sent home from an emergency department for an injury?

Yes No If yes, how many times? _____

Car accident / Motorcycle accident / Shot, beaten, stabbed, or other assault / Fall /

Work or industrial accident / Other accident/trauma _____

Reference. McCoy et al. (2013).

Independent Variables

This study's independent variables included a combination of sociodemographic and clinical variables, PLRI, and threat orientation items.

Sociodemographic Characteristics. Sociodemographic characteristic variables were defined as: (a) age, (b) gender, (c) ethnicity, (d) highest level of education, (e) marital status, (f) annual household income, (g) type of insurance, (h) zip code converted to geographical region, (i) employment status, (j) total hours worked per week, (k) type of shift worked, (l) smoking status, and (m) history of traumatic injury requiring hospitalization in the past five years.

Clinical Characteristics. Clinical characteristic variables were defined as: (a) type of mental illness, (b) number of mental illnesses, (c) number of chronic diseases, (d)

mechanism of injury (MOI), (e) time of the day of injury, (f) day of the week of injury, (g) Injury Severity Score (ISS), and (h) type and quantity of toxicology results. For further clarification, ISS is a medical score used to classify trauma severity; a major trauma is defined as an ISS greater than 15 (Baker et al., 1974). The ISS is generated using the Abbreviated Injury Score (AIS) instrument. The AIS is a numerical scale that ranges from 1 to 6, with six equating to nonsurvivable injury. Body regions are labeled 1 to 9 and include the head, face, neck, thorax, abdomen and pelvis, spine, upper extremities, lower extremities, and unspecified (Linn, 1995). Each injury is assigned an AIS severity score. The total ISS score is derived by taking the three highest AIS scores, squaring each of those scores, and then summing those squared scores (Baker et al., 1974). Only one injury per body region is allowed (Singh et al., 2011). For example, a patient with a severe head injury and no other injuries (AIS = 5, 0, 0) would have an ISS of 25, the same ISS as a patient who had multiple yet less severe injuries (AIS = 4, 3, 0). The ISS will be used as the measure for the injury severity variable in this study, and the ISS score will be obtained by the PI from the trauma registry (see Table 1).

Table 1*Injury Severity Score Calculation Example*

Region	Injury Description	Abbreviated Injury Scale (AIS) Score	Square of Top 3 Highest Scores
Head	Subdural Hematoma	3	9
Face	No Injury	0	
Neck	C2 Fracture	3	9
Thorax	No Injury	0	
Abdomen	Grade 5 Splenic Laceration	4	16
Spine	No Injury	0	
Upper Extremity	Humerus Fracture	2	
Lower Extremity	No Injury	0	
External and Other	No Injury	0	
AIS Score	Severity	Injury Severity Score (ISS)	34
1	Minor	1-8	Minor
2	Moderate	9-15	Moderate
3	Serious	16-24	Serious
4	Severe	25-49	Severe
5	Critical	50-74	Critical
6	Unsurvivable	75	Maximum

Note: Adapted from Linn (1995).

Perceived Susceptibility and Perceived Likelihood. Perceived susceptibility is defined as a person's acceptance of the subjective risks to a threat (Rosenstock, 1974).

The Perceived Likelihood of Recurrent Injury (PLRI) instrument was used in this study to measure perceived susceptibility.

Threat Orientation. Threat orientation is defined as an individual's perception of susceptibility to a threat. Threat orientation was measured in this study by the Threat Orientation Scale (TOS), which consists of four dispositional threat responses: control,

heightened sensitivity, avoidance denial, and optimistic denial (Thompson & Schlehofer, 2008).

Study Methods

Instruments

Two instruments were administered in this study and included the Threat Orientation Scale (TOS) (see Figure 4) and the Perceived Likelihood of Recurrent Injury (PLRI) (see Figure 5). For an overview of all instruments and data collection forms, see the psychometric matrix table in Table 2.

Figure 4

Threat Orientation Scale

Instructions:

We are interested in how you deal with information about harm that could come to you.

For example, when you hear about:

- a health problem that you may be at risk for;
- a new public danger;
- the risk of being a victim of crime; or
- the threat of terrorist attacks.

For each of the following, rate how much that approach or attitude describes you.

Control-based Items:

	Not at all like me						Very much like me
When I hear that my health is at risk, I try to actively work to decrease my risk in order to alleviate my concerns.	1	2	3	4	5	6	7
Working to decrease health risks helps me to feel less vulnerable to those risks.	1	2	3	4	5	6	7
When presented with a dangerous risk, it eases my concern if I work to decrease the risk.	1	2	3	4	5	6	7
When I sense that my safety is in danger, I find a course of action that would lead me to feel safe again.	1	2	3	4	5	6	7
One of the rules in my life that I follow is that in order to be free of worry, one must be proactive and tackle life's problems head on.	1	2	3	4	5	6	7

Figure 4 (continued).**Heightened Sensitivity Based Items:**

	<i>Not at all like me</i>						<i>Very much like me</i>
I am the type of person who worries extensively over a threatening situation.	1	2	3	4	5	6	7
It is my nature to feel as if I'm more vulnerable to certain dangers, try to overcome them, and still feel unsafe after taking some precautions.	1	2	3	4	5	6	7
I sometimes feel overwhelmed trying to protect myself from all the possible dangers in life.	1	2	3	4	5	6	7
No matter what I do to feel more secure, I frequently worry about my safety.	1	2	3	4	5	6	7
I feel that despite everything that I've done to avoid danger, it is not enough.	1	2	3	4	5	6	7

Optimistic Denial Based Items:

	<i>Not at all like me</i>						<i>Very much like me</i>
I rarely think about bad things happening to me.	1	2	3	4	5	6	7
If something bad happens to me, I will address it then, but it is not worthwhile to worry about what could happen.	1	2	3	4	5	6	7
There is no point in worrying about possible threats when they might not even happen to me.	1	2	3	4	5	6	7
I focus on the good things that happen to me, not the negative.	1	2	3	4	5	6	7
In general, I do not worry about threats to my personal safety.	1	2	3	4	5	6	7

Figure 4 (continued).

Avoidance Denial Based Items:							
	<i>Not at all like me</i>						<i>Very much like me</i>
I would rather not hear about health or safety risks that may affect me.	1	2	3	4	5	6	7
When I hear of news reports of health threats, I tend to ignore them because they are too stressful.	1	2	3	4	5	6	7
I tend to avoid information that I may be at risk for health problems.	1	2	3	4	5	6	7
Even if true, I would not want to hear bad news concerning my well being.	1	2	3	4	5	6	7
Hearing information about threats makes me more stressed, so I avoid it.	1	2	3	4	5	6	7

Scoring:

Control-based, heightened sensitivity-based, optimistic denial-based, and avoidance denial-based scores are calculated for each participant by calculating the mean score for each subscale.

Reference. Thompson and Schlehofer (2008).

Figure 5*Perceived Likelihood of Recurrent Injury*

1. In the next 5 years, how likely do you believe you will experience another injury requiring a hospital visit?

0 = no likelihood	0	1	2	3	4	5	6	7	8	9	10	10 = Strong likelihood
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2. In the next 5 years, how likely do you believe you will experience an injury requiring a hospital visit compared to another person engaging in the same activity that led to your most recent injury?

0 = no likelihood	0	1	2	3	4	5	6	7	8	9	10	10 = Strong likelihood
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3. In the next 5 years, how likely are you to return to the activity that led to your most recent injury?

0 = no likelihood	0	1	2	3	4	5	6	7	8	9	10	10 = Strong likelihood
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Note. Adapted from the PSRI based on cognitive interview feedback.

Table 2*Instrument Psychometric Matrix Table*

Author and Year	Version Numbers	Brief Description of Sample and Characteristics	Names of Subscales and Number of items for Each Subscale	Reliability for the Instrument	Validity for Entire Instrument Subscale	Reliability for Each Subscale
Adapted from Deroche (2017) Perceived Likelihood of Recurrent Injury Scale	Sports version: (Perceived Susceptibility to Sports Injury) Generic Version: Perceived Susceptibility to Recurrent Injury Final Version: Perceived Likelihood of Recurrent Injury	A general community convenience sample of 13 participants, aged 18 or older who experienced a traumatic injury within the past 5 years. Mean age is 47.	N/A	N/A	A cognitive interview analysis was used to reconstruct the generic version to the final version. t-tests were used to compare the difference in mean scores between the PSRI and PLRI: Item 1) $t(6) = 1.33, p = .23$ Item 2) $t(6) = 2.10, p = .08$ Item 3) $t(6) = -1.29, p = .24$	N/A
Thompson et al. (2006), (2008), and (2011)	20-item short form	20 item (2011) $n=200$ Female = 46% Male = 49% Declined = 5% 88% Caucasian Age range 20-85 (2008) Study 1 $n=1267$ 50% male/female Ages 18-97; 78.1% white; 8.3% black Study 2 $n=319$; Ages 18-77 47% female, 53% male 87% white	The Threat Orientation Scale short-form has four subscales and five items each; 1-7 Likert scale	(2008) Internal consistency of each 20-item resultant measure (0.87)	(2006) Construct Validity CB associated with health promotion ($r=0.56$; $p<0.001$) and health detection behaviors ($r=0.47$; $p<0.001$) HSB association with health promotion ($r=0.25$; $p<0.10$); health detection ($r=0.23$; $p=ns$) DB association with health promotion/health detection ($r= -0.28$; $p<0.10$; $r= -0.21$; $p=ns$) Scale Intercorrelations HSB correlation with use of CB ($r= 0.14$) and with DB	(2008) Denial Scales (0.87) (2011) Internal consistency reliability was determined by calculating the Cronbach's alpha for each subscale = 0.83; 0.89; 0.81; 0.84
McCoy et al. (2013)	N/A	N= 4,971 trauma patients 75% male 62% white 36% unemployed 26% uninsured 90% unmarried	2 –items Self-report included in the Participant Socio-demographic Questionnaire	N/A	N/A	N/A
Trauma Recidivism History	N/A	Education Annual Income Hours worked per week Shift hours Trauma history	6- items Self-report	N/A	N/A	N/A
Participant Socio-demographic Questionnaire	N/A	Age, Gender, Race/ Ethnicity, Marital Status, Employment Status, Zip Code, Insurance type, Mechanism of Injury, Injury Severity Score Days of Hospitalization Toxicology results Past Medical History	19- items Extracted from EHR	N/A	N/A	N/A
Principle Investigator Clinical Variable Form	N/A					

Note. Includes sociodemographic survey and clinical characteristic data forms.

Threat Orientation Scale

Items and Scoring. There are three different versions of the TOS. The original version is 30-items with three subscales: control-based (CB) (10-items), heightened sensitivity-based (HSB) (10-items), and denial-based (DB) (10-items). After psychometric testing and principal component analysis, the DB items were found to have two separate components. As a result, the 20-item short-form was created and contains two of the original subscales, and the newly divided DB subscale: optimistic denial-based (ODB) (5-items), avoidance denial-based (ADB) (5-items), (CB) (5-items), and (HSB) (5-items). There is also a 40-item long form containing the same subscales as the short form but includes a total of 10-items per subscale. The long form has not been psychometrically tested and consequently is not known to be reliable or if the data generated by this version is valid. Therefore, the 20-item short form was used for this study.

The TOS items are scored on a Likert scale from 1 (not at all like me) to 7 (very much like me). Subscale scores are calculated for each participant by calculating a mean score for each subscale (Thompson et al., 2011). There is no total score for the instrument. A high mean score for a subscale represents a strong relationship with the corresponding threat orientation. Conversely, a low mean score indicates a weak relationship (see Figure 4).

Reliability and Validity. The TOS has been determined to be reliable and produce valid data among college students, adults with children, and individuals among a nationally representative sample. Thompson et al. (2008) used a nationally representative sample ($n = 319$) to examine the psychometric properties of the threat orientation scale and the relationship between the orientations and the responses to a variety of threats and found the internal consistency high ($\alpha = 0.87$). Using results representing chemical exposure threat orientations, Thompson et al. (2011) reported good internal reliability for each subscale (CB, HSB, ODB, and ADB) on the 20-item short-form version ($\alpha = 0.83, 0.89, 0.81, 0.84$).

Thompson et al. (2006) also evaluated the construct validity of the TOS. Control-based orientations were correlated with health promotion ($r = 0.56; p < .001$) and health detection behaviors ($r = 0.47; p < .001$). Heightened sensitivity-based orientations were also correlated with health promotion ($r = 0.25; p < .10$) and health detection ($r = 0.23; p = ns$). Denial-based associations with negatively correlated with health promotion and health detection behaviors ($r = -0.28; p < .10; r = -0.21; p = ns$). In summary, the reliability is stronger than the validity of the TOS.

Injury Perception Measure

In the absence of an instrument specifically designed to measure a major trauma patient's perception of future injury susceptibility after experiencing an injury, the Perceived Susceptibility to Sports Injury (PSSI) (see Figure 6) was administered. The PSSI measures perceptions of future injury specifically among rugby athletes. Therefore, the PSSI instrument was adapted to create the Perceived Susceptibility to Recurrent Injury (PSRI) instrument (Figure 7) for use in a general sample. Next, the new content of

the PSRI instrument was evaluated through cognitive interviewing with a sample of trauma patients. Additional changes were made to create the final version, the Perceived Likelihood of Recurrent Injury (PLRI) (Figure 5). Details of changes are provided below.

Figure 6

Perceived Susceptibility to Sports Injury

Item	Scoring
1. What do you believe is the chance that you will get an injury during your sport season?	1 = very low chance 5 = very high chance
2. How susceptible do you feel you will get an injury during your sport season?	1 = not at all susceptible 5 = very susceptible
3. What do you believe is the chance that you will get an injury during your sport season in terms of percentages?	1 = less than a 10% chance 5 = 100% chance
4. What do you believe your chances are of getting an injury during your sport season compared with other players in your league?	1 = a lot lower 5 = a lot higher

Reference. Deroche et al. (2007).

