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Social Work Delivered Intervention for Persons with Mild Traumatic Brain Injury:
Implementation and Evaluation in an Urban, Public, Trauma Center Emergency Department

By

Megan Moore

A dissertation submitted in partial satisfaction of the

requirements for the degree of

Doctor of Philosophy

in

Social Welfare

in the

Graduate Division

of the

University of California, Berkeley

Committee in charge:

Professor Steven P. Segal, Chair
Associate Professor Susan I. Stone
Associate Professor Martha Shumway
Professor John Colford
Fall 2012

Abstract

Social Work Intervention for Persons with Mild Traumatic Brain Injury: Implementation and Evaluation in an Urban, Public, Trauma Center Emergency Department

by

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Doctor of Philosophy in Social Welfare

University of California, Berkeley

Professor Steven P. Segal, Chair

Mild traumatic brain injury (mTBI) is a prevalent and costly public health problem with potentially disabling consequences. Interventions aimed at alleviating cognitive, emotional and behavioral sequelae are underdeveloped. This prospective, quasi-experimental cohort study evaluated a brief social work delivered intervention (SWDI) for adults with mTBI discharged from the emergency department. The SWDI included education, reassurance, coping strategies and community resource information. Participants were recruited from consecutive admissions to the emergency department. A total of 64 persons with confirmed mTBI diagnoses were assessed 3 months post-injury. Participants in the Usual Care group (N=32) were identified via medical record; confirmation of mTBI was based on World Health Organization definition. Participants in the SWDI group (N=32) were identified and mTBI diagnosis confirmed by emergency department medical staff. Both groups completed standardized assessments of post-concussion symptoms, depression, anxiety, Posttraumatic Stress Disorder, alcohol use, and community functioning three months after injury. To assess change in alcohol use and community functioning, participants were asked to recall pre-injury drinking levels and functioning and then asked about current status three months post injury. The SWDI group also completed an open-ended Patient Experience Survey following their ED service.

The paired sample t test was used to assess community functioning outcomes. For all other standardized measures, non-parametric Mann Whitney or Wilcoxon Signed Rank tests were used to compare groups. Qualitative themes from the Patient Experience Survey were identified through systematic review of all survey responses.

Three months post injury, both groups reported pre-injury drinking in the “hazardous” range. The SWDI group reported significantly reduced alcohol use from pre-injury to post-intervention ($p < 0.05$). The Usual Care group maintained their pre-injury level of drinking. Analysis of the community functioning measure revealed the SWDI group maintained pre-injury levels of community functioning, while the Usual Care group reported significant decline in functioning ($p = 0.05$). All other analyses of standardized measures (anxiety, depression, PTSD, post-concussive symptoms) trended in favor of the intervention group, but were not statistically significant. Results from the SWDI Patient Experience Survey indicate that 96% of participants who remembered receiving the intervention (N=25) found it helpful. In response to an open ended question about the most helpful aspects of the intervention, 60% reported it was most

helpful to learn about symptoms to expect because this decreased anxiety about symptoms, 28% reported that the recovery tips were most helpful and 24% reported that education about ceasing alcohol use was most helpful.

The study provides support for the use of the SWDI in the emergency department. Decrease in alcohol use and maintenance of community functioning are clinically and functionally significant outcomes. Alcohol use is a risk factor for re-injury and poor outcome, and the measure of community functioning includes probes about work, school and social activity attendance as well as ability to complete household and daily living activities. In addition, the SWDI group overwhelmingly found the intervention helpful. Education about symptoms to expect and decreasing alcohol use was particularly salient for participants. Future studies should consider survey themes and ways to enhance the intervention in order to increase the impact on additional outcomes of interest.

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CHAPTER ONE

INTRODUCTION: EPIDEMIOLOGY AND CLASSIFICATION OF TRAUMATIC BRAIN INJURY IN CIVILIAN AND MILITARY POPULATIONS

Introduction

Traumatic brain injury (TBI) is a growing public health problem with approximately 1,700,000 injured US civilians treated each year, and emergency room visits and hospitalizations increasing by 14% and 20% respectively from 2002-2006 (Faul, Xu, Wald, & Coronado, 2010). TBI results when an outside force directly hits the head or causes the brain to move rapidly within the skull leading to central nervous system damage and altered consciousness (Piek, 2010). The US Centers for Disease Control and Prevention (CDC) define TBI as a “bump, blow or jolt to the head or a penetrating head injury that disrupts the normal function of the brain” (Faul, et al., 2010, p. 8). The National Institute of Neurological Disorders and Stroke (NINDS) specified that TBI can be “focal” or “diffuse” in nature and can occur as a result of a penetrating or closed injury (NINDS, 2002). Penetrating injury occurs “when an object pierces the skull and enters brain tissue” (NINDS, 2002). Mechanisms for penetrating injuries include gunshot wounds, blast injuries, falls and assaults, among others. Closed head injury results when the head violently strikes an object or is struck by an object and the skull remains intact (NINDS, 2002). This type of injury also arises as the result of inertia causing the brain to “collide with the inside of the skull” (Mayo Clinic, 2010). One such injury is called coup-contrecoup head injury. ‘Coup-contrecoup’ is an 18th century French term used to describe closed injury noted on the impact side of the brain as well as injury on the opposite side of impact, such as is observed when the brain is propelled back and forth in the skull after sudden stopping in high speed motor vehicle accidents (Courville, 1942). Other mechanisms for closed head injury include falls, bike accidents, sports related injuries and assaults.

TBI causes a range of short or long-term problems in thinking, sensation, language and emotion (NINDS, 2002). There is significant increased risk of a psychiatric disorder diagnosis after TBI (Fann, et al., 2004). Rates of depression following mild TBI (mTBI) have been estimated at 15% (Rapoport, McCullagh, Streiner, & Feinstein, 2003) and 28% in those with mild to moderate TBI (Rapoport, McCullagh, Shammi, & Feinstein, 2005). TBI patients are also at increased risk for developing anxiety (Hiott & Labbate, 2002) and Posttraumatic Stress Disorder (PTSD) (Lew, et al., 2007). TBI patients who develop these symptoms are at risk for slowed recovery and functional disability (Rapoport, et al., 2003; Rapoport, et al., 2005). TBI can also cause epilepsy (NINDS, 2002) and multiple TBIs create a cumulative effect, increasing risk for poor outcomes (CDC, 1997). The severity and longevity of symptoms after TBI depend on the type, mechanism and severity of injury.

The physical, social, cognitive and emotional outcomes after TBI contribute to the large monetary costs associated with this type of injury and can lead to suffering amongst survivors. In addition, TBI has historically been an injury associated with war trauma, and neurosurgical interventions have been perfected in battlefield operating rooms. TBI has been called the “signature injury” of the current US wars in Iraq and Afghanistan (Lew, et al., 2009, p. 698). In recent combat veterans, some estimates of concussion or mTBI range from 10-20% (Jaffe, et al., 2009). The high numbers of soldiers wounded with TBI returning from the US wars in Iraq and Afghanistan have brought attention to the poor outcomes from TBI and the importance of social interventions to improve symptoms and functioning after medical interventions have saved lives.

TBI is typically classified into three categories based on the Glasgow Coma Scale (GCS) that is used to assess level and duration of consciousness, a prognostic indicator after TBI (Teasdale & Jennett, 1974). The GCS assesses motor response, verbal response and eye opening on a 15-point scale (Teasdale & Jennett, 1974). A score of 3 is the lowest possible and indicates no motor or verbal response and no eye opening. A GCS score of 15 indicates spontaneous eye opening, full orientation to person, place and time, coherent verbal response and appropriate motor movements on command (Teasdale & Jennett, 1974). The GCS range from 3-8 is considered “severe” TBI, a score from 9-12 indicates “moderate TBI and a score of 13-15 specifies “mild” TBI. Researchers and practitioners are working to improve the specificity of TBI classification because there is extreme heterogeneity of injuries within these three broad categories making research and treatment based on such a classification difficult (Saatman, et al., 2008). Despite its limitations, this classification system is the most widely used.

Most of the head injury intervention research to date arises from the medical field and focuses on acute clinical management with an aim to prevent mortality and improve functional outcomes. Clinical trials using both animal and human models focus on hospital techniques including surgery, monitoring, intensive care practices, medication management, and imaging tools (Maas, et al., 2010). Despite methodological and classification difficulties in TBI medical research, improvements in medical management of TBI have decreased mortality rates and increased recovery rates (Saatman, et al., 2008). Individuals today survive previously fatal injuries.

Medical advances of this magnitude are critical; however, they produce unintended consequences. Increased numbers of disabled individuals with social, occupational, mood and other functional difficulties require ongoing care from a variety of professionals. In particular, individuals disabled as a result of TBI may benefit from social, psychological and environmental interventions aimed at improving their functioning in these areas. Unfortunately there is limited research on interventions to improve social, functional or mood symptoms after TBI. As Gruenberg (1977) observed about other medical problems decades ago, this is an example of the “failures of success” (p. 3). Medical advances treat the injury or disease, but research on prevention and effective treatment for the chronic disability caused by injury lag far behind (Gruenberg, 1977). Preventing mortality after severe injury must remain a research goal. Preventing the initial injury altogether as well as developing effective treatments for those disabled after all types of TBI must also be placed high on the research priority list.

Social work practitioners and researchers are well positioned to contribute to prevention efforts and to the specialized care of individuals and their families suffering from the acute and chronic consequences of TBI. Social workers receive clinical training in case management and therapeutic techniques. In the field, social workers provide social resources, linkage and psychological interventions to TBI patients in hospitals, veterans’ facilities, rehabilitation facilities, outpatient medical clinics and outpatient mental health clinics. Studying treatment effects and improving current interventions aimed at decreasing the impact of behavioral, mood and cognitive symptoms after TBI is crucial to move the field forward, address the needs of patients and the failures of our success. This dissertation provides an overview of TBI epidemiology, classification and outcomes in both civilian and military populations and then focuses on recovery after mTBI. The study presented here implemented and tested the effect of a social work delivered intervention for persons with mTBI discharged from a public, urban trauma center emergency department. Results provide support for continued use of the intervention, and recommendations for future social work research and practice with this population are provided.

Epidemiology in the Civilian Population

In response to the TBI Act of 1996, the CDC produced population based data on the incidence and prevalence of TBI in all age groups (Faul, et al., 2010). Data from 2002 through 2006 was the most recent data reported (Faul, et al., 2010). In the US approximately 1.7 million TBI patients were seen in emergency departments, hospitalized or died annually, a rate of 577 per 100,000 population (Faul, et al., 2010). There were approximately 52,000 deaths, 275,000 hospitalizations and 1.365 million discharges from the emergency department annually as a result of TBI (Faul, et al., 2010). TBI was a factor in one third of injury related deaths in the US (Faul, et al., 2010). Approximately 75% of all TBIs or 1.275 million were considered “mild”, consisting of a brief change in mental status or consciousness (CDC, 2003). As noted earlier, emergency room visits and hospitalizations are increasing (Faul, et al., 2010).

Falls account for more than 35% of TBIs, with children (0-4 years) and older adults (65+ years) representing the groups with the highest falls rates (Faul, et al., 2010). Motor vehicle related injuries, which include car accidents, motorcycle accidents, bike accidents and pedestrian struck by automobile accidents, represented over 17% of TBIs (Faul, et al., 2010). Those unintentionally struck by or against an object accounted for over 16% of TBI-related patients, and assaults cause 10% of annual TBIs (Faul, et al., 2010).

Males in every age group suffer more TBIs than females; TBI related deaths, hospitalizations and emergency visit rates combined were highest amongst males zero to four years in age (Faul, et al., 2010). Children (0-4 years), adolescents (15-19 years) and older adults (65+ years) are most at risk for TBI (Faul, et al., 2010). Children (0-14 years) accounted for more than one-third of TBI-related emergency department visits; adults (75+ years) have the highest rates of resulting hospitalization and death (Faul, et al., 2010). Both direct and indirect costs of TBI were estimated at \$50-\$60 billion per year in 2000 (Finkelstein, Corso, & Miller, 2006; Thurman, 2001).

Civilian TBI patients not treated by medical professionals, patients treated in outpatient settings and military personnel who are treated for TBI at U.S. Department of Defense or U.S. Veterans Health Administration Hospitals were not represented in these data; therefore these statistics were an underestimation of the problem. Estimates of untreated TBI from the National Health Interview Survey indicated that 25% of those with mild to moderate TBI did not seek medical care (Sosin, Sniezek, & Thurman, 1996). Estimates of civilian outpatient TBI-related visits represented approximately 37% of all TBIs, meaning the 1.7 million TBIs reported in the CDC report may only represent about 60% of annual TBIs (Schoutman & Fuortes, 2000).

Traumatic Brain Injury in Military Populations

TBI has long been an injury of war. During the Persian Gulf War, the US Congress created the Defense and Veterans Brain Injury Center (DVBIC) and charged the DVBIC with the responsibility to “integrate specialized TBI care, research and education across military and veteran medical care systems” (DVBIC, 2010). It has continued its charge during the two recent conflicts, Operation Iraqi Freedom and Operation Enduring Freedom. In 2008, the DVBIC mission was expanded to include the following Department of Defense programs: TBI surveillance, TBI registry, pre-deployment neurocognitive testing, family caregiver curriculum, 15 year longitudinal study of TBI, and independent study of automated neurocognitive tests (DVBIC, 2010).

In collaboration with the Armed Forces Health Surveillance Center (AFHSC), the DVBIC compiles data from medical records and reports the number of service members diagnosed with a TBI from all causes in military or veteran health service centers. As of the third quarter of 2011, the DVBIC estimates the total number of service members diagnosed with TBIs since 2000 at 220,430; nearly 77% of these injuries were mild (DVBIC, 2012). TBI has been noted as a “signature injury” of modern warfare (Lew, et al., 2009, p. 698). Because they are based on medical diagnoses, the DVBIC (2010) considers these numbers to be the most accurate military TBI prevalence rates; it considers other numbers reported in the media and research articles to be inflated due to their reliance on assessment tools that screen for TBI rather than medical diagnoses. However, closed injuries and mTBI can be difficult to immediately detect in combat situations when other more serious injuries are present and there may be no visible signs of TBI (Lew, 2005). Utilizing objective measures of TBI, such as altered consciousness and memory and neuroimaging is ideal, but can be challenging or impossible (Lew, 2005). In addition, altered consciousness after a traumatic event in combat can result from “normal responses to injury, acute stress, dissociation, sleep deprivation, syncope or the confusion of war” (Hoge, et al., 2009, p. 1589). Therefore, obtaining accurate numbers of military personnel with TBI is extremely difficult. Research with this population suffers from the same classification heterogeneity seen in civilian TBI populations.

Despite these discrepancies, in response to the many service members requiring specialized TBI care, the US government has taken an interest in prevention, treatment and rehabilitation after TBI (DVBIC, 2010). Current and emerging military research on TBI can provide new evidence and inform treatment in civilian populations.

TBI is a growing and important public health problem with implications for social workers serving these patients in a variety of settings. Because of the large numbers of individuals who suffer a TBI, many social workers placed in hospitals, rehabilitation facilities and both medical and mental health outpatient clinics will come in contact with TBI patients. The vast majority of TBIs in both military and civilian populations are mild injuries or concussions; gaining knowledge about effective psychosocial interventions is needed.

Classification of Traumatic Brain Injury

Due to the heterogeneity of TBI, it is difficult to study and improvements in interventions are slowed in both medical and social sciences. TBI has been classified using three main systems: 1) mechanism of injury, 2) injury severity, and 3) pathoanatomical features (Saatman, et al., 2008). Understanding the classification systems highlights the difficulty of research with this population and provides a sense for the state of the field and how brain injury is conceptualized today.

The first classification system looks at the mechanism of injury to determine intervention. Mechanistic classification is correlated with pathoanatomical characteristics and is useful for in vitro and prevention research, but is difficult to use in practice because it is often based on patient report or other subjective reports that make true specificity difficult (Saatman, et al., 2008). The second method classifies by injury severity using the Glasgow Coma Scale (GCS) and is the most commonly used classification system in clinical trials (Saatman, et al., 2008). As described earlier, the GCS distinguishes only three categories of injury within which there is huge individual variation making it difficult to obtain the baseline balance required to isolate and test the effect of interventions in trials. It has been suggested that because injuries with similar pathoanatomic features lead to similar pathophysiology, the third type of classification system, pathoanatomic features or injury type classification, can lead to improved targeting of interventions and create

more homogenous comparison groups for trials (Saatman, et al., 2008). This is particularly true for moderate and severe injuries when there is evidence of injury on radiological scans. The three classification methods are described in turn.