Original Perceived Susceptibility to Sports Injury. The PSSI was designed to measure an athlete's belief about his/her chance of being (a) injured during a sports season, (b) perception of susceptibility for future injury, and (c) chances of getting injured compared to another athlete in the same league (Deroche et al., 2007). Figure 6 shows the 4-item measure. Deroche et al. (2007) found the PSSI reliable ($\alpha = .81$). Factorial validity and strict invariance across gender were also supported by factor analysis (Gnacinski et al., 2017).

Perceived Susceptibility to Recurrent Injury. With its ability to reliably measure perceived susceptibility to sports injury among athletes, the PSSI was adapted by the investigator for use in a sample of traumatic injury patients. The adapted instrument was titled the Perceived Susceptibility to Recurrent Injury (PSRI) (Figure 7). The process of adaptation involved multiple steps and this work was partial fulfillment of a doctoral course.

Figure 7

Perceived Susceptibility to Recurrent Injury

Item	Scoring										
1. What do you believe is the chance that you will get another injury in the next 5 years?	0	1	2	3	4	5	6	7	8	9	10
2. How susceptible do you feel you will get an injury in the next 5 years?	0	1	2	3	4	5	6	7	8	9	10
3. What do you believe your chances are of getting an injury during the next 5 years, compared to someone else?	0	1	2	3	4	5	6	7	8	9	10
4. What are the chances you will return to the activity that lead to your recent injury in the next 5 years?	0	1	2	3	4	5	6	7	8	9	10

(0= no chance/not susceptible; 10= definitely a chance; definitely susceptible)

Note. Adapted from Deroche et al. (2007).

First, words like “players”, “sports season”, and “league” were changed to capture a generic population like “another person” and “in the next five years”. The measurement scale was also modified from a range of 1 to 5, representing the percent of chance and susceptibility to injury, to a range from 0 to 10 representing a more variable response scale from *no chance* and *not susceptible* to *definitely a chance* and *definitely susceptible*.

Second, the adapted PSRI was administered to a general community sample ($n = 13$) to measure perceived susceptibility to recurrent injury among patients who incurred an injury in the past five years. Participant feedback revealed that the type of injury needed specific inclusion/exclusion criteria. For example, participants who experienced injuries from ground-level falls or sustained injuries from car accidents secondary to being struck by another vehicle demonstrated difficulty answering the item about returning to the activity that led to their most recent injury. Two participants reported feeling that their accidents were “out of their control” and expressed difficulty in calculating chances of recurrent injury because their most recent injury “was not my fault,” and that they were not “a risky person.”

Third, a subset of the larger sample ($n = 12$) completed an additional evaluation of the adapted instrument. This process involved each participant completing the PSRI instrument and answering questions regarding the clarity and ease of use of the PSRI items and measurement scale. These interviews were recorded and transcribed. Initially, the cognitive interviewing process revealed that participants expressed concerns about: (a) some items felt “too subjective,” (b) the phrase “someone else” should be “better clarified,” and (c) “an injury” should be clarified using the phrase “same injury or “different injury,” (d) Item 2 was too similar to Item 1, and (e) “in the next 5 years” should be added to the beginning of the question to orient the participant to the time frame of the question. Next, a secondary review of the 12 transcripts was completed. Most participants were observed to have used the terms “likely, likelihood, and unlikely” to either express their chances of injury or when clarifying the question.

Fourth, the following changes were made to the adapted instrument: (a) to create more objectivity, the ‘type of injury’ was clarified by adding the word “same” before the word injury, (b) to specify “someone else”, “person engaging in the same activity that led to your most recent injury was added to the Item 3, (c) Item 2 was removed from the PSRI for the similarity it had to Item 1, (d) the time frame, “in the next 5 years” was moved to the beginning of each question to orient each participant to the timeframe for each item, and (e) the word “chance” was replaced with “likelihood.”

Fifth, once revisions were complete, all participants were recontacted to complete the adapted instrument and undergo a second cognitive interview. Fifty-four percent (54%) of the participants completed both the survey and second cognitive interview. To test if there were significant changes between the PSRI to the PLRI, a paired t-test was performed on each item ($n = 3$). There were no significant changes in scores between the items of the PSRI and the PLRI: Item 1 $t(6) = 1.33, p = .23$; Item 3 $t(6) = 2.10, p = .08$; and Item 4 $t(6) = -1.29, p = .24$. Each of the participants who participated in the second cognitive interview concluded that the new instrument was, “better without the second question,” and “the word ‘likely’ is better.” Another participant remarked, “the original questions were too direct, and the word “likely” seems “more like a feasible probability.” Participants also felt the adapted PLRI survey was, “more clear and detailed,” and that the new likelihood anchors “made sense.”

Perceived Likelihood of Recurrent Injury. The resulting PLRI is a 3-item instrument that measures the perceived likelihood of recurrent injury. Scores can range from 0 to 30. A total score is calculated for the PLRI by summing the responses for all three items (see Figure 5).

Protocol and Procedures

Once participants were screened for eligibility, met all inclusion criteria, and signed the study consent, data acquisition began.

Recruitment

Identifying Potential Participants

Eligible participants were identified by the PI through the trauma log that is generated through the hospital's electronic health record (see Table 3). The trauma log was used to identify the patient's alias trauma name, date of birth, visit number, mechanism of injury (MOI), and admission location. The visit number was required to access the patient's electronic health record. This information was used to screen participants for eligibility (age, MOI, and level of admission). No paper documents were printed.

Table 3*Hospital Trauma Log Book*

TRAUMA LOG BOOK HOSPITAL ED							06/16/21 10:30
ARRIVAL DT/TM	PATIENT NAME	DOB	AGE	SEX	MRN	BILLING	TRAUMA STATUS
DEPART DT/TM	AKA	REASON FOR VISIT					
DISCH DISPOSITION	INSURANCE	PHYSICIAN	PATIENT TYPE			ADMIT SOURCE	
06/16/21	Kansas, Z210879	01/23/2000	21 Years	Male	01010110	99999999	Alpha with critical care time
06/16/21	Parker, Joseph	TRAUMA-STABBING					
SICU	COMM	Webster, MD, Scott	(OPZ)	Trauma – OP		Emergency	
06/16/21	Louisiana, Z210880	03/20/1965	56 Years	Female	01010112	77777777	Bravo with critical care time
06/16/21	Apple, Betty	TRAUMA-MVA					
PCU	HMONC	Webster, MD, Scott	(OPZ)	Trauma – OP		Emergency	
06/16/21	Morocco, Z210881	12/05/1984	37 Years	Male	01010113	44444444	Alpha with critical care time
06/16/21	Fuentes, Jose	TRAUMA-MCC					
SICU	CONT	Webster, MD, Scott	(OPZ)	Trauma – OP		Emergency	

Note. All data in this example are fictitious.

Contacting Potential Participants

The PI consulted the primary nurse to assess if each potential participant met the eligibility requirements of being: (a) English speaking, (b) oriented to person, place, and time, and (c) not under the effects of sedating medications. When all inclusion criteria were met, the PI approached the potential participant, explained the study, and invited the potential participant to participate. When agreeable, the participant signed a protected health information (PHI) release form in addition to informed consent. Each consenting participant was assigned a unique code number that was recorded into an electronic Excel master list data sheet along with the visit number, participant's name, and zip code. This master list was kept separate from the data collection Excel sheet to protect participants'

anonymity. Both lists were protected with a strong password and were accessible only to the PI.

Data Acquisition

There were two sources of data for this study, the medical record and three investigator-administered participant surveys. The investigator collected the survey data from each participant before their release from the hospital.

Medical Record Data Collection

Participant-visit numbers were used by the PI to locate sociodemographic and clinical variables from the EHR (see items in Figure 8) and obtain the ISS from the trauma registry. Data were directly entered into an Excel data collection spreadsheet.

Instrument Data Collection

Other study data were collected using (a) sociodemographic questionnaire (SDQ) (see Figure 9), (b) Threat Orientation Scale (TOS) (see Figure 4), and (c) Perceived Likelihood of Recurrent Injury (PLRI) (see Figure 5). All three of these instruments were investigator administered.

Figure 8*Principal Investigator Electronic Health Record Data Extraction Items*

1. Age
2. Gender
3. Marital status
4. Employment status
5. Zip Code
6. Type of Insurance
7. Mechanism of Injury
8. Injury Severity Score
9. Days of hospitalization
10. Past medical history listed in EMR
11. Toxicology results (+/-)
 - ☐ Etoh level
 - ☐ Amphetamines
 - ☐ Benzodiazepines
 - ☐ Cannabis
 - ☐ Cocaine
 - ☐ Opiates
 - ☐ Oxycodone
 - ☐ PCP
 - ☐ Fentanyl

Figure 9

Participant Sociodemographic Questionnaire

1. Which of the following best describes you?
 - a. White, or Caucasian
 - b. Hispanic, Latino, or Spanish
 - c. Black or African American
 - d. Asian or Asian Indian
 - e. American Indian or Alaska Native
 - f. Middle Eastern or Northern African
 - g. Native Hawaiian or other Pacific Islander
 - h. Other race or ethnicity
 - i. Prefer not to say
2. Please circle your highest degree or level of education you have completed.
 - a. Some High School
 - b. High School
 - c. Bachelor's Degree
 - d. Master's Degree
 - e. Ph.D. or higher
 - f. Trade School
 - g. Prefer not to say
3. Please circle your annual household income?
 - a. Less than \$25,000
 - b. \$25,000 - \$50,000
 - c. \$50,000 - \$100,000
 - d. \$100,000 - \$200,000
 - e. More than \$200,000
 - f. Prefer not to say
4. If you are currently employed, how many hours do you work per week? _____
5. What time of the day do you work? Please circle the time of day you typically work
(morning, afternoon, evening, overnight)
6. In the last 5 years, have you been admitted to the hospital for an injury?
 - a. Yes / No
 - b. If yes, how many times? _____
 - c. Please circle the cause(s) for your previous injury
 - i. Car accident
 - ii. Motorcycle accident
 - iii. Shot, beaten, stabbed, or other assault
 - iv. Fall
 - v. work/industrial accident
 - vi. Other accident/trauma _____
7. In the last 5 years, have you been evaluated and sent home from an emergency department for an injury?
 - a. Yes / No
 - b. If yes, how many times? _____
 - c. Please circle the cause(s) for your previous injury
 - i. Car accident
 - ii. Motorcycle accident
 - iii. Shot, beaten, stabbed, or other assault
 - iv. Fall
 - v. work/industrial accident
 - vi. Other accident/trauma

Data Analysis

The data was analyzed using SPSS version 28.0 software program. Descriptive and multivariate statistics were used to address the following research aims. Statistical significance was defined as a p -value $< .05$.

Aim 1 was to describe select sociodemographic and clinical variables, threat orientations, PLRI, and presence of TR. Aim 1 was addressed through descriptive statistics: (a) frequency distributions, (b) percentages, and (c) measures of central tendencies.

Aim 2 was to describe the differences in select sociodemographic and clinical variables, threat orientations, and perceived likelihood of recurrent injury between groups with and without a history of TR. Aim 2 was addressed through tests of comparison: (a) Chi-Square, (b) Mann-Whitney U test, and (c) Independent t -tests.

Aim 3 was to describe the relationships between select sociodemographic and clinical variables, threat orientations, PLRI, and TR. Aim 3 was addressed using tests of association: (a) *Chi*-square, (b) Fisher's exact test, (c) Pearson r , (d) Spearman's Rho, (e) Independent t -test, (f) One-way ANOVA, (g) Kruskal-Wallis H, and (h) Mann-Whitney U test.

Aim 4 was to identify the odds of TR accounted for by select demographics and clinical variables, threat orientations, and PLRI. Aim 4 was addressed through binary logistic regression.

Protection of Human Subjects

Institutional Review Board (IRB) approval from the Level II Trauma Center's organization and from the University of San Diego was obtained before data collection.

The PI collected consent before enrolling participants, and participants were permitted to exit the study at any point. The PI protected the confidentiality of the participants and anonymity of the data by omitting personal identifiers during data collection and data analysis. Only participant-assigned code numbers were included on the data collection spreadsheet.

Participant survey responses and medical record data were entered in an Excel spreadsheet and then transferred to SPSS for analysis. Hard copy survey data were stored in a locked file cabinet behind a coded office door. Electronic data were stored in a secure computer system and protected by a strong password. Only the PI had access to these datasheets and passwords.

Participants were informed by the investigator to notify their nurse if they experienced a mental or emotional disturbance triggered by the study and that there was an available referral to the hospital social work and psychiatric evaluation team (PET). Moreover, participants were given the county's mental health hotline number in the event they experienced any mental health symptoms related to the study after being discharged from the hospital.

Summary

The purpose of this descriptive quantitative correlational study was to describe characteristics of individuals with a history of TR, compare the relationship between threat orientations and PLRI among trauma patients, and determine the odds for TR based on select demographics, clinical variables threat orientations, and PLRI.

Chapter 4

Results

The purpose of this study was to describe select sociodemographic and clinical variables, threat orientations, and the PLRI of individuals who were deemed at risk for trauma recidivism (TR). The sample ($N = 84$) consisted of major trauma victims who sustained a high-risk injury mechanism and were treated at and admitted to the designated Southern California Level II trauma center for hospitalization from October 23, 2021 to January 10, 2022. Data was analyzed using IBM SPSS statistical software version 28. The analysis describes associations of these variables on subsequent TR.

Aim 1: To describe select sociodemographic and clinical variables, threat orientations, PLRI, and presence of TR.

Aim 2: To describe the differences in select sociodemographic and clinical variables, threat orientations, and PLRI between groups with and without a history of TR.

Aim 3: To describe the relationships between select sociodemographic and clinical variables, threat orientations, PLRI, and TR.