Classification by Injury Mechanism

Because mechanism of injury is correlated with resulting injury pattern, classifying TBIs based on type, direction and speed of physical force can help in predicting type and severity of injury (Saatman et al., 2008). If the distance and rate of a fall resulting in TBI is known, or the weight, speed and type of object that struck a TBI patient is known, or the speed, direction and relative size of the cars and whether seatbelts were worn in a motor vehicle accident is known, this can help in prediction of pathoanatomical features of the injury. “Impact loading” such as is seen in penetrating injuries results in focal injuries including skull fracture, brain contusion, and hematomas (Dunn, Kim, & Gormley, 2009; Saatman, et al., 2008, p. 723). “Inertial loading” such as is seen in motor vehicle accidents tends to result in diffuse injuries including concussion, contusion and diffuse axonal injuries (Dunn, et al., 2009; Saatman, et al., 2008, p. 723). This is particularly useful in modeling injury types and recommending prevention methods, such as seat belts and helmets. However, in clinical settings, it is rare that this information is complete, accurate or even available. Typically, a general understanding of the mechanism of injury is known, but the direction, exact speed and weight of penetrating objects or rate of fall is not known. Therefore, this method is not a reliable way to classify patients for the purposes of either clinical treatment or research protocols. Physical mechanism of injury provides valuable information in clinical settings, and can be used in conjunction with the other classification systems to provide quality care and carry out high quality research.

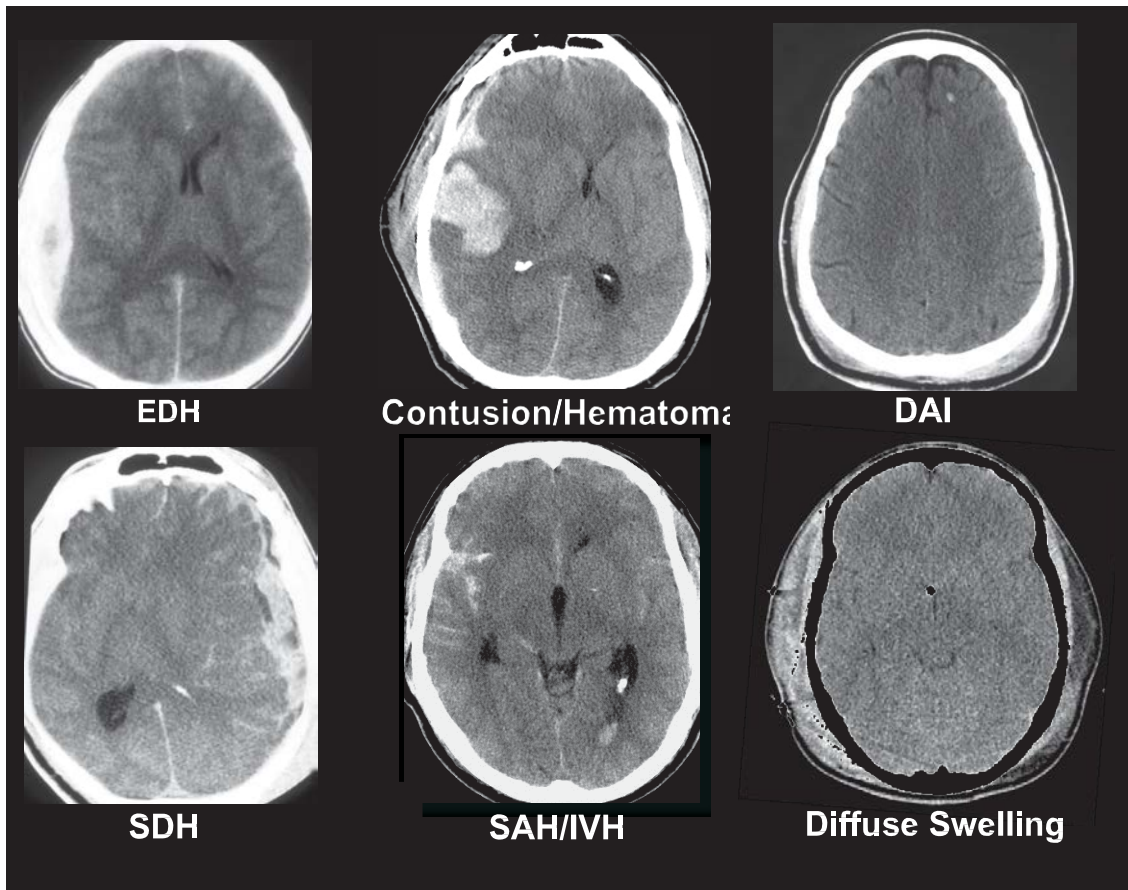
Classification by Injury Severity

Because of the prognostic importance of level and duration of consciousness for head injury outcomes, the Glasgow Coma Scale (GCS) was developed as a standard tool to assess motor and verbal response and eye opening, three areas of behavior thought to be associated with consciousness (Teasdale & Jennett, 1974). It is now widely used to track the duration and assess the level of consciousness in patients with TBI (Narayan, et al., 2002; Teasdale & Murray, 2000). A numerical value is assigned in each of the three categories and then added up for a total score ranging from 3, equivalent to no eye opening and no verbal or motor response to a score of 15, equivalent to full responsiveness in each category (NINDS, 2002). See Table 1 below for the details of the GCS scoring system. Injury severity is then labeled as mild, moderate or severe based on the total score. A score between 3-8 is determined a “severe” TBI, a score between 9-12 indicates a “moderate” TBI and a score between 13-15 is labeled a “mild” TBI (NINDS, 2002).

| |
|--|
| TABLE 1: GLASGOW COMA SCALE FROM NINDS (2002) |
| Glasgow Coma Scale |
| <p>The <u>eye opening</u> part of the Glasgow Coma Scale has four scores:</p> <ul style="list-style-type: none"> * 4 indicates that the patient can open his eyes spontaneously. * 3 is given if the patient can open his eyes on verbal command. * 2 indicates that the patient opens his eyes only in response to painful stimuli. * 1 is given if the patient does not open his eyes in response to any stimulus. |
| <p>The <u>best verbal response</u> part of the test has five scores:</p> <ul style="list-style-type: none"> * 5 is given if the patient is oriented and can speak coherently. * 4 indicates that the patient is disoriented but can speak coherently. * 3 means the patient uses inappropriate words or incoherent language. * 2 is given if the patient makes incomprehensible sounds. * 1 indicates that the patient gives no verbal response at all. |
| <p>The <u>best motor response</u> test has six scores:</p> <ul style="list-style-type: none"> * 6 means the patient can move his arms and legs in response to verbal commands. * A score between 5 and 2 is given if the patient shows movement in response to a variety of stimuli, including pain. * 1 indicates that the patient shows no movement in response to stimuli. |
| From NINDS (2002). http://www.ninds.nih.gov |

This scoring system is useful and reliable in the acute clinical setting for determining level and duration of consciousness (Teasdale & Jennett, 1974). However, there is a wide variation in location and type of injury for patients receiving the classification of mild, moderate or severe TBI. Figure 1 below illustrates the significant heterogeneity of injuries in patients classified as having a “severe” injury using the GCS (Saatman, et al., 2008). For milder injuries, the GCS differentiates even less well (Saatman, et al., 2008). In addition, other factors influencing patient outcomes after injury such as age and other injuries are not measured in the scale (Marmarou, et al., 2007).

FIGURE 1: HETEROGENEITY OF TRAUMATIC BRAIN INJURY
FROM SAATMAN, ET AL., 2008



“Heterogeneity of severe traumatic brain injury (TBI). Computed tomography (CT) scans of six different patients with severe TBI, defined as a Glasgow Coma Scale score of <8, highlighting the significant heterogeneity of pathological findings. CT scans represent patients with epidural hematomas (EDH), contusions and parenchymal hematomas (Contusion/Hematoma), diffuse axonal injury (DAI), subdural hematoma (SDH), subarachnoid hemorrhage and intraventricular hemorrhage (SAH/IVH), and diffuse brain swelling (Diffuse Swelling)” (Saatman, et al., 2008, p. 721)

Despite its limitations, injury severity classification is the most commonly used classification system in TBI clinical trials (Narayan et al., 2002). This is possibly attributable to its widespread use on the scene shortly after injury occurs, its widespread use in the emergency department and throughout hospitalization. Its usefulness in understanding and treating injury may be augmented by the use of additional classification systems.

Classification by Pathoanatomical Features

Classifying by pathoanatomical features can be simply summarized as a “where and what” description of injury type (Saatman, et al., 2008, p. 722). Radiological scans highlight both where injuries are located in the brain and what type of injuries may require surgical intervention. Four major pathoanatomical TBI types have been identified, including 1) subarachnoid hemorrhage, 2) hematoma, 3) contusion, and 4) diffuse axonal injury (Saatman, et al., 2008). See Figure 2 for a diagram of the four main pathoanatomical injury types.

The brain is covered by the hard skull and the soft meninges (Lumenta, 2010). The meninges have three layers called the dura mater, the arachnoid and the pia mater (Lumenta, 2010). The space between the arachnoid space and the pia mater is the subarachnoid space; it contains the cerebrospinal fluid (Lumenta, 2010). Hemorrhage means to bleed and subarachnoid hemorrhage, therefore, is bleeding within the subarachnoid space rather than in the brain itself (Kaye, 2005).

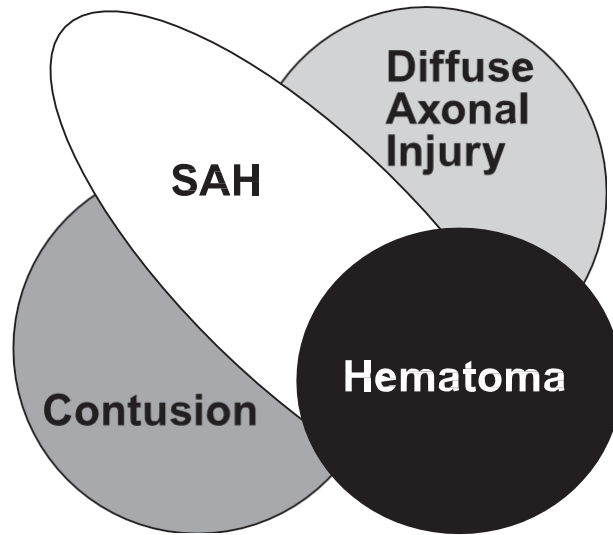
Hematoma is a collection of blood caused by tearing of veins (Parra, de Rueda Ruiz, Reveter, & Dieguez, 2010). Hematomas can occur in different parts of the brain and are labeled based on their location, such as subdural hematoma or epidural hematoma (Parra, et al., 2010). Hematoma can cause cerebral swelling and underlying brain structures to shift, which may require surgical intervention to evacuate (Kaye, 2005).

Cerebral contusions are hemorrhages caused by the brain hitting the skull and are often found on the frontal and temporal regions of the brain (Parra, et al., 2010). They can consist of “lacerated haemorrhagic brain” and can occur under the place of impact to the head and on the opposite side of the brain as a result of acceleration and deceleration of the brain within the cranial cavity after impact (Kaye, 2005, p.41).

Diffuse axonal injury (DAI) has been defined as a “shearing injury to axons as a result of acceleration/deceleration or rotary forces applied to the head” (Parra, et al., 2010, p. 38). This diffuse white matter shearing can occur during high-speed accidents (Piek, 2010). Patients with DAI generally present in a coma and have poor outcomes (Piek, 2010; Saatman, et al., 2008). This traditional definition and clinical presentation was initially used to explain deaths or extremely poor outcomes of TBI patients without noted structural changes in the brain (Saatman, et al., 2008). With the advancement of radiological techniques, DAI with less severe consequences has also been noted in milder injuries and called “traumatic axonal injury” (Saatman, et al., 2008, p. 724).

In many cases, there are multiple injuries, so further clarification of how multiple injuries can be understood within the pathoanatomical classification system will be helpful in utilizing this system in both clinical and research settings.

FIGURE 2: TRAUMATIC BRAIN INJURY VENN DIAGRAM
FROM: SAATMAN, ET AL., 2008



“Common pathoanatomic sequelae of traumatic brain injury (TBI). The Venn diagram represents the four main pathoanatomic sequelae of TBI: hematomas, including epidural, subdural, and parenchymal lesions; diffuse axonal injury; subarachnoid hemorrhage (SAH); and contusions” (Saatman et al., 2008).

CHAPTER TWO

OUTCOMES: FOCUS ON MILD TRAUMATIC BRAIN INJURY

While some individuals recover with limited residual sequelae, TBI causes a range of short or long-term problems in thinking, sensation, language and emotion (NINDS, 2002). There is significant increased risk of psychiatric disorder diagnosis after TBI (Fann, et al., 2004). For instance, rates of major depressive disorder in a hospitalized TBI sample were approximately 53% over the course of one-year post injury (Bombardier, 2010). Rates of depression following mTBI have been estimated at 15% (Rapoport, McCullagh, Streiner, & Feinstein, 2003) and 28% in those with mild to moderate TBI (Rapoport, McCullagh, Shammi, & Feinstein, 2005). TBI patients are also at increased risk for developing anxiety (Hiott & Labbate, 2002) and posttraumatic stress disorder (PTSD) (Lew, et al., 2007). TBI patients who develop these symptoms are at risk for slowed recovery and functional disability (Rapoport, et al., 2003; Rapoport, et al., 2005). The etiology of these symptoms is not well understood, particularly for those with mTBI. Complex models of factors contributing to the development of psychiatric symptoms after TBI have been proposed and include pre-existing biological, psychological and social factors in addition to physiological injury factors.

TBI can also cause epilepsy (NINDS, 2002) and multiple TBIs create a cumulative effect, increasing risk for poor outcomes (CDC, 1997). Particularly for mTBI, the propensity for development of prolonged symptoms may be linked to preexisting mental health and health conditions. The physical, social, emotional, cognitive and emotional outcomes after TBI contribute to its large monetary costs and can lead to suffering amongst survivors. TBI is a growing public health problem requiring attention from researchers and practitioners, including social workers, who serve this population. The severity and longevity of symptoms after TBI depend on the severity of injury. The outcomes after moderate and severe TBI are discussed briefly followed by a detailed discussion of mild TBI outcomes.

Outcomes after Moderate and Severe Traumatic Brain Injury

The lack of specificity in the GCS, described in an earlier section, leads to the combination of moderate and severe TBI in many outcome studies. Therefore, the outcomes from these two levels of severity will be described together. In addition to the GCS score, many clinicians and researchers use the Abbreviated Injury Scale (AIS) and the Injury Severity Scale (ISS) to assess severity in order to inform practice, predict mortality and morbidity and conduct research with more seriously injured trauma patients. In 1971, the American Medical Association's Committee on Medical Aspects of Automotive Safety published the AIS to differentiate injury severity in patients involved in motor vehicle accidents. The AIS was revised in 1976, 1980 and 1985 to be more widely applicable in the determination of blunt and penetrating injury severity (Civil & Schwab, 1988). The scale is separated into seven body regions: external, head (including face), neck, thorax, abdomen/pelvis, spine and extremities (Greenspan, McLellan, & Greig, 1985). Injury in each of these body regions is classified with a severity code of 1=minor, 2=moderate, 3=serious, 4=severe, 5=critical, 6=maximum injury, 7=virtually unsurvivable, 9=unknown (Greenspan, et al., 1985).

One limitation of the AIS is that the scores from the different body regions cannot be added to give an overall score (Greenspan, et al., 1985). To address this, the ISS was developed to

describe patients with multiple injuries (Baker, O'Neill, Haddon, & Long, 1974). The ISS is derived from the sum of squares of AIS score in the three most severely injured areas; it significantly improves upon the AIS correlation with mortality (Baker, et al., 1974). In studies of moderate and severe TBI, in addition to the GCS score, the AIS head score is used to determine severity of TBI (McGarry, et al., 2002).

The Glasgow Outcome Scale (GOS) is the commonly used scoring system for outcome after moderate and severe TBI (Wilson, Pettigrew, & Teasdale, 1998). The scale ranges from 1-5 (Jennett & Bond, 1975). The scores are ranked as follows: a score of 5 represents "good recovery" with "resumption of normal life even though there may be minor neurological and psychological deficits; a score of 4 represents "moderate disability" defined as "disabled but independent" when a patient can live independently and perform modified work; a score of 3 is equivalent to "severe disability" defined as a patient who is "conscious but disabled" and requiring 24 hour supervision with all activities of daily living; a score of 2 on this scale describes a patient in a "persistent vegetative state"; and a score of 1 represents death (Jennett & Bond, 1975, p. 482-483). The score can be determined by a number of professionals working with the patient, and the scale has been modified over the years to be more sensitive and systematically administered (Wilson, et al., 1998).