Aim 4: To identify the odds of TR accounted for by select sociodemographic and clinical variables, threat orientations, and PLRI.

Aim 1

To describe select sociodemographic and clinical variables, threat orientations, PLRI, and presence of TR. Results for Aim 1 are reported separately for all participants and those in the subsamples of non-TR and TR categories.

All Participants' Characteristics

The researcher completed descriptive statistical analysis on the 84 participants using frequency distributions, percentages, and measures of central tendencies (see Table 4). In this sample, mean age at time of injury was 44.3 years ($SD = 17.2$). The majority of cases (72.6%) were male ($n = 61$), Caucasian (56.0%; $n = 47$), single (54.8%; $n = 46$), were non-smokers (53.6%; $n = 45$), had only completed high school or trade school (60.7%; $n = 51$), worked morning hours (53.6%; $n = 45$) with a mean of 28.4 hours per week ($SD = 22.0$), and made less than \$25,000 per year (23.8%; $n = 20$). There was a wide distribution of payors with 46.4% reporting commercial insurance or military coverage ($n = 39$), 33.3% reporting Medical or Medicare insurance coverage ($n = 28$), and 13.1 % reported no payor ($n = 17$). Most cases resided in the specific setting region associated with the hospital (33.3%; $n = 28$) followed by a more central region (19.0%; $n = 16$) and southern region (13.1%; $n = 11$). These sociodemographic characteristics of all trauma patients closely reflected the community assessment data of the specific region reported in Chapter 3.

The average length of stay for all current admissions was 6.8 days ($SD = 6.4$), with a range of 1 to 32 days. The mean Injury Severity Score (ISS) was 12.7 ($SD = 8.4$) and ranged from 1 to 54. The most common mechanism of injury was high-risk motor vehicle accidents (MVA) (e. g., car accidents) (26.2%; $n = 22$) followed by motorcycle or dirt bike accidents (21.4%; $n = 18$). Injuries occurred most frequently on weekends (Friday through Sunday) (53.6%; $n = 45$). Time of injury occurred most frequently between the hours of 06:01 and 14:00 (33.3%; $n = 23$) with the lowest incidence between the hours of 22:01 and 06:00 (27.4%; $n = 23$).

Mental illness was present in 48.8% of cases ($n = 41$) with substance abuse or addiction reported as the most prevalent (26.2%; $n = 22$) diagnosis followed by depression (17.9%; $n = 15$). Seventeen (20.2%) had two or more coexisting mental illness diagnoses. Positive toxicology results were present in 60.7% of cases ($n = 51$), with cannabis (28.6%; $n = 24$) and amphetamines (22.6%; $n = 19$) having the highest occurrence. Seventeen (20.2%) of all trauma patients had two or more substances on their toxicology report. Twenty-six (31.0%) had two or more chronic illness diagnoses.

Most participants identified with the control-based threat orientation with a mean score of 5.5 ($SD = 1.3$) and the fewest identified with avoidance denial-based threat orientation with a mean score of 2.8 ($SD = 1.5$). The average PLRI score was 9.7 ($SD = 8.4$). All clinical variables and instrument scores are shown in Table 5.

In this sample, 31% ($n = 26$) participants reported being either admitted to a hospital or treated in the ER for an injury in the past 5 years, meeting TR criteria.

Non-Trauma Recidivist Sub-Sample Characteristics

Among the 58 (69%) non-trauma recidivists the mean age at time of injury was 45.4 years ($SD = 18.2$) (see Table 4). Majority of cases (74.1%) were male ($n = 43$), Caucasian (50.0%; $n = 34$), single (67.2%; $n = 39$), were non-smokers (56.9%; $n = 33$), completed high school or less (67.2%; $n = 39$), worked morning hours (56.9%; $n = 33$) with a mean of 27.5 hours per week ($SD = 22.5$). There was a wide distribution of incomes among non-trauma recidivists with the majority making less than \$25,000 per year (27.6%; $n = 16$). Twenty-eight (48.3%) participants carried commercial or military insurance, followed by Medical or Medicare (31.0%; $n = 18$). Most cases resided in the East region (27.6%; $n = 16$) followed by Central region (20.7%; $n = 12$). These

sociodemographic characteristics of non-trauma recidivists closely reflect the selected region community assessment data reported in Chapter 3, apart from having a lower marriage percentage.

The average length of stay for non-trauma recidivists was 7.9 days (SD = 6.9) with a range of 1 to 16 days (see Table 5). The mean ISS was 13.3 (SD = 9.2) and ranged from 2 to 54. The most common mechanism of injury was high-risk MVAs (27.6%; $n = 16$) followed by motorcycle or dirt bike accidents (20.7%; $n = 12$). Injuries occurred most frequently on the weekend (Friday through Sunday) (56.9%; $n = 33$). Time of injury occurred most frequently between the hours of 16:01 and 20:00 (31.0%; $n = 18$) and 14:01 and 22:00 (31.0%; $n = 18$) with the lowest incidence between the hours of 22:01 and 06:00 (29.3%; $n = 17$).

Mental illness was present in 39.7% of cases ($n = 23$) with substance abuse or addiction (22.4%; $n = 13$) followed by depression and anxiety or panic attacks equally prevalent (10.3%; $n = 6$) followed by anxiety and panic disorder (23.1%; $n = 6$). Seven (12.1%) had two or more coexisting mental illness diagnoses. Positive toxicology results were present in 58.6% of cases ($n = 34$), with cannabis (25.9%; $n = 15$) having the highest occurrence followed by amphetamines (20.7%; $n = 12$) and alcohol (17.2%; $n = 10$). Nine (15.5%) had two or more substances on their toxicology report. Nineteen (32.8%) had two or more chronic illness diagnoses.

Most participants identified with the control-based threat orientation with a mean score of 5.6 (SD = 1.2) and the fewest identified with avoidance denial-based threat orientation with a mean score of 2.7 (SD = 1.3). The average PLRI score was 9.3 (SD = 7.7).

Trauma Recidivist Sub-Sample Characteristics

As previously mentioned, the TR rate was 31% ($n = 26$). Among these 26 individuals, there were 29 hospital admissions and 33 visits to the ER for a total of 62 injuries in the last five years. One individual recorded six hospital admissions, all related to motorcycle crashes. Another individual recorded seven visits to the ER with a combination of Jiu-Jitsu fighting and motorcycle crash injuries while another individual had five work or industrial-related ER visits.

In this TR subsample, mean age at time of injury was 41.8 years ($SD = 21.2$). Majority of cases (69.2%) were male ($n = 18$), Caucasian (50.0%; $n = 13$), single (69.2%; $n = 18$), were smokers (53.8%; $n = 14$), had only completed high school or less (65.4%; $n = 17$), worked morning hours (46.2%; $n = 12$) with a mean of 30.6 hours per week ($SD = 21.2$). There was a wide distribution of incomes among recidivists with the majority making \$50,000-\$100,000 per year (23.1%; $n = 6$). Fifty percent (50.0%; $n = 13$) had either Medical coverage or no coverage. Most cases resided in the East region (46.2%; $n = 12$) followed by Central region (19.0%; $n = 6$) and South region (13.1%; $n = 4$). These sociodemographic characteristics of trauma recidivists closely reflect the specific region community assessment data reported in Chapter 3 apart from having a higher income and smoking percentage.

The average length of stay for trauma recidivists was 4.8 days ($SD = 4.1$) with a range of 1 to 16 days. The mean ISS was 11.5 ($SD = 6.2$) and ranged from 1 to 29. The most common mechanism of injury was high-risk MVAs (23.1%; $n = 6$) and motorcycle or dirt bike accidents (23.1%; $n = 6$) followed closely by bicycles, mountain bikes, or ATVs (19.2%; $n = 5$). Injuries occurred most during the weekday (Monday through

Thursday) (53.8%; $n = 14$). Time of injury occurred most frequently between the hours of 06:01 and 14:00 (38.5%; $n = 10$) with the lowest incidence between the hours of 22:01 and 06:00 (23.1%; $n = 6$).

Mental illness was present in 69.2% of cases ($n = 18$) with substance abuse or addiction and depression equally prevalent (34.6%; $n = 9$) followed by anxiety and panic disorder (23.1%; $n = 6$). Ten (38.4%) had two or more coexisting mental illness diagnoses. Positive toxicology results were present in 65.4% of cases ($n = 17$), with cannabis (34.6%; $n = 9$) having the highest occurrence followed by amphetamines (22.6%; $n = 9$) and alcohol (22.6%; $n = 9$). Eight (30.8%) had two or more substances on their toxicology report. Seven (26.9%) had two or more chronic illness diagnoses.

Most cases identified with the control-based threat orientation with a mean score of 5.4 ($SD = 1.5$) and the fewest identified with avoidance denial-based threat orientation with a mean score of 3.1 ($SD = 1.8$). The average PLRI score was 10.7 ($SD = 9.8$).

Table 4

Sociodemographic Characteristics

Variables	Mean (SD) or N (%)			p-value
	Total Sample (N=84)	Non- Recidivist Subsample (N=58)	Recidivist Subsample (N=26)	
Age	44.3 (17.2)	45.4 (18.2)	41.8 (21.2)	.140 ^a
Gender				
Male	61 (72.6%)	43 (74.1%)	18 (69.2%)	.641 ^b
Female	23 (27.4%)	15 (25.9%)	8 (30.8%)	
Ethnicity				
Caucasian	47 (56.0%)	34 (58.6%)	13 (50.0%)	.653 ^c
African American	12 (14.3%)	7 (12.1%)	5 (19.2%)	
Hispanic/Latino	16 (19.0%)	12 (20.7%)	4 (15.4%)	
Asian or Pacific Islander	3 (3.6%)	2 (3.4%)	1 (3.8%)	
Other or prefer not to say	6 (7.1%)	3 (5.2%)	3 (11.5%)	

Table 4 (continued).

Variables	<i>Mean (SD) or N (%)</i>			<i>p-value</i>
	Total Sample (N=84)	Non- Recidivist Subsample (N=58)	Recidivist Subsample (N=26)	
Marital status				
Married	27 (32.1%)	19 (32.8%)	8 (30.8%)	1.000 ^b
Single	46 (54.8%)	39 (67.2%)	18 (69.2%)	
Highest level of education				
Some High School	5 (6.0%)	4 (6.9%)	1 (3.8%)	.808 ^c
High School or Trade School	51 (60.7%)	35 (60.3%)	16 (61.5%)	
Associates	8 (9.5%)	7 (12.1%)	1 (3.8%)	
Bachelor's	13 (15.5%)	8 (13.8%)	5 (19.2%)	
Master's	6 (7.1%)	4 (6.9%)	2 (7.8%)	
Annual household income (\$)				
<25,000	20 (23.8%)	16 (27.6%)	4 (15.4%)	.363 ^c
25,000-50,000	17 (20.2%)	12 (20.7%)	5 (19.2%)	
50,000-100,000	19 (22.6%)	13 (22.4%)	6 (23.1%)	
100,000-200,000	7 (20.2%)	7 (20.2%)	6 (23.1%)	
>200,000	5 (6.0%)	2 (3.4%)	3 (11.5%)	
Employment status				
Employed	58 (69.0%)	39 (67.2%)	19 (73.1%)	.799 ^b
Unemployed	26 (31.0%)	19 (32.8%)	7 (26.9%)	
Hours worked per week (<i>including unemployed</i>)	28.4 (22.0)	27.5 (22.5)	30.6 (21.2)	.548 ^a
Shift worked*				
Morning	45 (53.6%)	33 (56.9%)	12 (46.2%)	.111 ^b
Afternoon/ Evening/ or Varies	15 (17.9%)	7 (12.1%)	8 (30.8%)	
Type of insurance				
Commercial or Military (VA, Tricare, TriWest)	39 (46.4%)	28 (48.3%)	11 (42.3%)	.450 ^c
Medical or Medicare	28 (33.3%)	18 (31.0%)	10 (38.5%)	
Uninsured	17 (13.1%)	12 (20.7%)	5 (19.2%)	
Geographical location**				
Central	16 (19.0%)	12 (20.7%)	4 (15.4%)	
South	11 (13.1%)	9 (15.5%)	2 (7.8%)	
East	28 (33.3%)	16 (27.6%)	12 (46.2%)	
North Inland	10 (11.9%)	6 (10.3%)	4 (15.4%)	
North Coastal	2 (2.4%)	1 (1.7%)	1 (3.8%)	

Table 4 (continued).

Variables	<i>Mean (SD) or N (%)</i>			<i>p</i> -value
	Total Sample (N=84)	Non-Recidivist Subsample (N=58)	Recidivist Subsample (N=26)	
Homeless	10 (11.9%)	8 (13.8%)	2 (7.8%)	.478 ^b
Out of County/ Out of State	7 (8.3%)	6 (10.3%)	1 (3.8%)	
Smoking status				
Yes	39 (46.4%)	25 (43.1%)	14 (53.8%)	
No	45 (53.6%)	33 (56.9%)	12 (46.2%)	
History of traumatic injury requiring hospitalization in the past five years	17 (20.2%)	0 (0.0%)	26 (100%)	
History of traumatic injury requiring ER visit in the past five years	18 (21.4%)	0 (0.0%)	26 (100%)	
Total trauma recidivism rate	26 (31.0%) ^d	0 (0.0%)	26 (100%)	

Note. Two-tailed *p*-values reported. *Missing 24 participants due to unemployment (*n* = 60).

**Geographic location was not included in the statistical analysis because it violated the statistical assumption of independence; trauma centers have assigned catchment areas.

^a Independent *t*-test. ^b Pearson's *Chi*-square. ^c *Fisher's exact test*. ^d Several participants had multiple hospital admissions, visits to the ER, or a combination of both within the past five years.