Of the 1.7 million TBIs treated in hospitals and emergency departments each year, 3% or 52,000 resulted in death (Faul, et al., 2010). TBI contributes to approximately 30% of injury related deaths in the US (Faul, et al., 2010). Mortality after severe TBI is approximately 30% (Jiang, et al., 2002; Narayan, et al., 2002; Hukkelhoven, et al., 2003). In one large study of severe TBI patients, using the GOS, one year after injury 30% had good recovery (able to return to work or school), 14% had moderate disability (live independently but cannot participate in work or school), 24% had severe disability (unable to live independently but able to follow commands), and 29% died (Jiang, et al., 2002, p. 870). Another large study found similar outcomes for patients with severe TBI (Hukkelhoven et al., 2003). The long-term negative impact of severe TBI on patient and family psychological symptoms and psychosocial functioning has been described (Hoofien, Gilboa, Vakil, & Donovan, 2001). In general, patients with severe TBI have poorer outcomes than those with moderate TBI. However, patients with moderate TBI also have poor functional outcomes, with many reporting moderate or severe disability, as defined above, two years post injury (Hellawell, Taylor, & Pentland, 1999).

There is significant increased risk of psychiatric diagnosis after moderate and severe TBI (Fann, et al., 2004). A large case control study identified 49% prevalence of psychiatric illness in the first year after moderate to severe TBI and 18% prevalence of psychiatric illness in the control group (Fann, et al., 2004). For those without prior year psychiatric illness, the relative risk for any psychiatric illness in the 6 months following moderate to severe TBI was 4.0 compared to those without TBI (Fann, et al., 2004). For individuals with prior psychiatric diagnoses, the relative risk for psychiatric illness in the 6 months following moderate to severe TBI was 2.1 compared to those without TBI (Fann, et al., 2004).

In one study, patients reported high rates of inability to return to work and poor mental health; 25% of patients reported functional disability severe enough to require personal assistance and problems with social integration one year after moderate to severe TBI (Andelic, et al., 2010). Much of the recovery after moderate and severe TBI occurs in the first six months after injury, but gains can be seen beyond that (Maas, Stocchetti, & Bullock, 2008). Functional disability and depression can persist even up to 10 years post moderate to severe TBI (Andelic, et al., 2009) and most likely beyond that, although few studies follow patients beyond 10 years.

Moderate and severe TBI cause much residual disability and more research is needed to improve acute TBI medical care that leads to improved functional outcomes (Maas, et al., 2010). Results from the International Mission on Prognosis and Clinical Trial Design (IMPACT) in TBI study group revealed that despite “extremely promising pre-clinical data and early phase trials, no agent has yet been shown convincingly in a phase III trial to have clear benefit in terms of improving functional outcome after TBI” (Maas, et al., 2010, p. 127). More rigorous research is also needed on social and psychological interventions to help these individuals and their families in the acute care setting, and the rehabilitation and the outpatient settings.

Outcomes after Mild Traumatic Brain Injury

Most TBIs (about 75%) are considered to be mild injuries (CDC, 2003). Perhaps because of the high prevalence and recent military focus on mTBI, more research and research synthesis is now available to understand mTBI outcomes. As described in the classification section, a general “mild” diagnostic category has limited validity in both clinical and research settings. Heterogeneity of injury types and inconsistency in the use of classification systems in research has led to heterogeneous study populations that cannot be compared and resulted in slowed advancement in the head injury field (Carroll, Cassidy, Holm, Kraus, & Coronado, 2004a; Comper et al., 2005; Narayan et al., 2002; Saatman et al., 2008).

Mild TBI can create “immediate physiological changes conceptualized as a multilayered neurometabolic cascade in which affected cells typically recover, although under certain circumstances a small number might degenerate and die” (Iverson, 2005, p. 310). When cellular or vascular changes are noted, the primary pathophysiologies of mTBI are 1) ionic shifts, 2) abnormal energy metabolism, 3) diminished cerebral blood flow, and 4) impaired neurotransmission (Iverson, 2005, p. 310). In addition, traumatic axonal injury (TAI), which is focal injury to white matter tracts that results from acceleration and deceleration, has been noted in mTBI patients (Lee, et al., 2008; Mittl, et al., 1994) and associated with poor outcome (Medana & Esiri, 2003). Many people, both with and without detectable cellular or vascular changes, experience physical, cognitive and behavioral symptoms immediately following mTBI (Carroll, et al., 2004b; McCrea, et al., 2009; National Center for Injury Prevention & Control (NCIPC), 2003).

Mild TBI is generally difficult to diagnose because diagnostic symptoms quickly resolve and there is typically no evidence of injury of radiological scans (Ruff, Iverson, Barth, Bush, & Broshek, 2009). This difficulty is marked when co-occurring psychiatric symptoms are present. In addition, many patients visit their primary care physician versus a hospital for care after an mTBI or don’t seek out care at all for the injury itself (Langlois et al., 2003; Mellick, Gerhart, & Whiteneck, 2003; Sosin, Sniezek, & Thurman, 1996). This leads to further challenges in diagnosis and treatment and potential for misattribution of mTBI sequelae as purely psychiatric or behavioral in nature. Most individuals recover within weeks to one month (Iverson, 2005; McCrea, et al., 2009) and up to three months (Carroll, et al., 2004b). However, approximately 15% of individuals experience prolonged and significant symptoms following mTBI (Ruff & Weyer Jamora, 2009; Stranjalis, et al., 2008). While this estimate is debated (Greiffenstein, 2008), it is clear that some mTBI patients present for clinical treatment of symptoms lasting beyond three months (Ruff & Weyer Jamora, 2009). Prolonged symptoms taken together, called post-concussive syndrome, result in functional decline in daily personal and work activities, social relationships and decreased financial independence (NCIPC, 2003).

Research supports a threshold for prolonged recovery after mTBI at three months post injury

for children and possibly for adults (Carroll et al., 2004b). However, the timeline for recovery in adults is less clear and needs more careful study (Carroll et al., 2004b). Both the Diagnostic and Statistical Manual of the American Psychiatric Association (DSM-IV) and the International Classification of Diseases (ICD-10) have diagnostic categories for a post-concussive disorder or syndrome, respectively (American Psychiatric Association, 1994; World Health Organization, 1992). However, because the explicit etiology of symptoms is unclear, it is difficult to rely on these diagnostic categories (Carroll et al., 2004b). In addition, research to date does not support the definitions provided by either of these classification systems because each requires an injury severity threshold (Carroll et al., 2004b). Current evidence does not support the definition of a post-concussive disorder or syndrome resulting directly from mTBI as defined by either the DSM-IV or ICD-10 codes; other factors influencing poor outcomes, such as psychological correlates, after mTBI must be taken into consideration and studied further (Carroll et al., 2004b).

Many of the measures used to assess outcome after mTBI have not been validated with mTBI populations (Carroll et al., 2004b). The Rivermead Post-Concussion Symptoms Questionnaire (King, Crawford, Wenden, Moss, & Wade, 1995), the Rivermead Head Injury Follow Up Questionnaire (Crawford, Wenden, & Wade, 1996) and the Glasgow Outcome Scale (Wilson, Pettigrew, & Teasdale, 1998) have been reliably confirmed with this population (Carroll et al., 2004b). The Problem Checklist and SF-36 (the Short Form Health Survey) have been shown to distinguish normal controls from mTBI patients (Carroll et al., 2004b).

Overall, there is much work to be done in order to better serve patients with mTBI. In order to address some of these issues, the World Health Organization (WHO) convened a task force on mTBI. They recommended the following definition of mTBI (Carroll, et al., 2004a):

Mild TBI is an acute brain injury resulting from mechanical energy to the head from external physical forces. Operational criteria for the clinical identification include: (i) 1 or more of the following: confusion or disorientation, loss of consciousness for 30 minutes or less, post-traumatic amnesia for less than 24 hours, and/or other transient neurological abnormalities such as focal signs, seizure and intracranial lesion not requiring surgery; (ii) Glasgow Coma Scale score of 13-15 after 30 minutes post injury or later upon presentation for healthcare. These manifestations of mTBI must not be due to drugs, alcohol, medications, caused by other injuries or treatment for other injuries (e.g. systemic injuries, facial injuries or intubation), caused by other problems (e.g. psychological trauma, language barrier or coexisting medical conditions) or caused by penetrating craniocerebral injury. (p. 115)

Deficits experienced after mTBI can be placed into four overarching categories, 1) physical symptoms, 2) cognitive deficits, and 3) behavioral changes and 4) psychiatric symptoms. These deficits can lead to functional disability, particularly for those who develop post-concussive syndrome. In military populations, polytrauma and the clinical triad of chronic pain, Posttraumatic Stress Disorder (PTSD) and persistent post-concussive symptoms can occur after mTBI.

Physical Symptoms

Physical symptoms of mTBI may include nausea, vomiting, dizziness, headache, blurred vision, sleep disturbance, and fatigue (Gerstenbrand & Stepan, 2001). Self-reported symptoms of headache, fatigue, forgetfulness and sleep difficulties are common in the first month after mTBI, but the evidence on typical duration of these symptoms is mixed, ranging from resolution after one

month to resolution after three months or continued symptoms up to one year post injury (Carroll et al., 2004b).

Cognitive Deficits

Many adults experience cognitive deficits measured on neuropsychological testing following mTBI including difficulty with recall, slowed information processing and inattention in the days immediately following injury (Carroll et al., 2004b; NCIPC, 2003). These symptoms are not unique to persons with mTBI but are more common in mTBI patients than for those with other injuries or in the general population during the first month after mTBI (Carroll et al., 2004b). These symptoms generally resolve within three months after injury (Carroll et al., 2004b; Kashluba et al., 2004; Schretlen & Shapiro, 2003).

Behavioral Changes and Psychiatric Symptoms

After mTBI, individuals may also notice changes including irritability, disinhibition or emotional lability (Gerstenbrand & Stepan, 2001; NCIPC, 2003). In addition, there is significant increased risk of psychiatric disorder diagnosis after mTBI (Fann, et al., 2004). A large case control study identified 34% prevalence of psychiatric illness in the first year after mTBI and 18% prevalence of psychiatric illness in the control group (Fann, et al., 2004). For those without prior year psychiatric illness, the relative risk for any psychiatric illness in the 6 months following mTBI was 2.8 compared to those without TBI (Fann, et al., 2004). For individuals with prior psychiatric diagnoses, the relative risk for psychiatric illness in the 6 months following mTBI was 1.6 compared to those without TBI (Fann, et al., 2004). Those with a prior psychiatric diagnosis were found to have elevated rates of psychiatric illness years after mTBI (Fann, et al., 2004). In another study, those with mTBI met DSM-IV criteria for posttraumatic stress disorder, panic disorder, agoraphobia and social anxiety at twice the rate of trauma patients without TBI (Bryant et al., 2010). Symptoms of depression are also common after mTBI. Meeting DSM-IV criteria for major depressive disorder after mTBI was associated with poor psychosocial functioning and distress (Rapoport, et al., 2003) and cognitive impairment (Rapoport, et al., 2005). TBI patients who develop psychiatric symptoms are at risk for slowed recovery and functional disability (Rapoport, et al., 2003; Rapoport, et al., 2005).

Substance abuse often co-occurs with TBI (Bjork & Grant, 2009; Corrigan & Cole, 2008; Parry-Jones, Vaughan & Cox, 2006; Ponsford, Whelan-Goodinson & Bahar-Fuchs, 2007). Alcohol-related disorders are linked to risk for traumatic injury and re-injury of all types (Dicker, et al., 2011; Gentilello, Donovan, Dunn & Rivara, 1995). After TBI, alcohol and drug use has been noted to initially decrease, but then increase at two and three years post injury (Ponsford, et al., 2007). Substance abuse is associated with poor outcome after injury (Parry-Jones, et al., 2006).

Due to the high incidence of mTBI each year, the subgroup of patients reporting symptoms of psychiatric illness, including substance abuse, represent a large number of individuals with high medical costs, and high levels of lost productivity and distress. The etiology of these symptoms is not well understood. Complex models of factors contributing to the development of psychiatric symptoms after TBI have been proposed and include pre-existing biological, psychological and social factors in addition to physiological injury factors. The connection between psychological distress, depression, medication, pain and post-mTBI symptoms need further study (Carroll et al., 2004b).

Functional Disability and Post-Concussive Syndrome

Functional disability, including problems with activities of daily living, problems completing work or school activities, limitations in recreational and social activity and managing finances independently have also been noted (NCIPC, 2003). Prolonged physical, cognitive and behavioral symptoms together are known as post-concussive syndrome (Carroll et al., 2004b). While many patients have little or no disability after the initial symptoms of mTBI resolve, some individuals experience persistent symptoms in cognition, self-reported physical and behavioral symptoms and resulting functional disability more than three months and even beyond one-year post injury.

Severity and type of injury, such as TAI (Medana & Esiri, 2003) and brain lesion or skull fracture (Carroll et al., 2004b) have been associated with poor outcome and development of post-concussive syndrome. Subgroup populations, including those who use alcohol, those with complicated mTBI, and other severe injuries, seizures and the elderly, have been studied as possible prognostic factors for poor outcomes (Carroll et al., 2004b). Because alcohol use is a risk factor for mTBI, more carefully controlled research is needed in order to determine whether it is also a prognostic factor for poor outcome (Carroll et al., 2004b). More research is needed to determine etiology and directionality of these phenomena (Bjork & Grant, 2009).

In addition, it has been hypothesized that pre-existing personality traits place individuals at risk to become part of the “miserable minority” experiencing prolonged symptoms after mTBI (Ruff, Camenzuli & Mueller, 1996, p. 551). Theoretically, personality traits interact with the acute physical symptoms of mTBI, an individual’s coping style, the environment and the meaning one makes about the injury to create a negative feedback loop (Kay, 1993). Other hypotheses for causes of prolonged symptomatology include “neurogenic, psychogenic...premorbid or comorbid factors, secondary gain and any combination” of these (Ruff & Weyer Jamora, 2009, p. 36). Recently, Hou and colleagues (2011) proposed a model for development of post-concussion syndrome after mTBI that includes, 1) predisposing factors such as anxiety, depression, life experiences and expectations, 2) social environmental factors such as social support, and 3) perpetuating factors in three categories, cognition, emotion and behavior (p.2). In their study, they showed that the specific perpetuating factors associated with risk for post-concussive syndrome included negative perceptions or cognitions about recovery after mTBI, stress, anxiety and depression and all-or-nothing behavior. The interaction of these perpetuating factors with a person’s pre-existing problems and social environment can lead to post-concussive syndrome after mTBI.

Military Polytrauma and the Clinical Triad: PTSD, Chronic Pain and Mild TBI Sequela

The high power explosives used in the current conflicts in Iraq and Afghanistan lead to increases in severe injuries (Lew, 2005). Concurrently, advances in armor and battlefield medical care have increased soldier survival rates (Lew, 2005; Okie, 2005; Warden, 2006). Veterans of these wars present with new injury patterns and new symptom constellations; a new term “polytrauma” has been used to describe the unique injury patterns from the current conflicts (Lew, 2005, p. xiii). The US Department of Veterans Affairs (VA) defines polytrauma as “two or more injuries to physical regions or organ systems, one of which may be life threatening, resulting in physical, cognitive, psychological, or psychosocial impairments and functional disability” (VA, 2010). Mental health problems are associated with combat injuries and often require psychiatric care (Sayer, et al., 2009). High rates of PTSD have been noted in polytrauma patients (Lew, et al., 2007). In addition, research indicates that acute and chronic pain were significant problems

associated with combat injuries (Clarke, et al., 2007; Lew, et al., 2007; Sayer et al., 2008; Sayer et al., 2009). High rates of post-concussive symptoms have also been reported in polytrauma military patients (Lew, et al., 2007). Due to the unique needs of these patients, the VA developed a Polytrauma System of Care, including four Polytrauma Rehabilitation Centers (PRC), four Polytrauma Transitional Rehabilitation programs and 22 Polytrauma Network Sites across the country (VA, 2010). In particular, PRCs were designed to treat patients with TBI (Sayer et al., 2008). Patients treated at PRCs often present with TBI as well as other injuries (Sayer et al., 2008). In addition to the specialized medical care these patients receive after injury, a focus is placed on understanding and treating the resulting psychological impairments and functional disability.

Veterans are also presenting with what has been termed the “polytrauma clinical triad” or co-occurring PTSD, chronic pain and persistent post-concussive symptoms after mTBI (Lew et al., 2009, p. 697). Persistent post-concussive symptoms were defined as “persistent and ongoing physical, cognitive, or behavioral difficulties lasting longer than 3 months following a mild TBI” in returning wounded soldiers (Lew et al., 2009, p. 697). This triad has been noted at high rates in patients seen in the PRCs (Lew et al., 2009). A study conducted within the Polytrauma System of Care reported 42% concurrent prevalence of the polytrauma clinical triad (Lew et al., 2009). In this population there was 81.5% prevalence of chronic pain, 68.2% prevalence of PTSD and 66.8% prevalence of post-concussive symptoms (Lew, et al., 2009). Symptoms of these three disorders overlap significantly making diagnosis, treatment and research difficult (Lew, et al., 2009).

Others have noted patterns of symptom overlap between post-concussive complaints and PTSD after mTBI (Hoge, et al., 2008; Belanger, Kretzmer, Vanderploeg & French, 2010), and PTSD has been found to explain the variance between reported post-concussive symptoms and TBI severity (Belanger, Kretzmer, Vanderploeg & French, 2010). The common occurrence of post-concussive symptoms after a variety of combat exposures, the lack of specificity of post-concussive symptoms related to mTBI and the association of post-concussive symptoms with PTSD has been highlighted in studies of UK military personnel (Fear, et al., 2009). Post-concussive symptoms were not unique to patients with mTBI when compared to non-TBI trauma patients; these symptoms were present at high rates in both mTBI and non-mTBI traumatic injury survivors (Meares, et al., 2008). It has been suggested that functional impairment, rather than mTBI, is associated with psychiatric illness after an injury (Bryant, et al., 2010). Some researchers suggest that post-concussive symptoms attributed to mTBI may be caused by primary psychiatric conditions such as PTSD and depression and that mTBI may be compounding the effects of these disorders (Bryant, 2008).

In addition, many soldiers are coping with the effects of war, TBI and PTSD by using substances (Corrigan & Cole, 2008; Olson-Madden, et al., 2010). This leads to further difficulty in diagnosis and treatment. Soldiers should be screened for TBI and PTSD and substance abuse and new interventions that are aimed at addressing all three will be necessary to adequately treat the complex constellation of problems for returning soldiers (Corrigan & Cole, 2008; Olson-Madden, et al., 2010).

The association of mTBI and PTSD must be explored further. Does mTBI cause neural damage that contributes to PTSD? Does this create a negative feedback loop that leads to increased functional disability and poor outcome after mTBI in combat injured veterans? More research to specify the cause and impact of polytrauma sequelae will be an important step toward developing effective interventions for both military and civilian populations.

CHAPTER THREE

INTERVENTIONS AFTER MILD TRAUMATIC BRAIN INJURY

Regardless of whether the etiology of symptoms after mTBI is understood, the incidence of mTBI is significant and many individuals report physical, cognitive, psychiatric and behavioral symptoms after mTBI. These symptoms are commonly reported immediately after mTBI and in the first one to three months following injury. Patients report significant distress about the symptoms, and therefore, clinicians have begun to study interventions aimed at decreasing the number and intensity of symptoms and subjective sense of distress about the symptoms. Interventions targeting physical, emotional and cognitive symptom abatement after mTBI have had mixed results.

Several systematic reviews have assessed the effectiveness of interventions for mTBI (Al Sayegh, Sandford, & Carson, 2010; Borg et al., 2004; Comper, Bisschop, Carnide, & Tricco, 2005; Snell, Surgenor, Hay-Smith, & Siegert, 2009; Soo & Tate, 2007). Intervention studies to date generally fall into several categories 1) patient education, 2) psychological, and 3) cognitive rehabilitation. However, there is large heterogeneity and generally poor methodological rigor amongst the studies, so studies within each category could not be combined in a meta-analysis. More research is needed in all three intervention categories.

Patient Education

There is limited evidence to support the effectiveness of early patient education and reassurance interventions (Borg, et al., 2004; Comper, Bisschop, Carnide and Tricco, 2005; Snell, Surgenor, Hay-Smith and Siegert, 2009; Al Sayegh, Sandford and Carson, 2010). However, the evidence remains tentative and may be overstated in the literature; one review found six randomized trials of education and reassurance indicating no benefit and three indicating a benefit in symptom improvement (Al Sayegh, Sandford and Carson, 2010). The methodological rigor varied greatly between the studies indicating more research is needed (Al Sayegh, Sandford and Carson, 2010).

The education component of the intervention typically includes a verbal explanation of a brochure or booklet that explains to the patients what an mTBI diagnosis means and common symptoms after mTBI; the patients are allowed to keep the brochure (Gronwall, 1986; Englander, et al., 1992; Alves, Macciocchi and Barth, 1993; Mittenberg, et al., 1996; Minderhoud, et al., 1980; Paniak, et al., 1998; Wade et al., 1998; Ponsford, et al., 2002; Bell, et al., 2008). The purpose of education about mTBI is to legitimize and normalize symptoms and the goal is to reduce distress about symptoms. The educational component targets reduction in post-concussive symptoms and distress. The reassurance component of the intervention includes verbal explanation by a health care professional of expected symptoms, encouragement of an expected good recovery and explanation of common coping strategies used for common symptoms after mTBI (Relander, Troupp and Bjorkesten, 1972; Gronwall, 1986; Alves, Macciocchi and Barth, 1993; Minderhoud, et al., 1980; Paniak, et al., 1998; Wade et al., 1998; Bell, et al., 2008). The goal of reassurance is to reduce distress about symptoms and provide ideas for coping within a construct of expected good recovery. Patients have some expectations of symptoms, tools for coping with symptoms and expectation that symptoms will subside. The intervention targets reduction in symptoms and distress and improved community functioning.

Patient education and reassurance interventions completed together have been shown to be effective in reducing symptoms and distress, particularly when completed early in recovery; however, more research is needed to confirm results (Borg, et al., 2004; Comper, Bisschop, Carnide and Tricco, 2005; Snell, Surgenor, Hay-Smith and Siegert, 2009; Al Sayegh, Sandford and Carson, 2010).

Some studies have demonstrated improvements in reported symptoms and distress with patient education and reassurance interventions (Gronwall, 1986; Hinkle et al., 1986; Minderhoud, et al., 1980; Wade et al., 1998; Ponsford, et al., 2002) and shorter duration of symptoms (Gronwall, 1986). One study and its follow up study found equivalent improvements in outcomes at 3 months and one year post injury for a group given education and reassurance alone and a group given additional, more extensive treatment (Paniak, Toller-Lobe, Durand and Nagy, 1998; Paniak, et al., 2000). A recent study augmented the education intervention with counseling and referral over the phone and demonstrated symptom reduction at 6 months post injury when compared to usual care (Bell, et al., 2008). However, the specific components (i.e. education, counseling or case management) and the number and intensity of contacts responsible for the outcome improvements were not identified in this study.

Other experimental studies found no difference between standard care and intensive follow up groups (Ghaffar, McCullagh, Ouchterlony, Feinstein, 2006), no difference in outcomes between usual care and targeted occupational therapy intervention groups (Elgmark Andersson, Emanuelson, Bjorklund and Stalhammar, 2007), and no difference between usual care and early education groups (Heskestad, 2010).

More research on the effect of targeted early patient interventions is needed. Intervention provided in the emergency department may be of particular interest because of the high prevalence of symptoms immediately after mTBI and the general trend towards a decrease in those symptoms in the first month after mTBI (Paniak, et al., 1998). Well-designed studies to test interventions targeting patients with prolonged symptoms and subjective sense of distress are also needed.

Psychological Interventions

A Cochrane Review found there was limited evidence for a positive effect of cognitive behavioral therapy (CBT) on acute stress disorder symptoms after mTBI (Soo and Tate, 2007). There is also limited evidence of cognitive behavioral therapy plus cognitive rehabilitation on general anxiety symptoms for those with mild to moderate TBI (Soo and Tate, 2007). Several randomized studies have reported some benefit of CBT after mTBI, but more rigorous designs are needed to better assess the effect (Al Sayegh, Sandford and Carson, 2010). These results must be understood within the context of limited amounts of research and study participants (Soo and Tate, 2007).

Because of the high prevalence of psychiatric symptoms after mTBI, psychological interventions such as CBT, modified to meet the unique needs of persons with brain injury are an exciting avenue for further exploration. In addition, research with severely injured TBI patients indicates that functional disability contributes to the development of depression and anxiety after injury (Schonberger, et al., 2011). While this relationship needs validation in mTBI populations, improving or maintaining pre-morbid functional status may prevent the development of psychiatric symptoms and can be a focus of social work intervention.

Cognitive Rehabilitation

Cognitive rehabilitation after mTBI has also been studied; outcomes are mixed. Non-randomized trials studying the effect of rehabilitation programs with a therapy component on mTBI symptoms reported a benefit, but randomized designs have shown mixed results (Al Sayegh, Sandford and Carson, 2010). As mentioned above, in one study CBT plus cognitive rehabilitation was shown to improve general anxiety symptoms after mild to moderate TBI (Soo and Tate, 2007). In one comprehensive review of the effects of cognitive rehabilitation after TBI, Cicerone, et al. (2005) reported that compensatory memory strategy training was effective in reducing mild memory deficits. These strategies included both internal visual imagery and external memory aids.

Overall, more research on interventions after mTBI is needed (Borg, et al., 2004; Carroll et al., 2004b; Comper, Bisschop, Carnide and Tricco, 2005; Ponsford, 2005; Soo and Tate, 2007; Al Sayegh, Sandford and Carson, 2010). One promising direction in mTBI intervention research comes from a well-designed trial that demonstrated symptom reduction at 6 months post injury in the intervention group that received an educational intervention augmented with 12-week telephone counseling and case management (Bell, et al., 2008). However, because the intervention included education and was compared to usual care, the specific components (i.e. education, counseling or case management) and the number and intensity of contacts responsible for the outcome improvements were not identified.

Contribution of Current Study

The present study builds on this research to isolate and test the therapeutic effects of a social work delivered education and reassurance mTBI intervention (SWDI). Early education and reassurance coupled with referral for patients experiencing significant post-concussive, anxiety, or depression symptoms is a promising intervention. However, as noted above, conflicting findings from previous studies indicate a need for further testing (Borg, et al., 2004; Comper, Bisschop, Carnide and Tricco, 2005; Snell, Surgenor, Hay-Smith and Siegert, 2009; Al Sayegh, Sandford and Carson, 2010).

This study utilizes social work practitioners trained in the emergency department setting. Social workers have not been engaged in mTBI intervention studies to date. Professionals used in other studies include occupational and physical therapists, nurses, neuropsychologists, clinical psychologists, and masters level psychologists. In order to sustain interventions for mTBI patients in this economic climate, it is extremely important to produce the maximum treatment effect using the lowest intensity of services and the most efficient provider. Social workers are well placed in hospitals and emergency departments to contribute to the care of individuals suffering from the acute and chronic consequences of mTBI. They are economically efficient and clinically trained to provide psychosocial interventions and case management to patients.

Research to date has not lead to models that can immediately identify persons who will have a poor outcome or develop post-concussive syndrome, yet we know that they may need enhanced services in order to recover. Therefore, the question facing service providers and researchers is how to provide enough services to every mTBI patient to improve outcomes and prevent development of post-concussive syndrome and also identify those experiencing poor outcomes in order to provide enhanced services. Given limited resources in public health settings, it is of utmost importance to triage patients into appropriate levels of service.

To this end, the present study evaluated the SWDI; the SWDI targeted problematic emotional, cognitive and behavioral symptoms, prevention of depression, anxiety and post-concussive symptoms and aimed to link those with concerning or prolonged symptoms to enhanced services. The SWDI was provided in the Emergency Department to patients with mTBI prior to discharge (SWDI Group) and compared to usual care (Usual Care Group). The outcomes of interest were assessed three months post injury and included psychiatric, cognitive, physical, and functional outcomes; specifically, depression, anxiety, post-concussive symptoms, PTSD, alcohol use, community functioning and successful linkage to community resources.

Theoretical Framework and Proposed Model of Change

Encouraging Healthy Behavior and Help Seeking

The rationale for using a patient education, reassurance and resource intervention in health care to induce use of coping strategies and appropriate resources is grounded in the Health Belief Model (HBM) (Rosenstock, 1974; Becker, et al., 1977). Proponents of HBM theorize that motivation, perceived threat of disease, and belief that a certain action will reduce the threat at an acceptable cost are the factors associated with the likelihood that a person will integrate a recommended novel health behavior (Becker, et al., 1977; Rosenstock, Stretcher and Becker, 1988).

An example of value-expectancy theory, the HBM overlaps with Bandura's social learning theory (SLT), and current adaptations of HBM explicitly drew on SLT concepts to expand the model (Rosenstock, Stretcher and Becker, 1988). For instance, the HBM takes into account the impact of reinforcement contingencies and modeling on expectations of outcomes, and incorporates the "efficacy expectation" or belief that one can accomplish the behavior (Rosenstock, Stretcher and Becker, 1988, p.178).

According to the HBM, several things are required in order to change a health related behavior. First, a cue to action, for example advice from a health care provider, an educational packet on disease or a mass media campaign, influences individuals' perception of a particular disease by alerting them that the disease exists and by providing a recommended action to combat the disease. Specifically, the cue influences individuals' perception of their susceptibility to the disease and the severity of the consequences of disease and those in turn influence the perceived threat of disease. Demographics and social, psychological and environmental factors also shape perception of the threat. Then a cost-benefit analysis is performed, in which the perceived benefits of the recommended action are weighed against the barriers to that same action (i.e. financial costs or physical discomfort). Finally, the expectation of efficacy in completing the action is considered. All of these factors interact to influence the likelihood that someone will change a health related behavior. See Figure 3 for a map of the HBM concept. See Figure 4 for addition of components of the SWDI into relevant parts of the HBM model.