Table 5*Clinical Variables*

Variables	Mean (SD) or N (%)			p-value
	Total Sample (N=84)	Non-Recidivist Subsample (N=58)	Recidivist Subsample (N=26)	
Number of chronic illness diagnoses				
0	39 (46.4%)	28 (48.3%)	11 (42.3%)	
1	19 (22.6%)	11 (19.0%)	8 (30.8%)	
≥2	26 (31.0%)	19 (32.8%)	7 (26.9%)	.486 ^a
Presence of MI ^b	41 (48.8%)	23 (39.7%)	18 (69.2%)	.012 ^{a *}
Number of MI diagnoses				
0	43 (51.2%)	35 (60.3%)	8 (30.8%)	
1	24 (28.6%)	16 (27.6%)	8 (30.8%)	
≥2	17 (20.2%)	7 (12.1%)	10 (38.4%)	.010 ^{a *}
Type of MI SA ^c or SI ^d	2 (2.4%)	1 (1.7%)	1 (3.8%)	.526 ^c
Schizophrenia or Psychosis	4 (4.8%)	3 (5.2%)	1 (3.8%)	1.000 ^e
Bipolar	4 (4.8%)	3 (5.2%)	1 (3.8%)	1.000 ^e
ADHD ^f	5 (6.0%)	2 (3.4%)	3 (11.5%)	.169 ^e
Anxiety/Panic Attack	12 (14.3%)	6 (10.3%)	6 (23.1%)	.176 ^c
Depression	15 (17.9%)	6 (10.3%)	9 (34.6%)	.012 ^{c *}
PTSD ^g	5 (6.0%)	3 (5.2%)	2 (7.7%)	.643 ^c
Substance Abuse or Addiction	22 (26.2%)	13 (22.4%)	9 (34.6%)	.240 ^a
Other	1 (1.2%)	1 (1.7%)	0 (0.0%)	.255 ^c
Positive toxicology	51 (60.7%)	34 (58.6%)	17 (65.4%)	.557 ^a
Total substances on toxicology report				
0	33 (39.3%)	24 (41.4%)	9 (34.6%)	
1	34 (40.5%)	25 (43.1%)	9 (34.6%)	
≥2	17 (20.2%)	9 (15.5%)	8 (30.8%)	.274 ^a
Type of Toxicology				
Amphetamines	19 (22.6%)	12 (20.7%)	7 (26.9%)	
Cannabis	24 (28.6%)	15 (25.9%)	9 (34.6%)	
Alcohol	17 (20.2%)	10 (17.2%)	7 (26.9%)	.959
Mechanism of Injury [†]				
High-Risk MVA ⁱ	22 (26.2%)	16 (27.6%)	6 (23.1%)	
Motorcycle or Dirt Bike	18 (21.4%)	12 (20.7%)	6 (23.1%)	
Bicycle/Mountain Bike or ATV ^l	10 (11.9%)	5 (8.6%)	5 (19.2%)	
Electric Scooter	5 (6.0%)	5 (8.6%)	0 (0.0%)	

Table 5 (continued).

Variables	Mean (SD) or N (%)			p-value
	Total Sample (N=84)	Non-Recidivist Subsample (N=58)	Recidivist Subsample (N=26)	
Fall from Height	10 (11.9%)	8 (13.8%)	2 (7.7%)	
Injury sustained from Animal	3 (3.6%)	2 (3.4%)	1 (3.8%)	
Stabbing or GSW ^m	6 (7.1%)	4 (6.9%)	2 (7.7%)	
Other Assault	4 (4.8%)	2 (3.4%)	2 (7.7%)	
Surfing or Sporting	1 (1.2%)	1 (1.7%)	0 (0.0%)	
Pedestrian vs Auto	5 (6.0%)	3 (5.2%)	2 (7.7%)	
Day of Week of Injury				
Weekday (Mon-Thurs)	39 (46.4%)	25 (43.1%)	14 (53.8%)	.361 ^a
Weekend (Fri-Sun)	45 (53.6%)	33 (56.9%)	12 (46.2%)	
Time of Day of Injury ‡				.403 ^f
0601-1400	28 (33.3%)	18 (31.0%)	10 (38.5%)	
1401-2200	27 (15.5%)	18 (31.0%)	9 (34.6%)	
2201-0600	23 (27.4%)	17 (29.3%)	6 (23.1%)	.752 ^e
LOS ⁿ	6.8 (6.4)	7.9 (6.9)	4.9 (4.1)	.015 ^{o*}
ISS ^p	12.7 (6.4)	13.3 (9.2)	11.5 (6.2)	.387 ^j
PLRI ^q Item 1	2.3 (3.1)	1.9 (2.5)	3.3 (3.9)	.095 ^o
PLRI Item 2	2.4 (2.7)	2.2 (2.4)	2.9 (3.2)	.344 ^o
PLRI Item 3	4.8 (4.4)	4.9 (4.4)	4.5 (4.4)	.716 ^o
PLRI Total Score	9.7 (8.4)	9.3 (7.7)	10.7 (9.8)	.489 ^o
TOS ^r Mean Scores				
CB ^s	5.5 (1.3)	5.6 (1.2)	5.4 (1.5)	.649
HSB ^t	3.0 (1.5)	2.9 (1.3)	3.2 (1.8)	.500 ^j
ODB ^u	4.5 (1.3)	4.6 (1.3)	4.5 (1.3)	.730 ^j
ADB ^v	2.8 (1.5)	2.7 (1.3)	3.1 (1.8)	.340 ^j

Note. * $p < .05$ two-tailed for differences between non-trauma and trauma recidivists.

† Mechanism of injury not included in statistical analyses. ‡ 6 missing data points.

^a Chi-square. ^b MI = mental illness. ^c SA = suicide attempt. ^d SI = suicidal ideation. ^e Fisher's exact Chi-square. ^f ADHD = attention deficit hyperactivity disorder. ^g PTSD = post-traumatic stress disorder. ^h N = 53. ⁱ N = 24. ^j Independent *t*-test. ^k High-risk MVA = motor vehicle accident and includes high speed, reckless behavior, positive toxicology result, and/or distracted driving. ^l ATV = all-terrain vehicle. ^m GSW = gunshot wound. ⁿ LOS = length of hospital stay. ^o Mann-Whitney U Test. ^p ISS = Injury Severity Score. ^q PLRI = Perceived Likelihood of Recurrent Injury. ^r TOS = Threat Orientation Scale. ^s CB = control-based orientation. ^t HSB = hypersensitivity-based orientation. ^u ODB = optimistic denial-based orientation. ^v ADB = avoidance denial-based orientation.

Of note, there were no significant differences between non-trauma and trauma recidivists on sociodemographic variables. However, there were significant differences

between the two groups for four clinical variables: (a) presence of mental illness ($p = .012$), (b) the number of mental illness diagnoses ($p = .010$), (c) depression ($p = .012$), and (d) length of hospital stay ($p = .012$).

In summary, there were several characteristics noted about trauma recidivists when compared to non-trauma recidivists in this study: (a) younger, (b) male, (c) Caucasian, (d) single, (e) graduated from high school or less, (f) had an annual household income \$50,000- \$200,000, (g) employed, (h) worked the morning shift, (i) held either commercial or medical insurance, (j) lived in the specific region of the trauma catchment area, (k) were smokers, (j) had a higher frequency of mental illness, and (k) had shorter hospital stays.

Aim 2

To describe the differences in select sociodemographic and clinical variables, threat orientations, and PLRI between groups with and without a history of TR.

Between-group analyses were completed by using Pearson's *Chi*-square, Fisher's exact test, Mann-Whitney U test, and Independent *t*-test (see Tables 4 and 5). In this sample, there were only four statistically significant differences between the presence and absence of TR: (a) presence of any mental illness, (b) the number of mental illness diagnoses, (c) depression, and (d) length of hospital stay (see Table 5).

Mental Illness

As displayed in Table 5 above, the presence of mental illness among trauma recidivists was statistically significant $\chi^2 (1, N = 26) = 6.29, p = .012$. There were also significant differences in the number of mental illness diagnoses between recidivist and non-recidivist groups, $\chi^2 (2, N = 26) = 9.31, p = .010$. Due to small sample sizes, a

Fisher's exact test was used to determine if there were statistically significant associations between specific mental health diagnoses and TR. Depression was the only statistically significant diagnosis ($p = .012$).

Length of Hospital Stay (LOS)

Length of hospital stay was not normally distributed; therefore, a Mann-Whitney U test was completed to determine the differences between LOS as measured by total days of hospitalization between non-trauma recidivist and trauma recidivist groups. Length of hospital stay for non-recidivists ($Md = 5.00$) were significantly higher than for recidivists ($Md = 3.00$) $U(N_{non-recidivists} = 58, N_{recidivists} = 26) = 505.00, z = -2.45, p = .014$ (see Table 6).

PLRI Items and Threat Orientation Scores (TOS)

The PLRI items were not normally distributed, therefore, a Mann-Whitney U test was completed to determine the differences between PLRI items and TR. Although the TOS score was calculated using a 1 to 7 Likert scale, there was an adequate distribution of scores to compute as a continuous variable and therefore an Independent t -test was completed (Kellar & Kelvin, 2012) to determine the differences in TOS between non-trauma recidivist and trauma recidivist groups (see Table 7). There were no significant differences between TR groups for either the PLRI items or threat orientation scores (TOS) mean scores (see Table 6 and Table 7).

Table 6*Mann-Whitney U Test Results Comparing Trauma Recidivism Groupings on PLRI Items*

PLRI Items	<i>Median</i>		<i>U</i>	<i>z</i>	<i>p</i>
	Non-Recidivist Subsample (N=58)	Recidivist Subsample (N=26)			
Item 1: In the next 5 years, how likely to you believe you will experience another injury requiring a hospital visit?	0.50	1.00	594.50	-1.63	.104
Item 2: In the next 5 years, how likely do you believe you will experience another injury requiring a hospital visit compared to another person engaging in the same activity that led to your most recent injury?	2.00	1.00	689.00	-.64	.520
Item 3: In the next 5 years, how likely are you to return to the activity that lead to your most recent injury?	5.00	3.50	753.00	-.01	.992
Total Score:	9.50	7.00	701.00	-.52	.607

Table 7*Independent t-test Results Comparing Trauma Recidivism and Threat Orientation Scale*

Threat Orientation Subscales	<i>Mean (SD)</i>		<i>t</i>	<i>p</i>
	Non-Trauma Recidivist Subsample (N=58)	Trauma Recidivist Subsample (N=26)		
Control (CB)	5.6 (1.2)	5.4 (1.5)	.458	.649
Heightened Sensitivity (HSB)	2.9 (1.3)	3.2 (3.2)	-.758	.500
Optimistic Denial (OD)	4.6 (1.3)	4.5 (1.3)	.343	.732
Avoidance Denial (AD)	2.7 (1.3)	3.1 (1.8)	-1.09	.340

Note. Degrees of freedom (df) = 82.

In summary, substantial differences existed between those with and without a history of TR. Those in the TR group were more likely to suffer from mental illness, specifically depression, and have twice as many mental illnesses as those in the non-recidivism groups. The TR group also had shorter hospital stays, spending an average of three days less than the non-recidivism group. There were no differences in TOS or PLRI items between TR groups.

Aim 3

To describe the relationships between select sociodemographic and clinical variables, threat orientations, PLRI, and TR.

Aim 3 findings will be presented in two sections. The first section presents only the relationships among the independent variables. The second section will present the relationships between the independent variables and the dependent variable.

Relationships Among the Independent Variables

Independent variables included: (a) age, (b) gender, (c) ethnicity, (d) highest level of education, (e) marital status, (f) annual household income, (g) type of insurance, (h) place of residence by geographical region, (i) employment status, (j) total hours worked per week, (k) type of shift worked (l) smoking status, (m) type of mental illness, (n) total number of mental illnesses (o) total number of chronic diseases, (p) mechanism of injury (MOI), (q) time of day of injury, (r) day of the week of injury, (s) injury severity score (ISS), (t) positive toxicology results, and (u) the total number of substances on the toxicology report.

Categorical Variables

Chi-square analyses were computed to explore the relationships among all independent categorical variables. Of note, most cross-tables had frequencies either less than five in a cell for a 2 x 2 table or more than 20% of cells had frequencies less than five in a cell for larger tables, which required the use of the Fisher's exact test. With so many comparisons, a Bonferroni correction was calculated using a .05 alpha level divided by the number of tests being performed (35) to offset the risk of a type 1 error (Kellar & Kelvin, 2012). Only significant relationships are reported below ($p \leq .001$) (see Table 8).

Marital Status. Marital status was significantly related to annual income, $\chi^2 (5, N = 84) = 25.50, p < .001$ and presence of any mental illness, $\chi^2 (1, N = 84) = 11.26, p < .001$. Those who were married had higher incomes and less presence of mental illness.

Employment Status. Employment status was significantly related to the presence of any mental illness, $\chi^2 (1, N = 84) = 11.91, p < .001$ and total number of mental illness diagnoses, $\chi^2 (2, N = 84) = 14.38, p < .001$. Those who had mental illness had significantly higher rates of unemployment.

Annual Household Income. Income was significantly related to marital status, $\chi^2 (5, N = 84) = 25.50, p < .001$ and type of insurance, $\chi^2 (10, N = 84) = 28.92, p = .001$. Married individuals had higher annual household incomes, and those with higher incomes had higher commercial or military-based insurance rates.

Type of Insurance. Type of insurance was significantly related to (a) annual household income, $\chi^2 (10, N = 84) = 28.92, p = .001$; (b) smoking status, $\chi^2 (2, N = 84) = 14.24, p < .001$; and (c) positive toxicology results, $\chi^2 (2, N = 84) = 13.08, p = .001$. Individuals with commercial or military-based insurance had higher annual household

incomes, while those uninsured had lower annual household incomes. Additionally, individuals with Medical, Medicare, or who were uninsured had significantly higher rates of smoking and positive toxicology reports than those with commercial or military-based insurance.

Smoking Status. Smoking status was significantly related to: (a) type of insurance, $\chi^2 (2, N = 84) = 14.24, p < .001$; (b) presence of any mental illness, $\chi^2 (1, N = 84) = 12.15, p < .001$; and (c) positive toxicology results, $\chi^2 (1, N = 84) = 13.90, p < .001$. Individuals who were smokers were more likely to have Medical, Medicare, or be uninsured and have higher rates of mental illness and positive toxicology reports.

Presence of Mental Illness. Mental illness was significantly related to: (a) marital status, $\chi^2 (1, N = 84) = 11.26, p < .001$; (b) employment status, $\chi^2 (1, N = 84) = 11.91, p < .001$; (c) smoking status, $\chi^2 (1, N = 84) = 12.15, p < .001$; and (d) number of mental illness diagnoses, $\chi^2 (2, N = 84) = 84.00, p < .001$. Individuals with mental illness were more likely to be single or divorced, unemployed, and be smokers.

Number of Mental Illness Diagnoses. The categorical representation of the number of mental illness diagnoses was significantly related to employment status, $\chi^2 (2, N = 84) = 14.38, p < .001$, and presence of mental illness, $\chi^2 (2, N = 84) = 84.00, p < .001$. Those with one or more mental illnesses were more likely to be unemployed.

Positive Toxicology. Positive toxicology results were significantly related to type of insurance, $\chi^2 (2, N = 84) = 13.08, p = .001$, and smoking status, $\chi^2 (1, N = 84) = 13.90, p < .001$. Individuals with a positive toxicology report were more likely to have Medical, Medicare, or be uninsured and be smokers.

Table 8*Significant Chi-square p-values for all Categorical Variables*

Variable	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18
Gender																		
Ethnicity																		
MS ^a							<.001							<.001				
Edu ^b																		
Emp ^c														<.001	<.001			
Shift																		
Income ^d			<.001						.001									
Region																		
Ins ^f							.001					<.001				.001		
DOI ^g																		
TOI ^h																		
Smoking									<.001					<.001		<.001		
# of CI ^h																		
Any MI ⁱ			<.001		<.001							<.001				<.001		
# of MI ^j					<.001									<.001				
+Tox ^k									.001			<.001						
MOI ^l																		
TR ^m																		

Note. Bonferroni correction was used to reduce the chance of a Type I error.

^a MS= marital status. ^b Edu = highest degree completed. ^c Emp = employment status. ^d Income = annual household income. ^e Region = geographic place of residence. ^f Ins = type of insurance. ^g DOI = day of injury. ^h TOI = time of injury. ⁱ MI = mental illness. ^j # of MI = categorical representation of the number of mental illness diagnoses. ^k +Tox = positive toxicology report.

^l MOI = mechanism of injury. ^m TR = trauma recidivism.

Continuous Variables

Pearson *r* and Spearman's Rho were computed to analyze the bivariate correlational relationships among all continuous variables (see Table 9).

Age. Age was positively correlated with PLRI item 3 $r(82) = .22, p = .041$ and CB threat orientation $r(82) = .27, p = .014$. In other words, those who were older were more likely to return to the activity that led to their most recent injury and affiliate with a control-based threat orientation.

ISS. Injury Severity Score was significantly and positively correlated with LOS $r(82) = .29, p = .008$. From a clinical perspective, those with more extensive injuries had significantly longer hospital stays.

PLRI. All PLRI items were significantly correlated with each other and the PLRI total score ($p = .007$ to $<.001$) (See Table 9). Additionally, PLRI item 2 was significantly correlated with the avoidance denial-based orientation on the TOS, $r(82) = .26, p = .019$, suggesting that those with higher scores in avoidance denial-based orientations also scored high in perceiving themselves as more likely to be hospitalized for an injury in the next five years compared to others.

Table 9

Pearson r and Spearman's Rho Correlations

Variable	1	2	3	4	5	6	7	8	9	10	11	12
Age	-	.05 [†]	-.08	-.07	.02 [†]	.11 [†]	.22** [†]	.19 [†]	.27*	-.20	.08	-.12
LOS ^a	.05 [†]	-	-.03 [†]	.29** [†]	-.13 [†]	-.17 [†]	-.25 [†]	-.25 [†]	.01 [†]	-.06 [†]	-.20 [†]	-.10 [†]
Work Hours	-.08	-.03 [†]	-	.21 [†]	-.08 [†]	-.03 [†]	.09 [†]	-.03 [†]	.10	-.19	.15	-.08
ISS ^b	-.07 [†]	.29** [†]	.21 [†]	-	-.12 [†]	-.12 [†]	-.01 [†]	-.10 [†]	-.06 [†]	-.18 [†]	.16 [†]	-.11 [†]
PLRI ^c Item 1	.02 [†]	-.13 [†]	-.08 [†]	-.12 [†]	-	.54**	.29**	.64**	-.02 [†]	.18 [†]	-.03 [†]	.12 [†]
PLRI Item 2	.11 [†]	-.17 [†]	-.03 [†]	-.12 [†]	.54**	-	.54**	.82**	-.04 [†]	.06 [†]	.16 [†]	.26** [†]
PLRI Item 3	.22** [†]	-.25 [†]	.09 [†]	-.01 [†]	.29**	.54**	-	.84**	.19 [†]	-.08 [†]	.18 [†]	-.03 [†]
PLRI Total Score	.19 [†]	-.25 [†]	-.03 [†]	-.10 [†]	.64**	.82**	.84**	-	.07 [†]	.03 [†]	.17 [†]	.15 [†]
CB ^d	.27*	.01 [†]	.10	-.06 [†]	-.02 [†]	-.18 [†]	.19 [†]	.07 [†]	-	.07	.18	-.33**
HSB ^e	-.02	-.06 [†]	-.19	-.18 [†]	.18 [†]	.06 [†]	-.08 [†]	.03 [†]	.07	-	-.35**	.28**
ODB ^f	.08	-.02 [†]	.15	.16 [†]	-.03 [†]	.16 [†]	.18 [†]	.17 [†]	.18	-.35**	-	.13
ADB ^g	-.12	-.10 [†]	-.08	-.11 [†]	.14 [†]	.26** [†]	-.03 [†]	.15 [†]	-.33**	.28**	.13	-

Note. Values are Pearson r unless denoted. * $p < .05$, ** $p < .01$. Gray shaded area denotes strong Spearman correlations among the PLRI items. Green shaded area denotes strong Pearson r correlations among Threat Orientation Scale items. [†]Spearman's Rho correlation.

^a LOS = length of stay, or total number of hospital days. ^b ISS= Injury Severity Scale. ^c PLRI = Perceived Likelihood of Recurrent Injury. ^d CB = control-based threat orientation. ^e HSB= heightened sensitivity-based threat orientation. ^f ODB = optimistic denial-based threat orientation. ^g ADB = avoidance denial-based threat orientation.

Continuous and Dichotomous Categorical Variables

An Independent *t*-test using equal variances not assumed was computed to analyze the relationships between all continuous and dichotomous categorical variables. With multiple comparisons, a Bonferroni correction was calculated using a .05 alpha level divided by the number of tests being performed (14) to offset the risk of a type 1 error (Kellar & Kelvin, 2012). Only significant relationships are reported below ($p \leq .004$) (see Table 10).

Gender. The HSB threat orientation was statistically significant between genders, $t(82) = -3.10, p = .004$. Females scored statistically higher in the HSB orientation (3.79 ± 1.45) than males (3.79 ± 1.45). In other words, females identified with anxiety and fear towards the possibility of future injury despite taking adequate precautions more than males.

Employment Status. Work hours were statistically significantly different between the employment statuses, $t(82) = 23.84, p < .001$. As expected, those unemployed (0.00 hours) worked significantly fewer hours than those employed (41.19 ± 13.16).

Shift Worked. The CB threat orientation was statistically significantly different between the types of shift worked, $t(82) = 3.22, p = .004$. Individuals working morning shifts had statistically significantly different CB scores (5.86 ± 1.09) from those working afternoon, evening, or varying shifts (5.86 ± 1.09). In other words, those who worked morning shifts demonstrated more personal control and sought more opportunities to protect themselves from harm than those working later shifts.

Smoking Status. The ADB threat orientation was statistically significant between smoking statuses, $t(82) = -4.61, p < .001$. Non-smokers had significantly lower ADB scores (2.18 ± 1.14) than smokers (3.54 ± 1.51). In other words, smokers are more likely than non-smokers to be aware of potential threats, pessimistic about personal risk and avoid thoughts about the threat because it induces overwhelming anxiety.

Presence of Any Mental Illness. Total hours worked per week was statistically significant between the presence and absence of mental illness, $t(82) = 3.15, p = .002$. Those with a history of mental illness worked significantly fewer hours (21.05 ± 22.18) than those without mental illness (35.49 ± 19.69). This may suggest that the presence of mental illness inhibits a person's ability to work full-time.

Presence of Any Substances on Toxicology Report. Age was statistically significantly different between the presence or absence of substances on the toxicology report, $t(82) = 3.40, p = .001$. Those with a positive toxicology report were younger (39.20 ± 14.37) than those with a negative toxicology report (52.12 ± 18.55).

Table 10*Independent t-test p-values*

Variable	Age	Work Hours ^a	CB ^b	HSB ^c	ADB ^d
Gender				.004	
Emp ^e		<.001			
Shift ^f			.004		
Smoking					<.001
Any MI ^g		.002			
+Tox ^h	.001				

Note. Bonferroni correction was used to reduce the chance of a Type I error.

^a Work hours = total hours worked per week. ^b CB = control-based threat orientation. ^c HSB = heightened sensitivity-based threat orientation. ^d ADB = avoidance denial-based threat orientation. ^e Emp = employment status. ^f Shift = type of shift worked. ^g MI = mental illness. ^h +Tox = positive toxicology report.

Continuous and Multi-Group Categorical Variables

A One-way ANOVA was computed to analyze the relationships between all continuous parametric variables and categorical variables with three or more groups. A Kruskal-Wallis H test was used for continuous non-parametric variables and categorical variables with three or more groups. Moreover, groups containing less than six in a cell were also included in the Kruskal-Wallis H test. Only two-tailed statistically significant correlations are reported ($p < .05$) (See Table 11).

Age. A Kruskal-Wallis H test showed that there was a statistically significant difference in age between the different ethnic groups, $\chi^2(4) = 13.58, p = .009$ with a mean rank age of 49.40 for Caucasians, 33.66 for Hispanic or Latino, 23.50 for African-American, 45.17 for Asian or Pacific Islander, and 48.67 for other. There were also significant age differences between education groups, $\chi^2(4) = 14.45, p = .006$ with a mean

rank age of 51.96 for bachelor's degree, 61.06 for associate's degree, 35.73 for high school or trade school, 30.50 for some high school, and 57.92 for master's degree.

Income was also significantly different across age groups, $\chi^2(4) = 18.13, p = .001$ with a mean rank age of 54.10 for income over \$200,000, 48.76 for incomes between \$100,000 and \$200,000, 49.61 for incomes between \$50,000 and \$100,000, 28.62 for incomes between \$25,000 and \$50,000, and 27.63 for incomes under \$25,000.

There was a statistically significant difference between age and the categorical representation of number of chronic illnesses as determined by one-way ANOVA ($F(2,81) = 12.12, p < .001$). As expected, a Tukey post hoc test revealed that mean age was statistically significantly higher in those with two or more chronic illness diagnoses (56.54 ± 16.92) compared to those with only one chronic illness diagnosis ($37.95 \pm 14.50, p < .001$) or those without any chronic illnesses ($39.18 \pm 14.55, p < .001$).

There was also a statistically significant difference between age and the categorical representation of the number of substances on toxicology report ($F(2,81) = 6.48, p = .002$) and between age and time of injury ($F(2,75) = 4.73, p = .012$). A Tukey post hoc test revealed mean age was statistically significantly lower in those with one substance on their toxicology report (38.47 ± 12.35) than those without any substances ($52.12 \pm 18.55, p = .003$). There were no significant age differences between those without any substances and those with two or more substances ($p = .052$) or between those with one and two or more substances ($p = .894$). The Tukey post hoc test also revealed that mean age was statistically significantly higher in those injured between the hours of 06:01 and 1400 (51.57 ± 16.95) and hours of 14:01 and 2200 (39.00 ± 14.45).

Total Hours Worked. A Kruskal-Wallis H test showed that there was a statistically significant difference in total hours worked between the different income groups, $\chi^2 (4) = 20.94, p < .001$ with a mean rank of work hours of 50.60 for income over \$200,000, 49.65 for incomes between \$100,000 and \$200,000, 35.11 for incomes between \$50,000 and \$100,000, 50.18 for incomes between \$25,000 and \$50,000, and 23.20 for incomes under \$25,000.

Length of Hospital Stay. There were no statistically significant results between LOS and any categorical variables.

Injury Severity Score. A Kruskal-Wallis H test showed that there was a statistically significant difference in ISS between the categorical representation of a total number of mental illnesses, $\chi^2 (2) = 11.95, p = .003$ with a mean rank ISS of 49.28 for those with no mental illness diagnoses, 28.19 for the group with one mental illness diagnosis, and 45.56 for the group with two or more mental illness diagnoses.

PLRI. There was no statistically significant difference in results between and of the PLRI items and total score with any categorical variables.

CB. A Kruskal-Wallis H test showed there was a statistically significant difference in the mean rank score of CB orientation between the different income groups, $\chi^2 (4) = 13.88, p = .008$ with a mean rank score of 52.20 for income over \$200,000, 46.56 for incomes between \$100,000 and \$200,000, 45.16 for incomes between \$50,000 and \$100,000, 40.59 for incomes between \$25,000 and \$50,000, and 24.03 for incomes under \$25,000.