FIGURE 3. HEALTH BELIEF MODEL
 ADAPTED FROM BECKER, ET AL., 1977

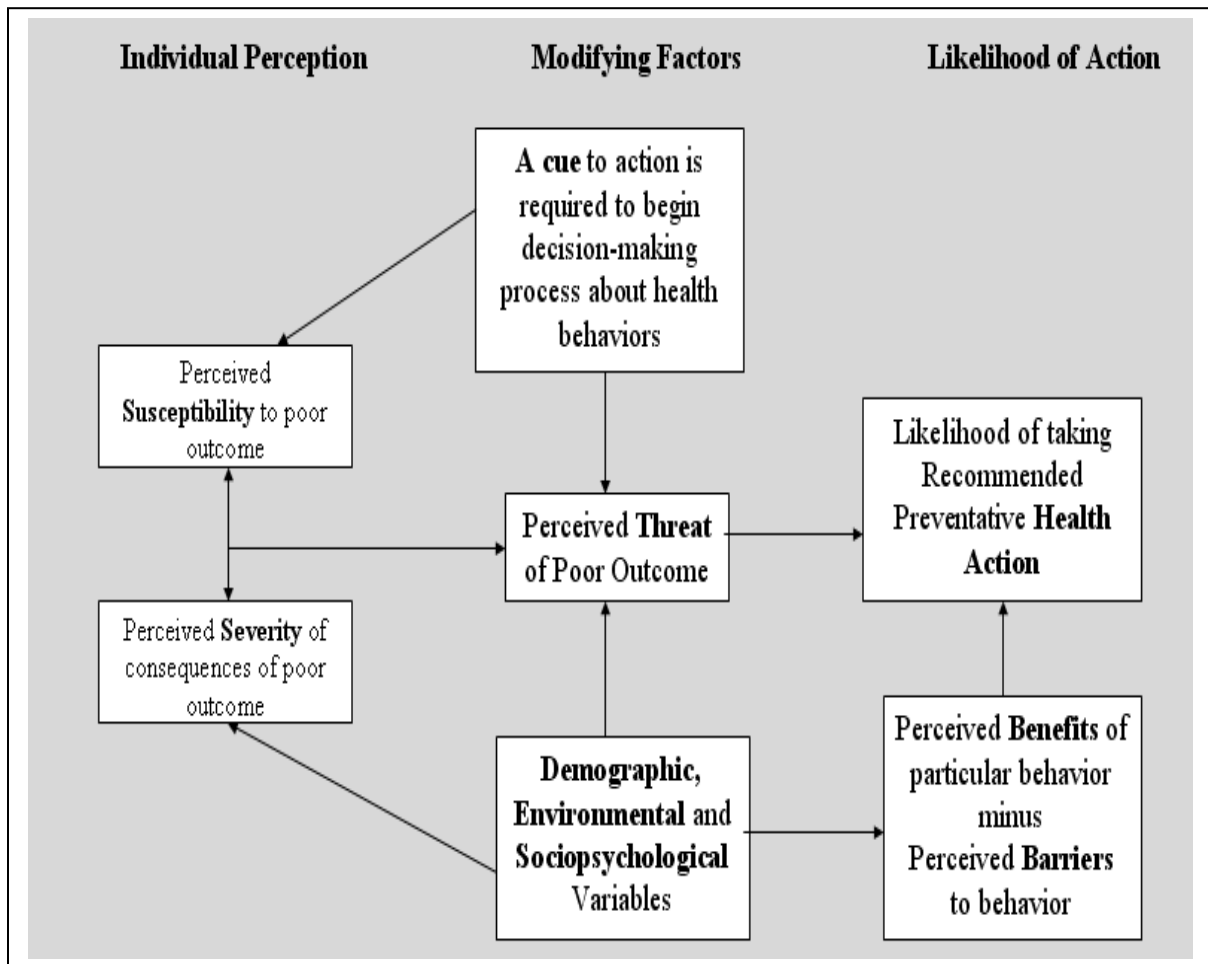
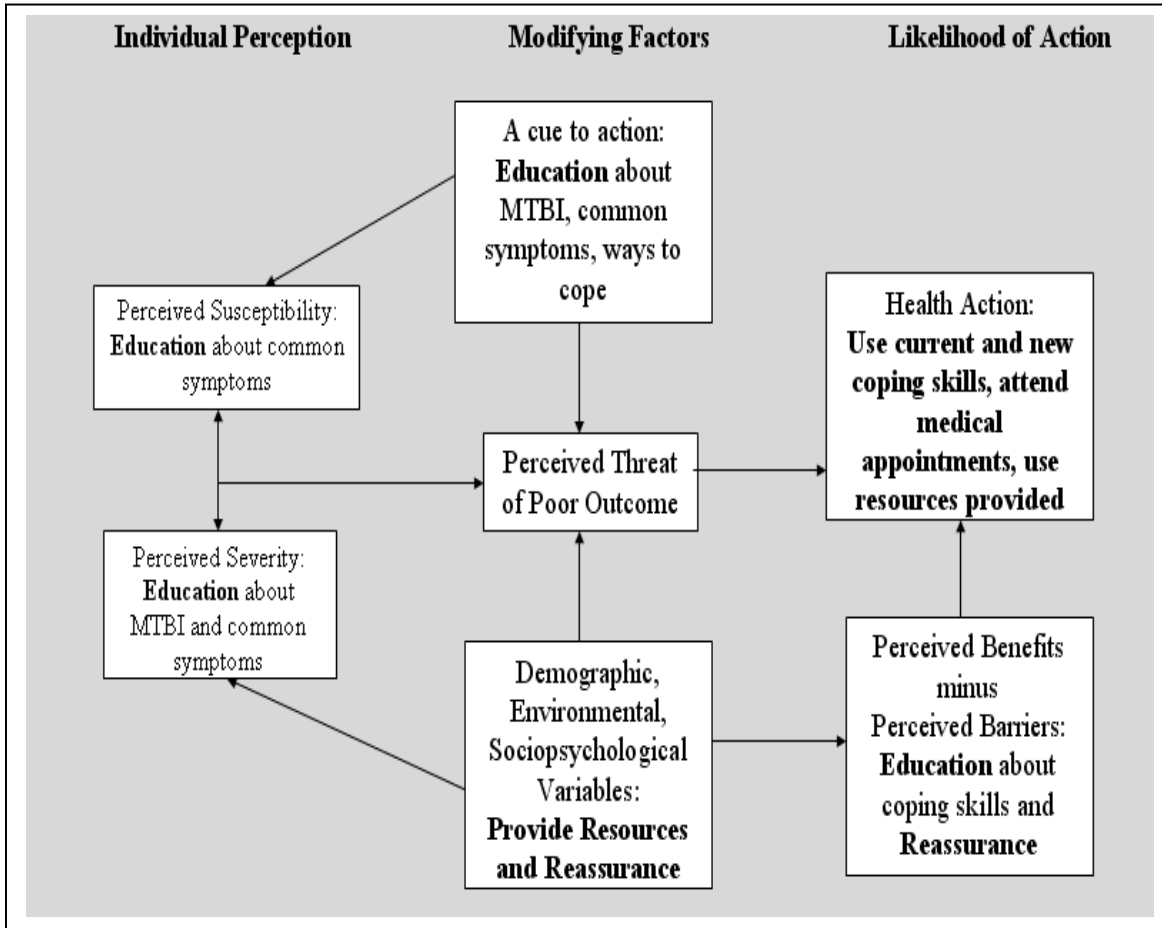


FIGURE 4. HEALTH BELIEF MODEL WITH EDUCATION, REASSURANCE AND RESOURCE INTERVENTION COMPONENTS
(ADAPTED FROM BECKER, ET AL., 1977)



Preventing Development of Post-Concussive Syndrome

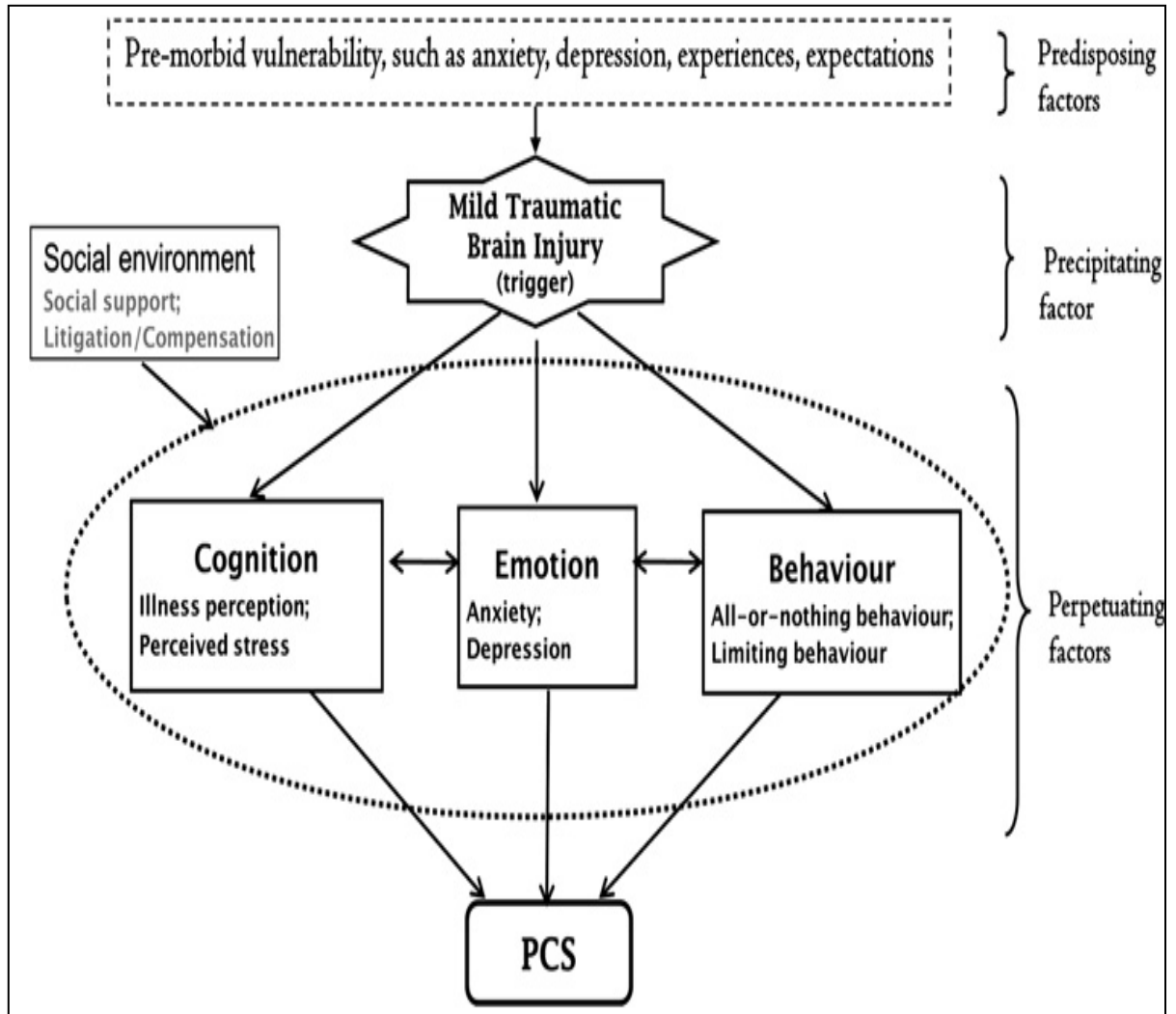
In order to address specific symptoms of mTBI and prevent development of post-concussive syndrome, the SWDI targeted malleable emotional, cognitive, and behavioral symptoms that have been associated with poor outcome. Hypotheses for causes of prolonged symptomatology include “neurogenic, psychogenic...premorbid or comorbid factors, secondary gain and any combination” of these (Ruff & Weyer Jamora, 2009, p. 36). Such a multidimensional cumulative stressor model highlights the complexity of the development of post-concussive syndrome. Pre-existing psychological, social and environmental stressors interact with the physical, cognitive and emotional symptoms triggered by an mTBI and lead to prolonged recovery and poor outcome (Ruff, 2011; Ruff, Camenzuli, & Mueller, 1996; Ryan & Warden, 2003). Hou and colleagues (2011) provided one such cumulative stressor model for development of post-concussion syndrome after mTBI that includes, 1) predisposing factors such as anxiety, depression, life experiences and expectations, 2) social environmental factors such as social

support, and 3) perpetuating factors in three categories, cognition, emotion and behavior (p.2). As early as two weeks post-injury, the interaction of the perpetuating factors, including negative perceptions or cognitions about recovery after mTBI, stress, anxiety and depression and all-or-nothing behavior, with a person's pre-existing problems and social environment were linked to risk of post-concussive syndrome development. While etiology of post-concussive syndrome continues to be debated, accumulated evidence indicates that the potentially malleable mTBI sequelae associated with poor outcome include anxiety and depression after injury, negative thinking about recovery and inactivity or decrease in functioning after injury. See Figure 5 for a depiction of Hou and colleague's (2011) model of contributing factors that lead to post-concussive syndrome for an example of a cumulative stressor model.

Areas of focus for the SWDI included patients' perception of the impact of the mTBI on their life, patients' emotions and patients' behavior patterns in relation to their experience of symptoms. The SWDI targeted negative cognitions about the impact of the mTBI on the persons' life by providing reassurance of good recovery. SWDI targeted anxiety and depression symptoms by providing education about coping strategies, and SWDI targeted all or nothing behavior by providing tips for healthy recovery and timelines to return to activities.

FIGURE 5. ONE CUMULATIVE STRESSOR MODEL PROPOSED FOR POST-CONCUSSIVE SYNDROME DEVELOPMENT

(FROM HOU, ET AL., 2011, P. 2)



CHAPTER FOUR METHODS

Study design

A quasi-experimental design was employed to test the effect of the SWDI versus usual care on outcomes of interest three months after mTBI. In addition, to determine for future studies whether there was a priming effect of a one-week interview on the three-month interview, ten participants in the SWDI Group completed both a one-week and three-month interview after injury. The Usual Care group received standard medical care and discharge instructions in the Emergency Department and were enrolled prior to full implementation of the SWDI. The SWDI Group received the SWDI in addition to standard medical care and discharge instructions. The study aims were: 1) Implement the SWDI in an urban, public trauma center, 2) Examine and compare SWDI and Usual Care Group outcomes, including psychiatric, cognitive, physical, and functional outcomes and alcohol use and service use after mTBI, 4) Assess patient reactions to and feedback about the SWDI and 5) Assess the impact of a one-week interview on responses in the three-month interview. It was hypothesized that participants in the SWDI Group would report superior outcomes on measures of depression and anxiety, post-concussive symptoms, alcohol use and community functioning and would report increased successful linkages to needed resources when compared to the Usual Care group. Because of the link between anxiety and depression and the development of post-concussive syndrome, the main outcome measure was the combined anxiety and depression scale (Patient Health Questionnaire-4 or PHQ-4). The primary endpoint was superior outcome on this measure.

Participants

Study inclusion criteria were based on the WHO recommended operational definition of mTBI (Carroll et al., 2004). Eligible participants were all admitted to the San Francisco General Hospital (SFGH) Emergency Department within 48 hours of an acute traumatic brain injury. Participants had a Glasgow Coma Scale score of 13-15 after 30 minutes post-injury or later upon presentation to the Emergency Department. In addition, eligible patients presented with or reported any one of the following symptoms: confusion or disorientation, loss of consciousness for 30 minutes or less, post-traumatic amnesia for less than 24 hours, other transient neurological abnormalities (focal signs, seizure, intracranial lesion not requiring surgery). Participants were English speaking and had a working phone number. The following served as exclusion criteria: patients <18 years of age; intracranial lesion requiring surgery; admission to an inpatient hospital unit from the ED; and patients in police custody. See Table 2 for an overview of the inclusion and exclusion criteria. Participants in the Usual Care group were identified using radiological records of head CT scans and were treated in the Emergency Department prior to the full implementation of the SWDI. Participants in the SWDI Group were identified by medical staff in the Emergency Department, who referred the patients to a social worker for delivery of the SWDI. Because of the identification method required for the Usual Care group, all participants received a head CT scan.

| TABLE 2: INCLUSION AND EXCLUSION CRITERIA | |
|--|--|
| INCLUSION CRITERIA (PATIENTS MUST MEET ALL OF THE FOLLOWING) | EXCLUSION CRITERIA (ANY ONE OF THE FOLLOWING) |
| 1) Admitted to ED within 48 hours of acute traumatic brain injury | 1) Patients <18 years of age |
| 2) Glasgow Coma Scale score of 13-15 after 30 minutes post-injury or later upon presentation to ED | 2) Intracranial lesion requiring surgery |
| 3) Present with or report any one of the following symptoms: <ul style="list-style-type: none"> • confusion or disorientation • loss of consciousness for 30 minutes or less • post-traumatic amnesia for less than 24 hours, • other transient neurological abnormalities (such as focal signs, seizure, intracranial lesion not requiring surgery) | 3) Admission to an inpatient hospital unit from the ED. |
| 4) English speaking | 4) Patients in police custody. |
| 5) Working telephone number | |

Study Setting

The study was conducted at the SFGH Emergency Department from October 2011-June 2012. SFGH is affiliated with the University of California, San Francisco (UCSF) and is an urban, public, level-one trauma center. In 2010 the Emergency Department served 53,000 patients, including approximately 18,000 ambulance arrivals (San Francisco General Hospital Foundation, 2011). This study represents a multi-disciplinary collaboration between UCSF/SFGH Neurological Surgery Department, UCSF/SFGH Emergency Department, SFGH Medical Social Services, UCSF/SFGH Psychiatry Department faculty and the University of California, Berkeley, School of Social Welfare.

Protection of Human Subjects

This study was a collaboration between UCSF and the University of California, Berkeley (UCB). It was conducted at UCSF by a UCB graduate student and involved mentors at both sites. Therefore, the study required approval from the UCSF Institutional Review Board (IRB) and acknowledgement and approval of the decision made by the UCSF IRB by the UCB Committee for Protection of Human Subjects. The study was approved by the UCSF IRB (Protocol Number 11-06789). UCB, operating under its Federal Wide Assurance (FWA) received and acknowledged the request and IRB documentation for the project. The UCB Committee for Protection of Human Subjects agreed to rely upon the decision made by the UCSF IRB, and authorized the principal

investigator to conduct the study (Protocol Number 2011-10-1). The approved Notice of Intent to Rely on One UC IRB was completed and submitted to the UCSF IRB as requested by UCB.

Adequacy of protection against risks. All participants were assigned a unique numeric study identifier. Individually identifying information linked to the study identifier was maintained separately from all other project records. Interviews were labeled only with study identifier. Both the paper files and electronic files were securely stored in a locked office and/or on a password protected computer.

Procedure

Intervention Development

The SWDI was developed in collaboration with the Neurological Surgery Service (Neurosurgery) and the UCSF Brain and Spinal Cord Injury Center and Emergency Department staff, including physicians, nurses and social workers. Three main steps were employed in the intervention development process. The first two steps involved using existing evidence to inform decisions about necessary components of the intervention. The final step included understanding and incorporating modifications to the intervention that were required in order to ensure successful implementation at the study site.