HSB. A Kruskal-Wallis H test showed there was a statistically significant difference in the mean rank score of HSB orientation between the different income

groups, $\chi^2 (4) = 12.98, p = .011$ with mean rank work hours of 40.00 for income over \$200,000, 23.65 for incomes between \$100,000 and \$200,000, 38.34 for incomes between \$50,000 and \$100,000, 45.65 for incomes between \$25,000 and \$50,000, and 48.73 for incomes under \$25,000. There was a statistically significant difference between HSB orientation mean scores and the type of insurance as determined by one-way ANOVA ($F(2,81) = 5.52, p = .006$). A Tukey post hoc test revealed that the mean HSB score was statistically significantly lower in those with commercial or military insurance (2.46 ± 1.28) than those with Medical or Medicare insurance ($3.56 \pm 1.62, p = .006$). There were no statistically significant differences in HSB mean scores between those with commercial or military insurance and those uninsured ($p = .098$) or between those with Medical or Medicare insurance and those uninsured ($p = .838$).

ODB. There were no statistically significant results between and of the ODB orientation mean rank score with any categorical variables.

ADB. A Kruskal-Wallis H test showed there was a statistically significant difference in mean rank scores of ADB orientation between the different income groups, $\chi^2 (4) = 12.61, p = .031$ with a mean rank score of 20.90 for incomes over \$200,000, 28.24 for incomes between \$100,000 and \$200,000, 39.13 for incomes between \$50,000 and \$100,000, 44.59 for incomes between \$25,000 and \$50,000, and 49.75 for incomes under \$25,000. Additionally, there was a statistically significant difference in ADB orientation mean rank scores between the different education groups, $\chi^2 (4) = 13.55, p = .009$, with mean rank scores of 38.58 for bachelor's degree, 28.69 for associate's degree, 45.26 for high school or trade school, 65.50 for some high school, and 19.83 for master's degree. There was also a statistically significant difference between ADB threat orientation and

type of insurance ($F(2,81) = 18.75, p < .001$). A Tukey post hoc test revealed that the mean ADB score was statistically significantly lower in those with commercial or military insurance (2.13 ± 1.15) compared to those with Medical or Medicare insurance ($3.20 \pm 1.38, p = .005$) or those who were uninsured ($3.75 \pm 1.63, p < .001$).

Table 11

One-Way ANOVA and Kruskal-Wallis H Test p-values

Variable	Ethnicity	Education	Income ^a	Med Ill ^b	Insurance	#Tox ^c	TOI ^d	#MI ^e
Age	.009 [†]	.006 [†]	.001 [†]	<.001		.002	.012	
LOS ^f								
WH ^g			<.001 [†]					
ISS ^h								.003 [†]
CB ⁱ			.008 [†]					
HSB ^j			.011 [†]		.006			
ODB ^k								
ADB ^l		.009 [†]	.031 [†]		<.001			

Note. *p*-values are reported as ANOVAs unless denoted. [†]Kruskal-Wallis H *p*-value.

^a Income = annual household income. ^b Med Ill= categorical representation of the number of medical illness diagnoses. ^c # Tox= categorical representation of number or substances on toxicology report. ^d TOI= time of injury. ^e # MI= categorical representation of number of mental illness diagnoses. ^f LOS = Length of stay, or total number of hospital days. ^g WH= hours worked per week. ^h ISS= Injury Severity Scale. ⁱ CB = control-based threat orientation. ^j HSB= heightened sensitivity-based threat orientation. ^k ODB = optimistic denial-based threat orientation. ^l ADB = avoidance denial-based threat orientation.

Relationships between the Independent Variables and the Dependent Variable

The presence of TR (yes/no) served as the dependent variable (DV). Each independent variable was analyzed for a corresponding relationship with the presence of TR (DV).

Categorical Independent Variables

Chi-square analyses were computed to explore the relationships between all categorical variables and the dependent variable, TR.

There was a strong and significant relationship between the presence of any mental illness (yes/no) and TR $\chi^2 (1, N = 26) = 6.29, p = .012$ and the categorical representation of the number of mental illness diagnoses $\chi^2 (2, N = 26) = 9.31, p = .010$. Due to small sample sizes, Fisher's exact test was used to determine if there was a statistically significant relationship between specific mental health diagnoses and TR. Depression was the only statistically significant specific mental health diagnosis related to TR ($p = .012$).

Continuous Independent Variables

Length of hospital stay was the only continuous variable statistically significantly related to TR. Length of hospital stay was not normally distributed; therefore, a Mann-Whitney U test was completed to determine the differences between LOS as measured by total days of hospitalization between non-trauma recidivist and trauma recidivist groups. Length of hospital stay for non-recidivists ($Md = 5.00$) were significantly higher than for recidivists ($Md = 3.00$) $U(N_{non-recidivists} = 58, N_{recidivists} = 26) = 505.00, z = -2.45, p = .014$ (see Table 6).

In summary, strong relationships were noted among several independent variables. Of most relevance to TR, those who were younger were more likely to have mental illnesses and to have more substances on their toxicology report. Mental illness also had strong associations with smoking and positive toxicology reports. Lastly, those with a history of TR were also more likely to have a shorter length of hospital stays.

Aim 4

To identify the odds of TR accounted for by select sociodemographic and clinical variables, threat orientations, and PLRI.

Appropriate relationship testing analyses (*Chi-square*, Independent *t-test*, One-way ANOVA, Pearson *r*, and Spearman Rho) were completed on the independent variables as they related to the dependent variable to determine the independent variables to include in the logistic regression model (results included above under Aim 3).

Although both presence of any mental illness (yes/no) and the categorical representation of the number of mental illnesses were statistically significant, the latter was chosen to include in the logistic regression model as it recorded a higher significance level.

Additionally, although PLRI item 1 (*how likely participants viewed themselves to experience trauma recidivism*) was not statistically significant in the bivariate analysis with TR, it is critical to control for when measuring TR and was included in the model. The data met the binary logistic regression assumptions including independent observations and no perfect multicollinearity and linearity of independent variables ($p = .166$ to $.423$).

Binary logistic regression was performed to determine if the total number of mental illnesses, length of hospital stay, and PLRI item 1 helped explain the presence of

TR in a sample of 84 participants. The sample included 26 participants with TR history and 58 without. The Hosmer and Lemeshow Test indicated a good fit, $\chi^2 (8, N = 84) = 3.97, p = .860$. The model was statistically significant at explaining TR, $\chi^2 (3, N = 84) = 15.82, p = .003$. The model explained 17.2% (Cox and Snell R²) to 24.2% (Nagelkerke R²) of the overall variance in TR. The model also correctly predicted the TR status of 79.8% of participants including 42.3% of those with a history of TR and 96.6 % of those without. The presence of two or more mental illness diagnoses was statistically significant when controlling for length of hospital stay and PLRI item 1.

In summary, the model suggested that for individuals with two or more diagnoses of mental illness, the odds of TR are approximately 6.5 times higher (OR = 6.48, 95% CI [1.7, 24.6]) (see table 12).

Table 12

Logistic Regression Variables in Equation

	<i>B</i>	<i>S.E.</i>	<i>Wald</i>	<i>df</i>	<i>Significance</i>	<i>Exp (B)</i>	<i>95.0% CI for Exp (B)</i>	
							<i>Lower</i>	<i>Upper</i>
Step 1								
0 MI ^a			7.592	2	.022			
1 MI	.554	.606	.835	1	.361	1.739	.531	5.703
2 ⁺ MI	1.869	.680	7.546	1	.006	6.480	1.708	24.585
LOS ^b	-.124	.069	3.231	1	.072	.884	.772	1.011
PLRI ^c Item 1	.098	.083	1.406	1	.236	1.103	.938	1.297
Constant	-.928	.576	2.598	1	.107	.395	-	-

^a MI = mental illnesses. ^b LOS = length of hospital stay. ^c PLRI Item 1 = In the next 5 years, how likely to you believe you will experience another injury requiring a hospital visit?

Summary

In summary, this chapter presents the results of this research study. The purpose of this study was to describe select sociodemographic and clinical variables, threat orientations, and the PLRI of individuals who were deemed at risk for TR. Eighty-four

(84) participants were selected from a designated Southern California Level II trauma center for hospitalization from October 23, 2021, to January 10, 2022.

The binary logistic regression revealed that the odds for TR were 6.5 times higher for individuals with two or more mental illness diagnoses when controlling for length of hospital stay and PLRI item 1.

Chapter 5

Discussion

Injury and trauma recidivism remain significant health care concerns in the United States. The purpose of this study was to describe select sociodemographic and clinical variables, threat orientations, and the PLRI of individuals who were deemed at risk for TR. The aims of this study were to: (a) describe select sociodemographic and clinical variables, threat orientations, PLRI, and presence of TR; (b) describe the differences in select sociodemographic and clinical variables, threat orientations, and PLRI between groups with and without a history of TR; (c) describe the relationships between select sociodemographic and clinical variables, threat orientations, PLRI, and TR; and (d) identify the odds of TR accounted for by select sociodemographic and clinical variables, threat orientations, and PLRI.

This chapter presents a discussion of the study findings. To place the study findings in the context of the state of the science, the findings are compared to other published literature. This chapter presents a discussion on opportunities to address TR. For specific study statistical results, see Chapter 4.

Overview of Study Findings

All eighty-four (84) participants experienced a traumatic accident and were recruited from a Level II trauma center in Southern California from October 2021 to January 2022. Consistent with Rosenstock's Health Belief Model, the study conceptual framework identified sociodemographic and clinical variables, perceived susceptibility towards a specific threat, and the likelihood of taking preventative action. These variables

contribute to the behavior of trauma patients, which subsequently leads to precautionary behaviors, or specifically in this study, TR.

Summary of Descriptive Results and Differences Between Groups

The results of the descriptive statistics for the total sample are discussed below. Differences between groups are highlighted for the non-recidivism sub-sample group, and the recidivism group sub-sample group. In addition, the recidivism group results are presented in more detail as this was the target sample in this study and the most predominantly documented group in previous TR studies.

Participant Sociodemographic Characteristics

In the current study, of the total sample ($N = 84$), most were middle-aged, male, Caucasian, single, completed high school or trade school, reported a household income less than \$25,000 per year, were employed, and worked the morning shift, were insured, lived in a specific region of a trauma catchment area, and were non-smokers. Other studies have reported similar sociodemographics for the general trauma population (Alghnam et al., 2016; McCoy et al., 2013).

The non-recidivist ($n = 58$) shared a similar sociodemographic pattern as the total sample, but was older when compared to the total sample and to the recidivist group. These results are comparable to the results reported by both Koleszar et al. (2015) and McCoy et al. (2013).

The recidivist group ($n = 26$) was younger than both the total sample and the non-recidivist sample. Interestingly, this study subsample was older than recidivists noted in previous studies (Harmon et al., 2019; Kaufmann et al., 1998; Reiner et al., 1990; Roding et al., 2016). However, the average age of the recidivism group in this study was within

the CDC's high-risk age group (1 to 44) for death secondary to injury and violence (2020b). Unlike the total sample and non-recidivist group, recidivists had higher annual household incomes and were smokers. Being male and either single or divorced were TR sociodemographic patterns seen in this study and are synonymous with previous literature (Alghnam et al., 2016; Kao et al., 2019; Keough et al., 2001; Koleszar et al., 2016). In this study, most of the recidivists were Caucasian, representing the geographical region the hospital served and similar to the results found by Alghnam et al. (2016) but different from Poole et al. (1993) and Reiner et al. (1990) who found racial minorities to be at higher risk for TR. Of surprise, only one in four trauma recidivists in this study were unemployed while Morrissey et al. (1991) found the trauma recidivist's unemployment rate to be near 90%. Additionally, most trauma recidivists in this study were insured as contrasted with the high uninsured rate found by Keough et al. (2001).

Of interest, almost half of trauma recidivists in this study had an annual household income ranging from \$50,000 to \$200,000 differing significantly from the very low income reported by the total trauma sample. Similarly, Alghnam et al. (2016) reported almost 40% of trauma recidivists had an annual income 400% above the poverty line. These higher socioeconomic statuses (SES) may demonstrate injury from recreational sports rather than injury from hazardous living conditions stemming from socio-ecological disparities (Mikhail et al., 2018). These higher income levels do not correspond to the low employment rate and low SES documented in previous TR studies (McCoy et al., 2014; Morrissey et al., 1991; Tellez et al., 1995; Sims et al., 1989; Williams et al., 1997) and may suggest the existence of different tiers of TR: higher and lower SES groups. The higher level of income among the recidivist group is interesting,

with a majority only holding a high school degree or less. Keough et al. (2011) found recidivists to also have lower education levels, but with lower income levels to match. Perhaps some of the labor trades or high-end tourism jobs pursued by the recidivist group in this study allowed for a more sizable income.

Most of the total sample, non-recidivism, and recidivism groups resided in the specific geographic region of the trauma catchment area; however, every region was represented. The region served by the trauma center in this study attracts people of various backgrounds. This specific region has a lower cost of living than the more central and northern areas and typically houses lower SES groups (San Diego County, 2013). Less expensive living conditions may also entice young people starting out or young families seeking larger houses to accommodate their children to move to this region. Moreover, this region's population is anticipated to grow by 51% by 2050 (San Diego's Regional Planning Agency [SANDAG], 2011) and may further impact the trauma center serving this region. There are also enduring problems with homelessness, drug trafficking, and methamphetamine production in this region (Drug Enforcement Administration, 2019) which may explain the high incidence of positive toxicology results in this study. Lastly, the study's region has various rugged trails and paths that residents and visitors use to hike and mountain bike (All Trails, 2022), and many of the trauma participants in this study were injured during these activities. In summary, there are diverse groups in this region and a plethora of risk factors to permit an environment conducive to injury and may explain why there was no significant difference among sociodemographic variables between TR subsamples.