First, we built on existing evidence in the literature (see review in Chapter 3). We used the HBM and the cumulative stressor models for the development of post-concussive syndrome described in Chapter 3 to conceptually guide development of SWDI components. We used education about common symptoms and coping strategies as a cue for patients to take action on the suggested recovery strategies, and we incorporated reassurance of recovery to bolster confidence and lower perceived threat of poor outcome. The specific coping strategies targeted the cognitive, emotional and behavioral pitfalls linked to poor outcome after mTBI identified in a variety of studies. The second phase of development utilized information from as yet unpublished needs assessment data collected by the Neurosurgery and Psychiatry Departments at the study site. The needs assessment identified patient discharge needs and was used to inform the choice of specific resources provided to patients. The final development step was learning how to effectively utilize existing resources within the study site and adapt the intervention to the specific needs of the Emergency Department. It was important that the intervention be sustainable if proven effective. Interdisciplinary meetings assisted in this process. The Emergency Department medical staff, including nurses, doctors and nurse practitioners was consulted regarding how mTBI diagnoses were made and how patients were triaged and moved through the Emergency Department. Medical Social Work was consulted regarding their experiences working with mTBI patients and their families, patient flow and recommendations for implementation. All of this information was incorporated into the intervention development process.

The final product included educational material about common symptoms after mTBI, coping strategies, recommendations for return to work/school/activities, timelines for recovery, advice for no alcohol/drug use, reassurance of good recovery and resource provision. Neurosurgery and the UCSF Brain and Spinal Cord Injury Center developed the medical educational and coping advice portion of the intervention, and provided the materials for the education packets. Specifically, the written materials included a simple definition of mTBI, common symptoms, tips for recovery, a recommendation for no alcohol and drug use for 6 months after injury, and the community resource list. The community resource list included the

Neurosurgery Outpatient Telephone Question and Referral Line and Traumatic Brain Injury Support Group. Neurosurgery manages the Outpatient Telephone Question and Referral Line; patients could leave a message and receive a call back from a Neurosurgery Nurse Practitioner within one day. Social work provided input on the community resource list and the method for delivery of the psychosocial portions of the intervention (coping strategies, resources, reassurance) in the Emergency Department. The goals of the SWDI treatment were to improve patient outcomes by normalizing symptoms, providing suggestions for symptom management, particularly focusing on emotional and behavioral strategies, and by providing reassurance of good recovery to alleviate negative cognitions of impact of mTBI on patients' lives and a list of medical and community resources. The educational materials are included in Appendix A. Phone numbers, names and other non-relevant information specific to the study site have been redacted.

Implementing the Social Work Delivered Education, Reassurance and Resource Intervention

The implementation process required support from all involved collaborating departments and incorporated feedback about patient treatment and flow obtained from Emergency Department staff during the intervention development phase. Emergency Department medical staff were trained regarding the process of patient referral to the SWDI, and Emergency Department social work staff were trained regarding execution of the intervention. Neurosurgery completed the trainings for the medical staff and the principal investigator, a trained Emergency Department social worker and specialist in working with persons with TBI, trained the social work staff. In addition, extensive advertising and consistent reminders to staff about the referral and intervention process were required over the course of the study in order to ensure full and accurate implementation.

Delivery of Social Work Delivered Education, Reassurance and Resource Intervention

The process for delivery of the SWDI and study procedures are outlined in Table 3. A patient entered the Emergency Department after suffering a mTBI; medical staff provided medical care and determined mTBI diagnosis; medical staff referred patient to social work; social worker provided SWDI. The SWDI included usual medical care, discharge instructions and follow up medical appointments as required and determined by medical staff, and a brief meeting with a social worker in the Emergency Department the day of their injury. Social workers provided written educational material and verbally discussed the material with the patients. Patients were informed of community and medical resources. After the verbal explanation of the material the social work staff answered any questions. The final portion of the brief intervention included reassurance of a full recovery. Social workers instructed patients to call the Neurosurgery patient line with any further questions. The social worker then completed a baseline data collection sheet. Eligible patients were contacted three months post-injury to participate in the research interview. All mTBI patients treated with the SWDI at the study site were screened for eligibility during the SWDI Group enrollment period between October 2011 and June 2012.

| TABLE 3: PATIENT FLOW AND STUDY PROCEDURE: SOCIAL WORK DELIVERED EDUCATION, REASSURANCE AND RESOURCE INTERVENTION GROUP |
|---|
| Step 1. Patient enters Emergency Department (ED) |
| Step 2. ED medical staff provides usual care and determines mTBI diagnosis |
| Step 3. ED medical staff refer to social work for SWDI |
| Step 4. Social worker provides SWDI *Review mTBI education packets with patient, including common symptoms and coping skills; recommend no alcohol use for 6 months *Reassure patient of expected recovery *Inform patient of community resources and encourage them to use these if needed |
| Step 5. ED medical staff provides usual care discharge instructions |
| Step 6. ED Social work staff complete numbered baseline data collection sheet |
| Step 7. Three-Month Research Interview |

Delivery of Usual Care

Those in the Usual Care group received usual medical care, discharge instructions and follow up medical appointments as required and determined by medical staff. The process for delivery of Usual Care and study procedures is outlines in Table 4. A patient entered the Emergency Department after suffering a mTBI; medical staff provided medical care and usual discharge instructions. The participants in the Usual Care group were treated prior to the full implementation of the SWDI. They were retrospectively identified through chart review. Eligible patients were then contacted three months post-injury to participate in the research interview. All mTBI patients treated with usual care at the study site were screened for eligibility during the Usual Care Group enrollment period between October 2011 and March 2012.

| TABLE 4: PATIENT FLOW AND STUDY PROCEDURE: USUAL CARE GROUP |
|--|
| Step 1. Patient enters Emergency Department (ED) |
| Step 2. ED medical staff provides usual care |
| Step 3. ED medical staff provides usual care discharge instructions |
| Step 4. Study eligible patients identified through chart review |
| Step 5. Three-Month Research Interview |

Consent Procedures

At the start of the telephone research interview, participants were provided with study information and verbal consent for participation was obtained. After obtaining verbal consent from participants, the Short Orientation Memory Concentration Test was administered in order to determine whether participants had the necessary cognitive ability to complete the study. This test assessed participant orientation, ability to concentrate and ability to retain and recall simple information, which are necessary for participating in a research interview. A score of 23-28 correct out of 28 is considered normal and a score of 0-22 correct is considered cognitively impaired (Wade and Vergis, 1998). If participants did not score at least 23 on the test, they did not continue the research interview.

Evaluation Procedures

A research interviewer completed the structured outcome assessment interviews over the phone at three months post injury for all participants and at one week post injury for a subgroup of participants in the SWDI Group. All records were coded by participant number and kept in a locked office at UCSF. Appendix B contains the research interviews.

Outcome Measures

The aims of the SWDI were directly linked to outcomes of interest. The primary endpoint was superior outcome on the PHQ-4 anxiety and depression subscales. The secondary endpoints included superior outcomes on measures of post-concussive symptoms and PTSD and maintenance of pre-injury community functioning and integration, decrease in alcohol use, and successful linkage to needed services. In addition, patient experience of the SWDI was assessed for those in the SWDI Group. The Short Orientation Memory and Concentration Test was used to

assess potential participants cognitive ability. A comprehensive list of the measures and related outcomes is included in Table 5.

Short Orientation Memory Concentration Test (SOMC; Katzman, et al., 1983)

The SOMC is a 6-item test used to identify cognitive impairment. The test includes assessment of participants ability to correctly identify the year, month, and time, recall an address, count backwards and say the months of the year in reverse order. The SOMC has good test-retest reliability ($r=0.83$). It was devised from the 26-item Blessed Information-Memory-Concentration-Test and is correlated with this test (multiple $r=0.963$ and $r^2=0.926$). The SOMC is also correlated with the immediate recall ($r=0.68$) and delayed recall ($r=0.74$) scores on the Rivermead Behavioral Memory Test (Wade and Vergis, 1999). This test was chosen because it is not culture specific, assesses participant orientation, ability to concentrate and ability to retain and recall simple information (Wade and Vergis, 1998, p. 165). These abilities are important for participating in a research interview. A score of 23-28 correct out of 28 is considered normal and a score of 0-22 correct is considered cognitively impaired (Wade and Vergis, 1998).

Demographics and Mechanism of Injury

Information was collected on age, sex, race, marital status, insurance status and mechanism of injury.

Patient Health Questionnaire-4 (PHQ-4; Kroenke, Spitzer, Williams & Lowe, 2009)

The PHQ-4 is a 4-item scale that combines the first 2 items on the Patient Health Questionnaire-9, which have been shown to reliably assess depressive disorders and the first 2 items on the Generalized Anxiety Disorder-7 scale, which have been shown to reliably assess anxiety disorders. Patients are asked how often over the last 2 weeks they have experienced 1) feeling nervous, anxious or on edge, 2) not being able to stop or control worrying, 3) felt down, depressed or hopeless and 4) had little interest or pleasure in doing things on a 4-point scale (0-Not at all to 3-Nearly every day). The PHQ-4 has good internal consistency (Cronbach's $\alpha=0.85$). It is correlated with the mental health scale ($r=0.80$), social functioning scale ($r=0.52$), general health perceptions ($r=0.48$), role functioning ($r=0.37$), bodily pain (0.36) and physical functioning ($r=0.36$) on the Medical Outcomes Study Short-Form General Health Survey (SF-20) which measures functional status. Increasing scores on the PHQ-4 have a strong incremental relationship with self-reported disability days; this dose response is similarly strong to the longer scales from which the PHQ-4 is derived. The PHQ-4 has strong factorial validity.

A score of 0-2 is considered normal, a score of 3-5 is considered mild depression/anxiety, a score of 6-8 is considered moderate depression/anxiety, and a score of 9-12 is considered severe depression/anxiety. It was chosen for this study because of its good psychometric properties, brevity and ease of administration.

Rivermead Postconcussion Symptoms Questionnaire (RPQ; King et al., 1995)

The RPQ is a 16-item scale used to assess presence and severity of post-concussive symptoms commonly reported after TBI. It asks patients to rate the degree to which the 16 most common post-concussive symptoms have been bothering them compared with before their injury on a 5-point scale (0-Not experienced at all to 4-A severe problem). The RPQ developers did not report reliability coefficients. Scatter plots indicating good test-retest reliability over 24 hour retest

interval at 8 days post injury and 10-day retest interval at 6 months post injury were reported (King, et al., 1995). The RPQ is positively correlated with the Rivermead Head Injury Follow Up Questionnaire (Spearman rho = 0.67 at 3 months post injury and rho = 0.56 at 6 months post injury). The RPQ distinguished between mTBI patients with and without Post-Concussive Syndrome, and mTBI patients “on sick leave” from work and those who were not (TBI Outcome Measures Working Group, 2010).

Scores range from 0-64, with higher scores indicating increasing number and severity of symptoms. The RPQ was chosen for this study because it has been recommended as a core Common Data Element for TBI research by the federal interagency TBI Outcomes Workgroup (National Institute of Neurological Disorders and Stroke, Department of Veterans Affairs, National Institute on Disability and Rehabilitation Research, Defense Centers of Excellence for Psychological Health and Traumatic Brain Injury, and Defense and Veterans Brain Injury Center) (Wilde, et al., 2010).

Posttraumatic Stress Disorder (PTSD) Checklist-Civilian Version (PCL-C; Weathers, Litz, Huska & Keane, 1994)

The PCL-C is a 17-item, self-reported scale that maps directly onto the Diagnostic and Statistical Manual of Mental Disorders IV for PTSD. The PCL-C measures the three domains of PTSD, re-experiencing, avoidance and hyperarousal. Patients are asked to identify to what degree they have experienced PTSD symptoms over the last 30 days on a 5-point scale (1=Not at all to 5=Extremely). The scale has good internal consistency (Cronbach’s alpha=0.94) and test-retest reliability (r=0.92 for immediate retest; r=0.88 at one-week; r=0.68 at two-weeks). It has been used with TBI populations.

The PCL-C has a score range from 17-85, with the cutoff for PTSD set at 50 points. The PCL-C was chosen for this study because it has been recommended as a supplemental Common Data Element for TBI research by the federal interagency TBI Outcomes Workgroup (National Institute of Neurological Disorders and Stroke, Department of Veterans Affairs, National Institute on Disability and Rehabilitation Research, Defense Centers of Excellence for Psychological Health and Traumatic Brain Injury, and Defense and Veterans Brain Injury Center) (Wilde, et al., 2010).

Community Integration Questionnaire (CIQ; Wilier, et al., 1993)

The CIQ is a 15-item scale used to assess overall community integration, home integration, social integration and productive activity after TBI. Patients are asked about their level of independence and participation in activities of daily living, social activities, finances, and work activities. The CIQ has good internal consistency (Cronbach’s alpha=0.76) and good test-retest reliability (r=0.91).

Scores can range from 0-29 with higher scores indicating greater integration. It was chosen for this study because of its good psychometric properties, brevity and ease of administration. At the three-month interview, participants were asked to rate their functioning both before their injury (during a typical month) and since their injury (in the last month) in order to assess change community functioning. The ten participants who completed both a one-week and three-month interview were asked about pre-injury functioning during the one-week interview and current, three month post-injury functioning during the three-month interview.

Alcohol Use Disorders Identification Test (AUDIT; Saunders, et al., 1993)

The AUDIT is a 10-item scale used to assess the presence of an alcohol use disorder and to distinguish hazardous drinking and harmful use patterns. Patients are asked to report on their alcohol consumption patterns over the last year, including frequency, pattern and amount of alcohol consumed, whether they have had trouble stopping drinking once started and whether they have had any consequences from their drinking such as inability to complete usual tasks, felt guilty, sustained an injury, or been told to stop or cut back on drinking by others. The AUDIT has good internal consistency; mean across 18 studies (Cronbach's alpha=0.83) (TBI Outcome Measures Working Group, 2010). The AUDIT has good test-retest reliability (kappas range from 0.70 to 0.89 using cut-off of 8; intraclass correlations range from 0.87 to 0.95) (TBI Outcome Measures Working Group, 2010). It satisfactorily identifies hazardous drinking and harmful use of alcohol (TBI Outcome Measures Working Group, 2010). The score range is 0-40 with a score of 8 or more indicating hazardous drinking and a score of 13 for women and 15 for men indicating likely alcohol dependence.

The AUDIT was chosen for this study because it has been recommended as a supplemental Common Data Element for TBI research by the federal interagency TBI Outcomes Workgroup (National Institute of Neurological Disorders and Stroke, Department of Veterans Affairs, National Institute on Disability and Rehabilitation Research, Defense Centers of Excellence for Psychological Health and Traumatic Brain Injury, and Defense and Veterans Brain Injury Center) (Wilde, et al., 2010). At the three- month interview, participants were asked to recall drinking habits before injury and report on their current drinking in order to determine change in drinking habits. The ten participants who completed both a one-week and three-month interview were asked about pre-injury drinking during the one-week interview and current, three month post-injury drinking during the three-month interview.

Service Use

Participants were asked about number and type of medical appointments attended and other resources used to address mTBI. They were also asked about their typical pre-injury service use patterns.

Patient Experience Survey

Participants in the SWDI Group were asked whether they remembered receiving the intervention, whether they used it at home, whether it was helpful, which parts were helpful and ideas for improving the intervention.

| TABLE 5. OUTCOME MEASURES | |
|--|---|
| Measure | Outcome |
| Short Orientation Memory Concentration Test (SOMC; Katzman, et al., 1983) | Cognitive Impairment |
| Patient Health Questionnaire-4 (PHQ-4; Kroenke, et al., 2009) | Depression and Anxiety |
| Rivermead Postconcussion Symptoms Questionnaire (RPQ; King et al., 1995) | Post-concussive symptoms |
| Posttraumatic Stress Disorder Checklist-Civilian Version (PCL-C; Weathers, et al., 1994) | PTSD |
| Community Integration Questionnaire (CIQ; Wilier, et al., 1993) | Community Functioning/Social Integration |
| Alcohol Use Disorders Identification Test (AUDIT; Saunders, et al., 1993) | Alcohol Use |
| Service use | Service Use |
| Patient Experience Survey | Patient Experience |

Analysis

Statistical Power and Sample Size

It was hypothesized that the SWDI would directly impact emotions, including anxiety and depression, which can lead to the development of post-concussive syndrome. Therefore, the main outcome measure was the anxiety and depression scale, the PHQ-4. The PHQ-4 is a combination of the Generalized Anxiety Disorder Scale-2 (GAD-2) and the depression scale, the Patient Health

Questionnaire-2 (PHQ-2). Due to recent validation and because mTBI is an understudied area, there is little known about the sensitivity of these scales. While there are several studies that utilize the scales, none reported sufficient data on the GAD-2, and only one study of the PHQ-2 reported sufficient data to inform sample size calculations. Therefore, sample size determination was guided by effect sizes observed in that study.