The different regions in the United States (US) have various concentrations of demographics. There were no TR studies noted to take place in the US North-West region. However, most recidivism studies took place in the US North-East region and recorded a higher burden of unemployment, lack of insurance, and substance abuse, in addition to a higher prevalence of racial minorities sustaining recurrent traumatic injuries (Keough et al., 2001; Koleszar et al., 2016; Sims et al., 1989; Williams et al., 2016). The US South and South-East regions also reported higher prevalence of racial-minorities sustaining trauma, mostly those identifying as Black (Griffin et al., 2014; Poole et al., 1993). Among the US South-West region, the only significant demographic differences between the non-recidivism and recidivism groups included being male (Hedges et al., 1995; Kaufmann et al., 1998).

In summary, these study results were comparable to previous literature. Disparities reported between sociodemographic characteristics may be explained by the geographical location each study was conducted.

Participant Clinical Characteristics

In this study, the presence of mental illness, depression, length of hospital stay, and response to how likely participants viewed themselves to experience TR (PLRI item 1) were the only statistically significant variables in bivariate analysis between those with a history of TR and those without. However, differences between the non-recidivism and recidivism groups will still be discussed among the most relevant clinical variables.

The total sample and the non-recidivist group had fewer chronic illnesses diagnoses than the recidivist group. In congruence, Alghnam et al. (2016) reported trauma recidivists were more likely to have a higher prevalence of chronic health

conditions like hypertension, diabetes, stroke, and depression. Chronic illnesses and corresponding medications can lead to increased confusion, decreased mobility, and altered physiological reserves that all serve to place a patient at higher risk for injury (Xue et al., 2021).

Regarding mental illness, in this study, the presence of mental illness was significantly higher in recidivists than in the total sample and the non-recidivist group. More specifically, depression was present in over one-third of trauma recidivists compared to only 10% in the non-TR group. Depression was the most prevalent mental illness diagnosis and resembled the results found by Koleszar et al. (2016) and Wan et al. (2006). Mental illness is reported to be an independent risk factor for unintentional injury and trauma with over half of trauma recidivists having been specifically diagnosed with depression (Wan et al., 2006).

A positive toxicology result was present for most of the recidivist group, those with mental illness, and in more than half of non-recidivists suggesting that substance use may place a person at high-risk for injury regardless of TR stratification. The predominance of substance use in all trauma patients was noted in previous studies and is a known risk factor for both first-time injury and repeat injury individuals (Cordovilla-Guardia et al., 2017; Koleszar et al., 2016; Nygaard et al., 2017). Cordovilla-Guardia et al. (2017) further added that consumption of drug substances was associated with increased recidivism risk, and those who consumed these substances were over three times more likely to have multiple recidivism accounts than those with a single injury account. Cannabis was the most popular drug of choice among both recidivists and non-recidivists in this study which was not surprising considering the drug was legalized in

California in 2016 through Assembly Bill 64 (California Legislative Information, 2016). Smoking was more prevalent in the TR group than the non-TR group. Similarly, Koleszar et al. (2016) found that a majority of recidivists used tobacco products. Smoking has been linked to heavy substance abuse (Weinberger et al., 2017) and may represent a strong indicator of TR risk.

Mechanism of injury (MOI) is a critical variable to also consider with TR as more than half of recidivists will be reinjured by the same mechanism (Kaufmann et al., 1998). In this study, the most common MOIs among all TR participants were high-risk car accidents, or in the trauma setting more commonly referred to as *motor vehicle accidents* (MVA's), followed by motorcycle (MCC) crashes. The mechanism of injury varied in previous TR studies. Among violent injuries, recidivists were most likely to sustain injury from a gunshot wound (Kao et al., 2019; Keough et al., 2001) or physical assault (McCoy et al., 2013). Among non-violent injuries, recidivists were most likely to experience MVA's and fall from height, while non-recidivists were most likely to sustain MVA's and ground-level falls (Koleszar et al., 2016). When comparing the types of injury among non-recidivist and recidivist groups in this study, it appeared that most recidivists had injuries secondary to work-related activities or recreation hobbies (e.g. injuries from work, motorcycles, or Jiu-Jitsu). In previous studies, recidivists were noted to have sustained injuries from gunshots, stabbings, or pedestrian vs. automobile mechanisms (Koleszar et al., 2016; McCoy et al., 2013; Wan et al., 2006). In contrast, non-recidivists had a higher incidence of falls from height, most of these being from ladders and mirrored the results found by Koleszar et al. (2016).

In this study, the weekends (Friday through Sunday) had the highest frequency of injuries for the entire sample and non-recidivists while the weekdays (Monday through Thursday) were the most common for recidivists. With most of the trauma sample working traditional hours during the week, this time of injury pattern makes sense as most people enjoy extracurricular activities on the weekend. The most prevalent time of injury occurred between the hours of 6:01 and 14:00 for both recidivism groups and may suggest the current participants were injured after work, possibly from MVA's on their way home or to an evening event. While not addressed in previous TR research, in a retrospective study looking at the time and seasonal patterns of injury, Kieltyka et al. (2016) reported traumatic injuries occurred most frequently on Fridays and Saturdays and between the hours of 22:00 and 02:00 and would align with person's partaking in the bar and party scene.

The average length of hospital stay (LOS) was three days longer for the non-recidivism group than the recidivism group. While Kao et al. (2019) found no difference between LOS among TR groups, Rogers et al. (2013) and Nygaard et al. (2017) found longer average LOS among recidivism groups. Differences between the non-recidivism and recidivism groups in the current study may suggest that LOS has an impact on an individual's outlook and ability to return to high-risk behavior.

Shorter LOS in the study sample may also indicate less severe injuries and therefore lower injury severity scores (ISS). The average ISS was lower in the recidivism group than the non-recidivism group. Nygaard et al. (2017) and Reiner et al. (1990) also found lower ISSs among recidivists and contributed the finding to recidivists sustaining a

higher frequency of penetrating injuries causing isolated injuries, compared to blunt injuries that cause more systemic bodily injury.

In summary, most clinical variables in this study parallel previous literature results. Limitations reported in other TR studies may threaten the generalizability when making comparisons to this study.

Participant Threat Orientations

Although there were no significant differences between non-recidivism and recidivism groups, there were a few trends noted in threat orientations. The total sample and both recidivism groups in this study scored highest in the control-based orientation (CB) suggesting participants engage in preventative health behaviors. The recidivism group had a slightly higher average mean score for heightened sensitivity-based (HSB) and avoidance denial-based (ADB) orientations than the non-recidivism group. The non-recidivism group reported slightly higher control-based (CB) orientations and optimistic denial-based (ODB) orientations than those in the recidivism group. The possible meanings of these findings are discussed below.

The TOS has never been used in TR research so there are no results to compare to this study. However, Thompson and Schlehofer (2008) did note the intersection between HSB and ADB orientations as they both include awareness of and anxiety about one's vulnerability. This could explain the pattern seen in this study with trauma recidivists scoring higher in both HSB and ADB orientations. Control-based orientations are motivated to maintain or enhance personal control, protect an individual from harm, demonstrate strong self-efficacy, and to use appropriate action to reduce risk (Thompson & Schlehofer, 2008; Thompson et al., 2011) and may help to explain why more non-

trauma recidivists scored higher in the current study. Regarding the ODB orientation, this study's results are puzzling as ODB orientations are associated with decreased perception of personal susceptibility, denial of information, and tendency to disregard preventative action (Thompson et al., 2011) and are characteristics not likely to be correlated with CB orientations. The difference may be in the fact trauma recidivists are more accepting of future injury knowing their past injury history, while non-trauma recidivists view themselves optimistically less likely to get injured knowing their limited past-injury history.

Participant Acceptance of Subjective Risks

The participant's acceptance of subjective risks was measured using a newly adapted instrument (PLRI). Item 1 measured how likely participants viewed themselves to experience TR. Recidivists conveyed an awareness of their susceptibility to injury and recorded a higher average score of awareness compared to non-recidivists. Initially, this appeared puzzling because why would someone aware of their risk for injury, continue to get injured? However, after reviewing the types of injury among trauma recidivists, most were related to extreme sports or occupation. Because these repeat injuries occurred during adrenaline-based recreations or while at work, recidivists may realize they are at risk, but not possess the control, desire, or freedom to change their behavior. Similarly, Van Horn (2005) found 57% of trauma patients also perceived themselves as likely to have another injury in the next five years whereas Claassen et al. (2007) reported only 33% of high-risk trauma patients acknowledged they were involved in risky behavior and were significantly more likely to return to trauma services. It appears that whether a

person is aware of or accepts their risk for potential injury, an individual's motivation to change high-risk behavior may not be affected.

Item 2 of the PLRI measured the participant's awareness of their risk level for TR compared to someone else. The recidivism group reported seeing themselves as more likely to get injured than someone else and scored higher than the non-recidivism group. These results were consistent with the pattern seen in PLRI item 1.

Lastly, PLRI item 3 measured how likely a participant would return to the high-risk behavior that led to their current hospitalization. Non-recidivists reported themselves more likely to return to the high-risk behavior than recidivists. However, recidivists recorded a higher total PLRI score than non-recidivists. It appeared that recidivists were more aware of their subjective risk than non-recidivists. In previous perceived risk research, Weinstein (1980) found that most people expect others to fall victim to the misfortune of specific actions, while they remain immune from the consequences of that same action. Perhaps this is the phenomenon seen within the non-recidivism group. Regarding the recidivism group, Rutter et al. (1998) found that increased risk perception led to subsequent reckless behavior, unlike the projected precautionary behavior one would anticipate after a serious injury. In other words, as risk perception increased, it appeared to compel individuals to further risky behaviors leading to recurrent injury and may help explain the phenomenon seen among recidivists.

Trauma Recidivism Rates

For this research study, among the total sample, the TR rate was 31% and fell within the low range of 1% (Hedges et al., 1995) and the high range of 44% (Kao et al., 2019) of previous TR studies. As previously noted in Chapter 4, a few of the recidivists

had more than one injury within the past five years. One individual reported a total of seven hospitalizations after sustaining various injuries from extreme sports. Additionally, other studies have shown recidivists are prone to more than two traumatic injuries within a five-year period (Hedges et al., 1995; McCoy et al., 2013; Poole et al., 1993).

In summary, there are strong differences between those with and without a history of TR. Those in the recidivism group were more likely to suffer from mental illness, most specifically depression, and have twice as many mental illnesses as those in the non-recidivism group. These findings are synonymous with previous literature (Koleszar et al., 2016; Wan et al., 2006). The recidivism group also had shorter lengths of hospital stay, spending an average of three days less than the non-recidivism group which was consistent with studies by Reiner et al. (1990) and Rogers et al. (2013). There were no differences in TOS or PLRI items between the non-recidivism and recidivism groups.

Relationships Between Study Variables

This section discusses the pertinent relationships between study variables including sociodemographic and clinical variables, perceived acceptance of subjective risks (PLRI), threat orientations, and TR. In addition, the results relative to the recidivism group are given special attention farther down in this section.

Sociodemographic Variables

There were several significant relationships among the study's sociodemographic variables for the total sample. Of interest, ethnicity strongly associated with annual household income as well as geographical place of residence and may suggest disparities among ethnic groups. As expected, employment status had a strong relationship with education, annual household income, and type of insurance. Smoking status had

numerous significant relationships with other sociodemographic variables with the strongest relationships being between (a) highest degree completed, (b) employment status, (c) annual household income, and (d) type of insurance. When compared to this study's descriptive statistics, these results may suggest that smoking is associated with lower SES.

Clinical and Sociodemographic Variables

There were several significant interrelationships between clinical variables among the total sample. Mental illness and substance abuse were strongly associated with each other and shared many similar relationship trends with other clinical variables. Of those relationships, the strongest included (a) marital status, (b) highest degree completed, (c) employment status, (d) type of shift worked, (e) annual household income, and (f) smoking status. When compared to the descriptive statistics in this study, these results may suggest that mental illness and substance abuse impede relationships, education, opportunities for employment and income, and lead to smoking susceptibility. This pattern of lifestyle choices undergirded by mental illness resembles previous TR literature (Koleszar et al., 2016; Wan et al. 2006).

Mechanism of injury was significantly associated with: (a) employment status, (b) annual household income, (c) time of injury, (d) smoking status, and (e) toxicology results. As previously noted, recidivists had higher levels of employment and income than non-recidivists and may explain the significant relationship with MOI. Moreover, most participants in this study had a positive toxicology result indicating substance use may influence the type of traumatic injury sustained. Studies have also shown strong relationships between smoking and substance abuse (Koleszar et al., 2016; Weinberger et

al., 2017) and may explain the pattern seen in this study. The time of day of injury has been shown to have a significant relationship with the incidence of traumatic injuries (Kieltyka et al., 2016). In this study, most of the traumas occurred from MVAs, MCCs, or mountain bicycles during daytime hours. This may suggest that most individuals commute or ride recreationally during daytime hours and would explain the higher incidence of traumatic injury.

Sociodemographic Variables and Trauma Recidivism

There were no statistically significant relationships between any sociodemographic variables and TR. Likewise, Madden et al. (1997) also did not find significant relationships among any sociodemographic or clinical variables and concluded that injury alone placed a person at risk for TR. Other studies found significant relationships between TR and (a) the male gender and single marital status (Keough et al., 2001; Koleszar et al., 2016; McCoy et al. 2013); (b) the male gender and minority race (Hedges et al., 1995; Morrissey et al., 1991; Nygaard et al., 2017); (c) type of insurance (Alghnam et al., 2016; Koleszar et al., 2016; Williams et al., 1997); and (d) living in an urban setting (Rogers et al., 2013).

Clinical Variables and Trauma Recidivism

In this study, there were statistically significant relationships among the presence of mental illness, the total number of mental illnesses, depression, LOS, and TR.

Mental Illness and Depression

In this study, the presence of mental illness and depression were significantly associated with TR. Wan et al. (2006) reported similar results and added that those with mental illness are 4.5 times as likely to experience TR than those without mental illness.

Furthermore, in this study, the recidivist group had twice as many mental illnesses as the non-recidivist group. Psychiatric disorders and traumatic injuries have been shown to be bi-directionally correlated where mental illness can lead to destructive behavior and injury can lead to maladaptive coping mechanisms leading to a recurring injury sequence (Shadloo et al., 2016) and may help explain the patterns observed in this study.

Additionally, half of those with mental illness also have substance use disorder (National Institute of Mental Health, 2021), which may explain the high association between mental illness and positive toxicology results in this study. Moreover, the concomitance of mental illness and substance use disorder is often defined as a dual diagnosis (Young et al., 2018).

Length of Hospital Stay

Reiner et al. (1990) and Rogers et al. (2013) did report slightly longer LOSs for recidivists, but their results were not significantly related to TR. In this study, LOS had a significant inverse relationship with TR. In other words, those with a history of recidivism had significantly shorter LOS than those without a history of recidivism. In theory, those with shorter lengths of hospital stay have less severe injuries and therefore may dampen an individual's risk perception. For example, a mechanism causing minor injury may not seem as threatening after a quick recovery compared to more extensive injuries leading to longer LOS and extensive recovery. Smeltzer and Redeker (1995) theorized that individuals who survive a major traumatic injury may believe that their survival indicates special protection and leads to a decreased sense of vulnerability. Moreover, individuals who perceive their injuries as high severity may reconsider returning to the behavior that led to their injury and may begin to implement protective

behaviors (Stretcher & Rosenstock, 1997), demonstrate a more control-based orientation (Thompson & Schlehofer, 2008), and prevent TR from occurring.

Other Clinical Variables and Trauma Recidivism

There was no relationship between smoking and TR as found by Alghnam et al. (2016) but was smoking was significantly related to the presence of mental illness and positive toxicology results. McCoy et al. (2013) also found a strong relationship between mental illness and substance abuse and Koleszar et al. (2016) found that 66% of trauma recidivists used tobacco products. Remarkably, there was no significant relationship between positive toxicology and TR in this study either. Cordovilla-Guardia et al. (2014) found that approximately two out of three recidivists tested positive for alcohol or drugs while Kaufmann et al. (1998) found that TR was significantly associated with positive blood alcohol levels and longer hospital stays. Moreover, Harmon et al. (2019) reported that over half of patients who tested positive for opioids on their first trauma admission also tested positive on the second admission. Although substance abuse was not significantly related to TR in this study, it should be considered when providing injury prevention education to trauma patients.

Participant Acceptance of Subjective Risks

Individuals who viewed themselves as most likely to sustain recurrent injury were among the recidivism group. The acknowledgment of previous injury and acceptance of one's lifestyle choices and behaviors may have supported the positive relationship between perception and reality in this study.

The participant's awareness of their risk level for TR compared to another person (item 2) was significantly and positively related to the ADB orientation. In other words,

individuals who avoid thoughts of personal risk because it leads to overwhelming anxiety (Thompson & Schlehofer, 2008) were more likely to acknowledge they were at higher risk for recurring injury than someone else. This seems odd, as this would require an individual to reflect about their risk and compare it to the general public's risk and would likely induce anxiety in the ADB individual. Thompson and Schlehofer (2008) did note that individuals with ADB orientations were more likely to avoid answering threat risk questions or answer more hastily and this may explain the responses seen in this study.

Item 2 also demonstrated strong positive relationships with the geographic region of residence and the presence of any mental illness. As previously mentioned, the safety level of a living area may affect how a person views their risk for injury. Regarding the presence of mental illness, those who had at least one mental illness demonstrated more awareness about their increased risk for injury when compared to someone else. This could imply that those with mental illness are aware of their injury risk and may be open to interventions and injury prevention education.

How likely a person was to return to high-risk behavior (item 3) and the total score of the PLRI were not significantly associated with any variable and may suggest the PLRI needs further adaptation and testing.

Participant Threat Orientations and Trauma Recidivism

While this instrument has been available for some time, the Threat Orientation Scale (TOS) was used for the first time in TR research in this study. There were no statistically significant threat orientations related to TR. Other studies have hypothesized that denial-based orientations would be associated with TR because of decreased perception of risk towards a potential threat (Thompson et al., 2006; Thompson &

Schlehofer, 2008; Thompson et al., 2011). In the current study, although recidivists averaged higher ADB scores than non-recidivists, non-recidivists averaged higher ODB scores than recidivists. These results suggest that recidivists may experience more anxiety when hearing about a potential threat leading them to evade receiving the risk information and ultimately use self-denial to preclude self-relevance. In contrast, in other studies, non-recidivists tend to have overly optimistic estimates of personal susceptibility, low concern, and a tendency to avoid preventative action (Thompson et al., 2011). Both denial-based orientations place an individual at risk for TR; however, knowing recidivists are prone to ADB orientations rooted in anxiety, injury prevention education can be targeted at minimizing anxiety before implementation.

In summation, there were significant relationships among several clinical variables. Most importantly, mental illness, LOS, and response to how likely participants viewed themselves to experience TR (PLRI item 1) were the variables most significantly related to TR.

Odds of Trauma Recidivism

The binary logistic regression in this study revealed the odds for TR were 6.5 times higher for individuals with two or more mental illness diagnoses when controlling for length of hospital stay and PLRI item 1. Similarly, Wan et al. (2006) found that mental illness placed an individual at 4.5 times the risk for injury recidivism than those without mental illness when controlling for substance abuse, homelessness, and gender. When controlling for age, gender, ethnicity, marital status, chronic illnesses, type of mental illness, and geographic region, Alghnam et al. (2016) found that depression was associated with almost 1.5 times higher odds of TR than those without depression. In

addition, Alghnam et al. found the presence of hypertension and type of health insurance coverage to be significant predictors of TR. In contrast, in two separate logistic regression analyses, McCoy et al. (2013) found the male gender, single marital status, the White race, and interpersonal violence to be the strongest independent predictors of TR. In a different study, Koleszar et al. (2016) found that uninsured patients were almost three times more likely to experience TR than those with insurance.

Length of hospital stay was not included in previous TR logistic regression studies, so there were no results to compare. Likewise, the PLRI instrument was designed and used for the first time in TR research and therefore had no findings to compare.

In summary, mental illness demonstrated to be the strongest indicator for TR in this study and aligns with previous research (Koleszar et al., 2016; Wan et al., 2006), although other studies reported other significant variables to be further predictors of TR (Alghnam et al., 2016; Keough et al., 2001; Madden et al., 1997; McCoy et al., 2013; Morrissey et al., 1991; Sims et al., 1997).

Study Limitations

There were several study limitations identified. The first was a small sample size ($N = 26$) for the TR group. As a result, tests of association were underpowered, possibly leading to inflated relationships and type II errors.

Second, the population served by the designated trauma center was restricted by preset trauma catchment boundaries and, therefore, decreased the generalizability of the findings to other geographic locations. Additionally, the region served by this study's trauma center has a very low number of African American individuals and limits the ability to generalize these findings to other ethnically diverse populations. Previous

literature identified African American individuals as highest risk for TR and should be further investigated in a more ethnic representative sample. Third, most trauma patients receive pain medications prehospital by emergency medical staff or upon arrival to the trauma bay, making it difficult to differentiate between recreational use and medical administration by the time urine samples were obtained for toxicology review. Therefore, recreational use of pain medications could not be verified.

Fourth, because the study instruments were only validated among English-speakers, this study only included this population in the sample. Previous trauma studies have revealed ethnic minorities are at higher risk for TR (Keough et al., 2001; Nygaard et al., 2017; Poole et al., 1993). By eliminating non-English speakers, this study did not measure non-English speakers' threat orientations or PLRI. The designated trauma center for this study serves a large trauma population of a bordering nation that is non-English speaking. Unfortunately, many of these patients from this bordering nation were unable to be recruited for this study.

Finally, the actual rate of TR may have been underestimated because: (a) of the failure of some patients to seek emergency care following a traumatic injury; (b) of the severity of an injury impeded some patients' capacity to consent to participation; (c) any patients experiencing psychosis would have precluded participation, and (d) some patients died before a history of previous trauma was obtained. Indeed, in this study, it is known that several potential study participants met the inclusion criteria for high-risk behavior; however, they could not be interviewed because they had a traumatic brain injury, were demonstrating signs of psychosis, or expired in the trauma room before obtaining a TR history.

Implications for Research

There are currently no instruments to measure TR risk. This study suggests the PLRI and TOS instruments are not ready to measure perceived susceptibility and threat orientations in the field of TR research.

All PLRI items were anticipated to have strong associations with TR, however, this was not the case. This expectation was because the PLRI instrument was specifically adapted for the purpose of this study. Specifically, the PLRI was tested for internal consistency as well as having undergone cognitive interviewing before it was utilized for this study. While the PLRI items demonstrated good internal consistency, further testing is recommended to test sensitivity and specificity for TR screening.

It is further recommended that the TOS instrument undergo possible revision followed by psychometric testing specifically among the trauma population. Although the subscales were not significantly correlated with TR in this study, item adaptation and psychometric testing for reliability and validity would be helpful to address the overall quality of the instrument.

Further psychometric research is required to develop sound and comprehensive screening instruments for those at the highest risk for TR. Trauma and public health nursing researchers are prime advocates for primary injury prevention and are encouraged to facilitate this instrumentation work. These instruments could be tested in local and rural clinics, schools, and hospital settings to advance the science of injury risk screening.

Implications for Practice

Awareness of risk factors is critical in preventative healthcare both for the trauma healthcare provider (HCP) and the patient. Characterizing the trauma recidivist may allow targeted prevention and intervention programs to decrease recurrent injury and hospital visits. The presence of a traumatic injury within five years of a previous injury is the best indicator of TR and screening should be included in the trauma triage process.

The findings of this current study indicated there is a strong relationship between mental illness and injury, making assessment for mental illness an important process for trauma HCPs to understand. Although substance use was not directly related to TR, it was significantly associated with mental illness and should also be addressed during each trauma assessment. During a trauma admission, trauma HCPs should provide additional education to patients with a history of mental illness, most specifically, depression.

Furthermore, trauma HCPs must recognize how individuals perceive potential threats and the likelihood of future injury differently. In this study, those with mental illness were more likely to acknowledge their risk for TR which may open a window of opportunity for trauma HCPs to provide more in-depth education and offer preventative resources like free mental health counseling or substance abuse recovery programs. Similarly, those with less awareness of their risk for future injury could be educated regarding their likelihood to experience an injury in the future and be offered helpful injury prevention education, e.g., using safety equipment.

Additionally, trauma patients who stay in the hospital less than five days may be more likely to revert to their high-risk behavior and return to trauma services. Trauma healthcare providers should be aware of the implications of shorter LOSs. For example,

less severe injuries leading to shorter LOSs may diminish an individual's perception of the consequences of their high-risk behavior and eventually lead to recidivism.

Contrastingly, more severe injuries resulting in longer LOSs may enhance an individual's consequence awareness enough to change high-risk behavior and reduce the odds of recidivism.

In closing, special care for those with mental illness, especially depression, must be considered. Screening for substance abuse will demonstrate vital as mental illness and substance use disorder often coincide. Shorter hospital stays can remind trauma HCPs that their patient is at higher risk for returning to trauma services. Whereas an individual's response to how likely they view themselves to experience TR gives the trauma HCP an understanding of the individual's ability to discern their injury risk level.

Summary

The purpose of this study was to describe select sociodemographic and clinical variables, threat orientations, and the PLRI of individuals who were deemed at risk for TR. Eight-four (84) participants were recruited from a Level II trauma center in Southern California from October 2021 to January 2022. For this research study, the TR rate was 31%. The only statistically significant variables contributing to TR included the number of mental illness diagnoses and length of hospital stay. Although threat orientation and overall PLRI in TR were not significantly related to TR, further psychometric testing to adapt the instruments to trauma populations may improve them as clinical screening measures.

Conclusion

Injury and TR are significant health care concerns that can be prevented with timely recognition of risk factors and interventions. There exists a lack of screening and assessment instruments for both providers to measure both TR risk and an individual's readiness to change high-risk behavior. Trauma recidivists frequent emergency and trauma rooms, stationing trauma HCPs as pivotal resources in identifying, intervening, and preventing recurrent injury. This study confirms mental illness as a predominant factor in injury and should be assessed for in clinical practice. This study builds upon previous research and highlights challenges within universal screening for TR risk factors. Most events resulting in injury or disability are predictable and preventable. Trauma healthcare providers seeking to practice with an upstream mentality have a responsibility to aid in screening to help identify those at risk and prevent further injuries and death.

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Appendix A

USD IRB



Oct 22, 2021 8:33:25 AM PDT

Molly Bauer
Hahn School of Nursing & Health Science

Re: Exempt - Initial - IRB-2022-89, Recurrent Injury Perceptions in Trauma Recidivism

Dear Molly Bauer:

The Institutional Review Board has rendered the decision below for IRB-2022-89, Recurrent Injury Perceptions in Trauma Recidivism.

Decision: Rely on External IRB

Selected Category:

Findings:

Research Notes:

Internal Notes:

The USD IRB requires annual renewal of all active studies reviewed and approved by the IRB. Please submit an application for renewal prior to the annual anniversary date of initial study approval. If an application for renewal is not received, the study will be administratively closed.

Note: We send IRB correspondence regarding student research to the faculty advisor, who bears the ultimate responsibility for the conduct of the research. We request that the faculty advisor share this correspondence with the student researcher.

The next deadline for submitting project proposals to the Provost's Office for full review is N/A. You may submit a project proposal for expedited or exempt review at any time.

Sincerely,

Eileen K. Fry-Bowers, PhD, JD
Administrator, Institutional Review Board

**Office of the Vice President and Provost
Hughes Administration Center, Room 214
5998 Alcalá Park, San Diego, CA 92110-2492**