Lowe, Kroenke, & Grafe (2005) reported sensitivity data for the PHQ-2 from a sample of 167 participants. Using the Structured Clinical Interview (SCID) to diagnose depression and compare to the PHQ-2, participants whose diagnostic status improved on the SCID had a PHQ-2 mean increase of 2.3 with a standard deviation of 2.1 and an effect size of -1.4 .

Results of this study were used to calculate the sample sizes needed in each group to achieve 80% power with an $\alpha=0.05$, given 2-tailed tests of significance. See equation and input values below. A sample of 26 in each group was determined in order to achieve 80% power to detect a difference of 2.3 in the mean PHQ-2. This difference corresponded to a large effect size.

Equation 1: Sample size for a comparison of two means.

$$N = \frac{4\sigma^2(z_{crit} + z_{pwr})^2}{D^2}$$

| <u>Input Values</u> | | <u>Calculated Results</u> | |
|------------------------------------|------|---------------------------|-------------------------------------|
| Minimum expected difference: | 2.3 | Sample size (N): | 26.17282392938586 (total, 2 groups) |
| Estimated standard deviation: | 2.1 | Z _{crit} : | 1.959963986120195 |
| Desired power: | 0.80 | Z _{pwr} : | 0.8416212327266186 |
| Significance criterion (2-tailed): | 0.05 | | |

Data Coding

Answers to individual questions on the SOMCT, RPQ, PHQ-4, PCL-C, AUDIT and CIQ were summed per published instructions for scoring each measure. Participants' total scores on each measure were compared. All quantitative data analysis was conducted using IBM SPSS Statistics Software 20.

Missing Data

The impact of item-level missing data was addressed and minimized by utilizing standardized assessment procedures. Specifically, one consistent, trained interviewer completed all research interviews. A script was strictly followed to introduce the study procedures and conduct the assessments. In addition, the structured outcome assessment interviews were completed over the phone for participant convenience. Every effort was made to complete the interview in one session. If data were missing for a particular participant on a measure, their data for that measure were not included in the final analysis. However, the procedures described above

resulted in very few missing data points.

Assumption Checking

In addition to checking graphical data, the Kolmogorov-Smirnov test was used to check for normality of distributions. Checking for normality in the sample data is necessary because parametric statistical tests assume data come from a normally distributed sampling distribution, and therefore, use the mean as an appropriate comparison point. If the sample data are normally distributed, the central limit theorem can be used to infer that the sampling distribution is also normal (Field, 2009). If data are significantly skewed, or non-normally distributed, using these tests is likely to result in inaccurate comparisons and interpretation of data. When data are non-normally distributed, non-parametric tests are more appropriate because these tests do not assume a normal sampling or population distribution.

Enrollment Bias

The impact of enrollment bias was minimized by systematic screening of all mTBI patients treated at the study site during the study period. Chi-square tests were used for categorical variables, and the non-parametric Mann-Whitney U test was used for continuous variables to examine enrollment bias. In particular, demographic characteristics and injury characteristics for patients who completed research interviews and those who did not because of refusal, inability to reach potential participant or study staff time limitations were compared. All comparisons were done using two-tailed tests of significance with $\alpha=0.05$.

Baseline Comparability of Groups

It is assumed that many factors can influence the outcome of a particular study. By starting with groups balanced on any known prognostic characteristics, the risk that both known and unknown prognostic factors influence the clinical course/outcome of the study (confounding) is reduced. Baseline balance, or comparability, prevents systematic confounding and allows investigators to isolate and test the effect of the intervention as it is the sole or main difference between the groups.

The presence of baseline imbalance should be assessed and its impact tested at the completion of a study (Altman, 1985). Baseline imbalance can be either random, systematic or both. Selection bias leads to systematic or reproducible imbalance. Interpretation of results should be done within the context of quantifying the impact of baseline imbalance on outcomes. Baseline imbalance can be a true threat to the validity of a study. Resulting confounding can occur randomly or systematically. Systematic imbalance occurs as a result of selection bias that leads to confounding (Schulz, 1995; Berger and Exner, 1999; Berger and Weinstein, 2004; Berger, 2005). Selection bias arises from nonrandom assignment processes that result in group differences not caused by the intervention (Fraser, et al., 2009). Prevention of baseline imbalance with good study design and careful implementation of the design is a key to obtaining useful data. However, even with proper design and implementation, baseline balance should be assessed and its impact tested in order to avoid reporting biased results.

Baseline comparability of the Usual Care and SWDI Groups was examined. Characteristics compared included age, sex, race, marital status, insurance status and injury characteristics. Group differences on categorical variables were examined with chi-square tests, and differences on continuous variables were examined with the non-parametric Mann-Whitney U

test. All comparisons were done using two-tailed tests of significance with $\alpha=0.05$.

Determining Successful Implementation of SWDI

In order to determine whether SWDI was implemented, the total number of patients provided with the intervention was determined and compared to the total number of eligible patients.

Examining Participant Outcomes

Differences between the Usual Care Group and SWDI Group on outcomes of interest was assessed using two sample t-tests of significance with an $\alpha=0.05$ when data were normally distributed. Non-parametric Mann-Whitney and Wilcoxon signed-rank tests of significance with an $\alpha=0.05$ were utilized to compare the SWDI Group and Usual Care Group on outcomes of interest for non-normally distributed data.

Assessing Patient Experience

Themes from the qualitative portion of the Patient Experience Survey administered to the SWDI Group were identified through systematic review of all survey responses by the principal investigator.

Assessing the Impact of a One-Week Interview on Responses at Three Months

In order to determine whether there existed a priming effect of a one-week interview on the three-month interview, three-month outcomes were compared between participants in the SWDI Group who completed both a one-week and three-month interview ($N=10$) and participants in the SWDI Group who completed only the three-month interview ($N=20$). Outcomes on all measures were compared using t-tests of significance with an $\alpha=0.05$ when data were normally distributed. Non-parametric Mann-Whitney and Wilcoxon signed-rank tests of significance with an $\alpha=0.05$ were utilized for comparisons on non-normally distributed data.

Identifying High Risk Patients

Identifying patients at high risk for developing post-concussive syndrome, anxiety, depression, and PTSD and those who are at risk for hazardous alcohol use and decreased community and social functioning is an important step for further intervention development. To that end, three-month outcomes on the RPQ, PHQ-4, PCL-C, AUDIT, and CIQ for the entire study sample with three-month interview data ($N=59$) were analyzed to determine demographic and injury characteristics of a high risk group.

Patients were determined to be high risk if they met any two of the following criteria: 1) an RPQ score of 6 or higher, 2) a PHQ-4 score of 6 or higher, 3) a PCL-C score of 50 or higher, 4) a score of 8 or more on the AUDIT after injury, and 5) a CIQ score below 13. These criteria were based on previous studies that determined cut off scores for poor outcome on the measures of interest. The ICD-9 definition of post-concussive syndrome is met when three or more of the symptoms on the RPQ are present at three months. This has been quantified in mTBI patients (Ingebrigtsen, Waterloo, Marup-Jensen, & Romner, 1998). A score of six or higher is required for three or more symptoms to be present. While this is a working definition of post-concussive syndrome, it was used here as a starting point for defining high risk for post-concussive symptoms. The cut-off score was six for the PHQ-4 because that has been validated as the low end of the scale for “moderate-severe” anxiety/depression (Kroenke, et al., 2009). A score of 50 on the PCL-C is

the minimum required for a diagnosis of PTSD (Weathers, et al., 1994). A score of 8 or more on the AUDIT is considered “hazardous drinking” (Saunders, et al., 1993). The CIQ cut-off for high risk was based on a sensitivity study by the authors of the measure that determined the CIQ distinguishes between three groups: those who are living independently (mean score 20.5), those who are living in community with support (mean score 13.3, and those in a supported living institution (mean 10.4) (Willer, Ottenbacher, & Coad, 1994). Therefore, a cut off score of 13 or lower was considered high risk here since all of the participants were living in the community.

CHAPTER FIVE RESULTS

Participants

The study was conducted from October 2011-June 2012. Participants in the Usual Care group (N=32) completed one telephone interview three months post injury. The research interview assessed cognitive impairment, depression, anxiety, post-concussive symptoms, PTSD, alcohol use, community functioning and successful linkage to community resources. A total of 19% of eligible participants were enrolled in the Usual Care Group. The relatively low enrollment rate in this group was largely due to inability to reach patients and time limitations of study staff (principal investigator alone screened, tracked and enrolled every patient). Participants who did not receive a score of 23 or higher on the SOMCT (N=3) did not continue the research interview. Therefore, only their baseline data and responses to the SOMCT were included in the final analysis. All mTBI patients treated with usual care at the study site were screened for study eligibility until desired sample size was reached in March 2012.

All participants in the SWDI Group (N=32) completed a patient experience survey to assess perceptions of the SWDI and its usefulness. A total of 55% of eligible participants were enrolled in the SWDI Group. Participants who could be reached three months post injury (N=30) completed a telephone interview to assess cognitive impairment, depression, anxiety, post-concussive symptoms, PTSD, alcohol use, community functioning and successful linkage to community resources. Twelve participants in the Intervention Group also completed an interview one-week post injury to determine whether a priming effect existed of a first research interview on the second interview. Two of these participants could not be reached for the three-month interview. Therefore only their responses on the Patient Experience Survey were included in the final analysis. All mTBI patients treated with the SWDI were screened for study eligibility until desired sample size was reached in June 2012. A longer period of enrollment was required to achieve desired sample size in the SWDI Group because there were fewer total eligible patients in this group. See Figure 6 for a flow diagram of participant enrollment. Table 6 presents the detailed eligibility and enrollment outcomes in the Usual Care Group and SWDI Group.

Figure 6: Participant Enrollment Flow Diagram

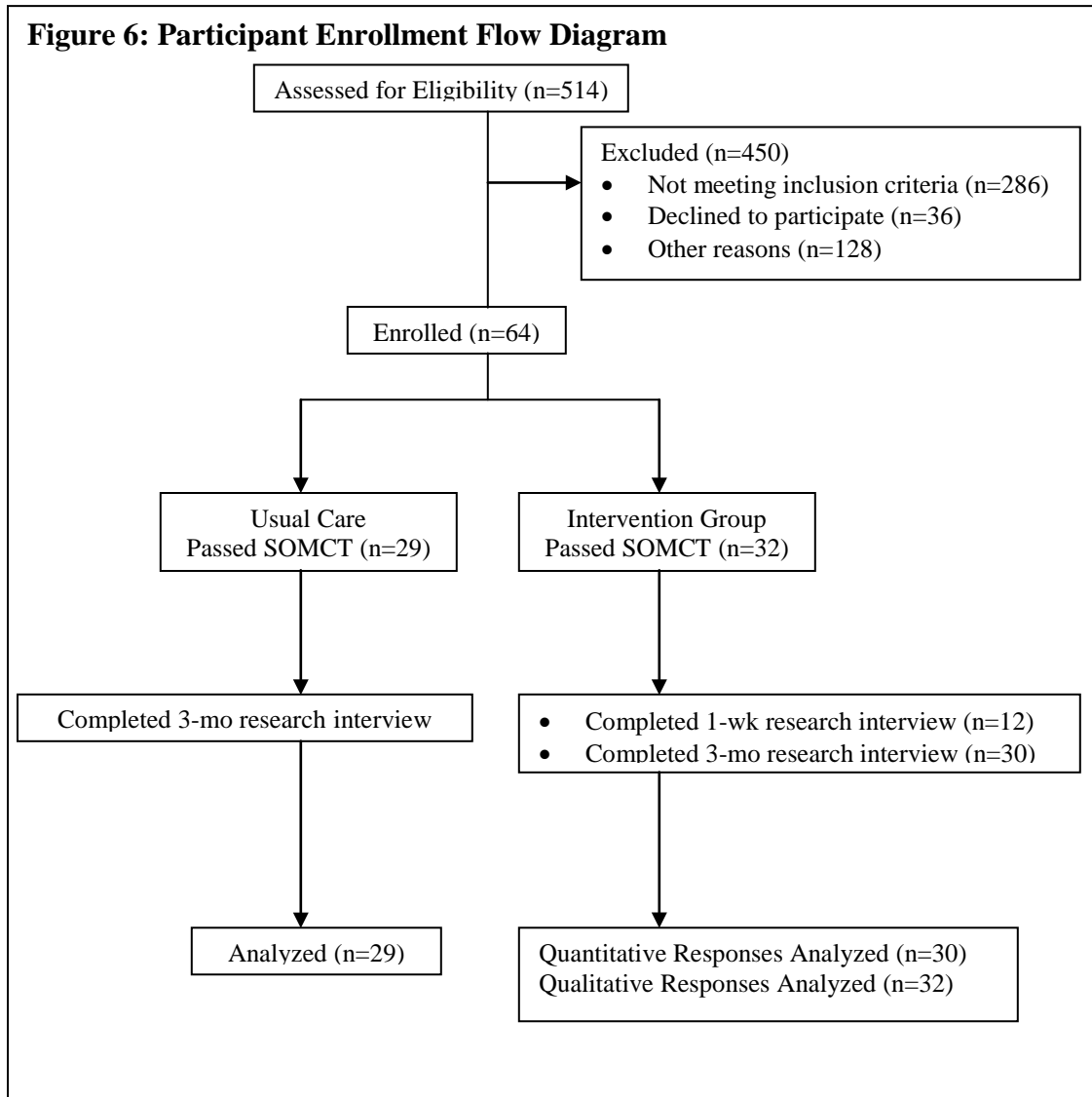


TABLE 6: ELIGIBILITY AND ENROLLMENT BY MONTH

| Usual Care | | | | | | |
|--|----------------|--------------|------------|------------------------|--------------------|--------------------|
| Enrollment Month | Total Screened | Not Eligible | Eligible | Eligible: Not Enrolled | Eligible: Declined | Eligible: Enrolled |
| | N | N | N | N(% Eligible) | N(% Eligible) | N(%Eligible) |
| 2011 | | | | | | |
| October 15-31 | 52 | 27 | 25 | 10(40) | 3(12) | 12(48) |
| November | 90 | 53 | 37 | 16(43) | 10(27) | 11(30) |
| December | 77 | 42 | 35 | 31(89) | 2(6) | 2(6) |
| 2012 | | | | | | |
| January | 79 | 44 | 35 | 31(89) | 2(6) | 2(6) |
| February | 71 | 37 | 34 | 25(74) | 5(15) | 4(12) |
| March 1-4 | 8 | 4 | 4 | 3(75) | 0(0) | 1(25) |
| Total | 377 | 207 | 170 | 116(68) | 22(13) | 32(19) |
| SWDI Group | | | | | | |
| Enrollment Month | Total Screened | Not Eligible | Eligible | Eligible: Not Enrolled | Eligible: Declined | Eligible: Enrolled |
| | N | N | N | N(% Eligible) | N(% Eligible) | N(%Eligible) |
| 2011 | | | | | | |
| October 15-31 | 1 | 1 | 0 | 0(0) | 0(0) | 0(0) |
| November | 12 | 6 | 6 | 2(33) | 2(33) | 2(33) |
| December | 25 | 16 | 9 | 1(11) | 4(44) | 4(44) |
| 2012 | | | | | | |
| January | 20 | 14 | 6 | 0(0) | 3(50) | 3(50) |
| February | 23 | 11 | 12 | 1(8) | 2(17) | 9(75) |
| March | 21 | 12 | 9 | 1(11) | 2(22) | 6(67) |
| April | 16 | 8 | 8 | 5(63) | 1(13) | 2(25) |
| May | 15 | 10 | 5 | 1(20) | 0(0) | 4(80) |
| June 1-5 | 4 | 1 | 3 | 1(33) | 0(0) | 2(67) |
| Total | 137 | 79 | 58 | 12(21) | 14(24) | 32(55) |
| <i>Note: Percentages rounded to nearest whole number</i> | | | | | | |

Baseline Characteristics

Usual Care Group

Demographic characteristics. In the Usual Care Group the average participant age was 43 years and 78% were male. Fifty-nine percent were white, 13% were black or African American, 19% were Latino, 3% were Asian, 3% were Pacific Islander and 3% were Native American. The Asian, Pacific Islander and Native American categories were collapsed for analysis into one category that included all three because of the small numbers of participants in each. Thirty-one percent of the Usual Care Group were married and 79% reported having private insurance. Table 7 provides an overview of the demographic characteristics.

Injury characteristics. In terms of injury characteristics, the percentage in each mechanism category was as follows: 38% were assaulted, 22% were involved in bike accidents, 6% were in motor vehicle accidents, 25% suffered a fall, 16% were struck by an object, 3% were in a motor cycle accident, and none were involved in pedestrian or sports related accidents. The struck by an object, motorcycle, pedestrian and sports related categories were collapsed for analysis into one category that included all four because of the small numbers of participants in each. Eighty-four percent of participants had a loss of consciousness at the time of injury; 63% had a GCS of 15; and the presence of alcohol (ETOH) was noted in 41% of participants at time of injury. Table 8 provides an overview of the injury characteristics.

Other characteristics. The average score was 26 on the SOMCT.

SWDI Group

Demographic characteristics. In the SWDI Group the average participant age was 36 years and 69% were male. Fifty percent were white, 19% were black or African American, 19% were Latino, 13% were Asian, and there were no Pacific Islanders or Native Americans in the group. The Asian, Pacific Islander and Native American categories were collapsed for analysis into one category that included all three because of the small numbers of participants in each. Nineteen percent of the SWDI sample were married and 72% reported having private insurance. Table 7 provides an overview of the demographic characteristics.

Injury characteristics. In terms of injury characteristics, the percentage in each mechanism category was as follows: 13% were assaulted, 38% were involved in bike accidents, 9% were in motor vehicle accidents, 16% suffered a fall, 3% were struck by an object, 3% were in a motor cycle accident, 13% were involved in a pedestrian and 6% were injured in sports related accident. The struck by an object, motorcycle, pedestrian and sports related categories were collapsed for analysis into one category that included all four because of the small numbers of participants in each. Seventy-nine percent of participants had a loss of consciousness at the time of injury; 61% had a GCS of 15; and the presence of alcohol (ETOH) was noted in 35% of participants at time of injury. Table 8 provides an overview of the injury characteristics.

Other characteristics. The average score was 27 on the SOMCT.

Baseline Comparability of Groups

The groups were well balanced with respect to demographic and injury characteristics (see Tables 7 and 8). Chi-square tests of independence were performed to examine the comparability of the Usual Care Group and SWDI Group on the following categorical variables: sex, race, marital status, insurance status, mechanism of injury, whether participants had loss of consciousness and ETOH present at time of injury. All comparisons were done using two-tailed tests of significance with $\alpha=0.05$. No significant differences between the groups were noted on any of these variables. Results of the individual tests were as follows: sex, $X^2(1, N = 64) = 0.721, p = 0.396$; race, $X^2(3, N = 64) = 0.800, p = 0.849$; marital status, $X^2(1, N = 61) = 1.238, p = 0.266$; insurance status, $X^2(1, N = 61) = .454, p = 0.501$; mechanism of injury, $X^2(4, N = 64) = 8.481, p = 0.075$; loss of consciousness, $X^2(1, N = 60) = 0.054, p = 0.817$; ETOH present, $X^2(1, N = 64) = .176, p = 0.674$. The groups were comparable on all variables.

Results of the Kolmogorov-Smirnov tests of normality revealed the SOMCT data, $D(62) = 0.354, p < 0.001$, GCS, $D(61) = 0.396, p < 0.001$ and Age, $D(62) = 0.154, p < 0.001$, were not normally distributed. Therefore, Mann-Whitney U tests were performed to examine comparability of the Usual Care Group and SWDI Group with respect to SOMCT, GCS and Age. SOMCT scores in the Usual Care Group ($Mean = 26.13$) did not differ significantly from scores in the SWDI Group ($Mean = 26.90$), $U = 403.500, z = -1.223, p = 0.221$. GCS scores in the Usual Care Group ($Mean = 14.60$) did not differ significantly from scores in the SWDI Group ($Mean = 14.58$), $U = 450.0, z = -0.257, p = 0.798$. The age of participants in the Usual Care Group ($Mean = 42.60$) did not differ significantly from the age of participants in the SWDI Group ($Mean = 36.44$), $U = 360.0, z = -1.691, p = 0.091$.

| TABLE 7. BASELINE DEMOGRAPHIC CHARACTERISTICS | | | |
|---|-------------------------------|--------------------------------|-----------------------|
| Variable | Usual Care N = 32* | SWDI Group N = 32** | p value*** |
| Age (years, mean + - SD) | 43+-16 | 36+ -16 | 0.091 |
| Male, No. (%) | 25 (78) | 22 (69) | 0.396 |
| Race | | | 0.849 |
| White, No. (%) | 19 (59) | 16 (50) | |
| African American, No. (%) | 4 (13) | 6 (19) | |
| Latino, No. (%) | 6 (19) | 6 (19) | |
| Asian/PI/Native Am, No. (%) | 3 (9) | 4 (13) | |
| Married, No. (%) | 9 (31) | 6 (19) | 0.266 |
| Insured, No. (%) | 23 (79) | 23 (72) | 0.501 |
| SOMCT (score, mean + - SD) | 26+-3 | 27+-2 | 0.221 |
| <i>Note: Numbers rounded to nearest whole number (except p-values)</i> | | | |
| *N=29 for Married and Insured; N=30 for Age due to missing data in chart | | | |
| **N=30 for SOMCT | | | |
| ***Two-sided statistical significance values by Mann-Whitney U and Chi-squared tests. | | | |

| TABLE 8. BASELINE INJURY CHARACTERISTICS | | | |
|---|-------------------------------|--------------------------------|-----------------------|
| Variable | Usual Care N = 32* | SWDI Group N = 32** | p value*** |
| Mechanism | | | 0.075 |
| Assault, No. (%) | 12 (38) | 4 (13) | |
| Bike Accident, No. (%) | 7 (22) | 12 (38) | |
| Motor Vehicle Accident, No. (%) | 2 (6) | 3 (9) | |
| Fall, No. (%) | 8 (25) | 5 (16) | |
| Other, No. (%) | 3 (9) | 8 (25) | |
| Loss of Consciousness, No. (%) | 27 (84) | 23 (79) | 0.817 |
| GCS = 15, No. (%) | 19 (63) | 19 (61) | 0.798 |
| ETOH present, No. (%) | 13 (41) | 11 (35) | 0.674 |
| <i>Note: Numbers rounded to nearest whole number (except p-values)</i> | | | |
| *Usual Care: N=30 for GCS due to missing data in chart | | | |
| **SWDI Group: N=31 for ETOH present and N=29 for GCS due to missing data in chart | | | |
| ***Two-sided statistical significance values by Mann-Whitney U and Chi-squared tests. | | | |

Enrollment Bias

There were no significant differences identified between eligible patients enrolled and those not enrolled in both the Usual Care Group and the SWDI Group.

Usual Care Group

See Table 9 below for an overview of the examination of enrollment bias in the Usual Care Group. Chi-square tests of independence were performed to examine the comparability of enrolled and non-enrolled eligible patients on the following categorical variables: sex, race, mechanism of injury, whether participants had loss of consciousness and ETOH present at time of injury. The non-enrolled eligible participants were identified through chart review, and therefore comparisons could not be performed on the marital status and insurance status variables because this information was not reliably reported in the medical record. All comparisons were done using two-tailed tests of significance with $\alpha=0.05$. No significant differences between the groups were noted on any of these variables. Results were as follows: sex, $X^2(1, N = 167) = 0.678, p = 0.410$; race, $X^2(3, N = 165) = 4.325, p = 0.504$; mechanism of injury, $X^2(4, N = 169) = 1.859, p = 0.762$; loss of consciousness, $X^2(1, N = 152) = 1.672, p = 0.196$; ETOH present, $X^2(1, N = 144) = 3.367, p = 0.067$. The groups were comparable on all variables.

Results of the Kolmogorov-Smirnov tests of normality revealed the GCS data, $D(162) = 0.436, p < 0.001$ and Age, $D(162) = 0.144, p < 0.001$, were not normally distributed. The SOMCT could not be compared because those not enrolled did not take the test. Mann-Whitney U tests were performed to examine comparability of the Usual Care Group enrolled versus not enrolled with respect to GCS and Age. GCS scores in the Usual Care Group enrolled ($Mean = 14.63$) did not differ significantly from scores of those not enrolled ($Mean = 14.69$), $U = 1874.500, z = -0.800, p = 0.424$. The age of enrolled participants in the Usual Care Group ($Mean = 41.76$) did not differ significantly from the age of those not enrolled ($Mean = 38.99$), $U = 1677.500, z = -1.367, p = 0.172$.

TABLE 9. EXAMINATION OF ENROLLMENT BIAS: USUAL CARE GROUP

| Variable | Usual Care Enrolled N = 32* | Usual Care Not Enrolled N = 138** | p value*** |
|---------------------------------|--------------------------------|--------------------------------------|------------|
| Age (years, mean + - SD) | 42+-16 | 39+-18 | 0.172 |
| Male, No. (%) | 22 (76) | 94 (68) | 0.410 |
| Race | | | 0.504 |
| White, No. (%) | 19 (59) | 73 (55) | |
| African American, No. (%) | 4 (13) | 8 (6) | |
| Latino, No. (%) | 6 (19) | 26 (20) | |
| Asian/PI/Native Am, No. (%) | 3 (9) | 26 (20) | |
| Mechanism | | | 0.762 |
| Assault, No. (%) | 12 (38) | 49 (36) | |
| Bike Accident, No. (%) | 7 (22) | 19 (14) | |
| Motor Vehicle Accident, No. (%) | 2 (6) | 12 (9) | |
| Fall, No. (%) | 8 (25) | 37 (27) | |
| Other, No. (%) | 3 (9) | 20 (15) | |
| Loss of Consciousness, No. (%) | 27 (84) | 88 (73) | 0.196 |
| GCS = 15, No. (%) | 19 (63) | 97 (72) | 0.223 |
| ETOH present, No. (%) | 13 (41) | 66 (59) | 0.067 |

Note: Numbers rounded to nearest whole number (except p-values)

*Usual Care Enrolled: N=30 for GCS due to missing data in chart

**Usual Care Not Enrolled: N ranges from 112-138 due to missing data

***Two-sided statistical significance values by Mann-Whitney U and Chi-squared tests.

SWDI Group

See Table 10 below for an overview of the examination of enrollment bias in the SWDI Group. Chi-square tests of independence were performed to examine the comparability of enrolled and non-enrolled eligible patients on the following categorical variables: sex, race, mechanism of injury, whether participants had loss of consciousness and ETOH present at time of injury. The non-enrolled eligible participants were identified by the social work tracking form and chart review, and therefore comparisons could not be performed on the marital status and insurance status variables because this information was not reliably reported in these records. All comparisons were done using two-tailed tests of significance with $\alpha=0.05$. No significant differences between the groups were noted on any of these variables. Results were as follows: sex, $X^2(1, N = 57) = 0.143, p = 0.706$; race, $X^2(3, N = 56) = 2.963, p = 0.397$; mechanism of injury, $X^2(4, N = 57) = 6.246, p = 0.182$; loss of consciousness, $X^2(1, N = 48) = 1.517, p = 0.218$; ETOH present, $X^2(1, N = 52) = 0.026, p = 0.873$. The groups were comparable on all variables.

Results of the Kolmogorov-Smirnov tests of normality revealed the GCS data, $D(56) = 0.424, p < 0.001$ and Age, $D(56) = 0.166, p = 0.001$, were not normally distributed. The SOMCT

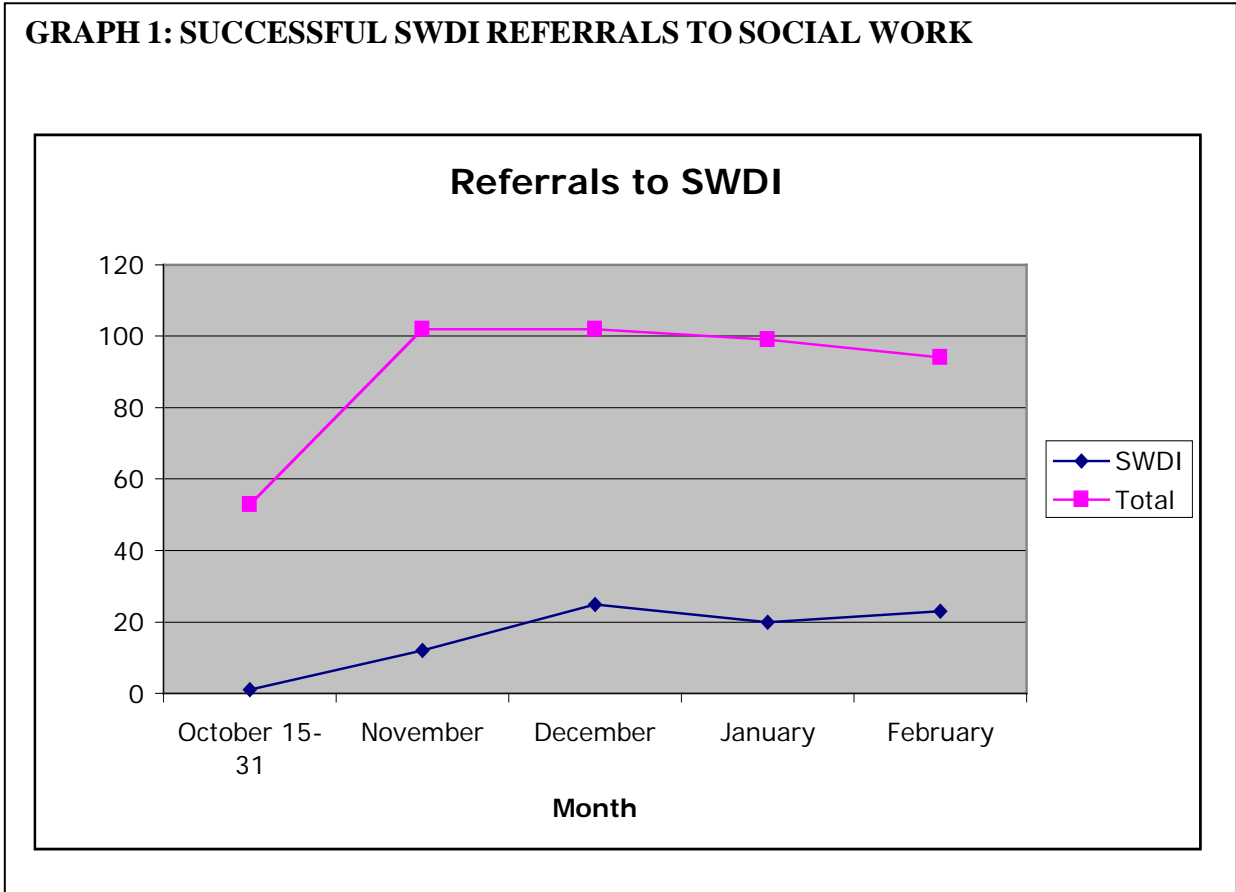
could not be compared because those not enrolled did not take the test. Mann-Whitney U tests were performed to examine comparability of the enrolled participants in the SWDI Group versus those not enrolled with respect to GCS and Age. GCS scores in the SWDI Group enrolled (*Mean* = 14.58) did not differ significantly from scores of those not enrolled (*Mean* = 14.76), $U = 327.500$, $z = -1.217$, $p = 0.223$. The age of enrolled participants in the SWDI Group (*Mean* = 36.44) did not differ significantly from the age of those eligible and not enrolled (*Mean* = 34.96), $U = 360.000$, $z = -0.644$, $p = 0.520$.

| TABLE 10. EXAMINATION OF ENROLLMENT BIAS: SWDI GROUP | | | |
|---|----------------------------------|---------------------------------------|-------------------|
| Variable | SWDI Enrolled N = 32* | SWDI Not Enrolled N = 26** | p value*** |
| Age (years, mean + - SD) | 36+ -16 | 35+-17 | 0.520 |
| Male, No. (%) | 22 (69) | 16 (64) | 0.706 |
| Race | | | 0.397 |
| White, No. (%) | 16 (50) | 9 (38) | |
| African American, No. (%) | 6 (19) | 6 (25) | |
| Latino, No. (%) | 6 (19) | 8 (33) | |
| Asian/PI/Native Am, No. (%) | 4 (13) | 1 (4) | |
| Mechanism | | | 0.382 |
| Assault, No. (%) | 4 (13) | 5 (20) | |
| Bike Accident, No. (%) | 12 (38) | 3 (12) | |
| Motor Vehicle Accident, No. (%) | 3 (9) | 6 (24) | |
| Fall, No. (%) | 5 (16) | 3 (12) | |
| Other, No. (%) | 8 (25) | 8 (32) | |
| Loss of Consciousness, No. (%) | 23 (79) | 12 (63) | 0.218 |
| GCS = 15, No. (%) | 19 (61) | 19 (76) | 0.223 |
| ETOH present, No. (%) | 11 (35) | 7 (33) | 0.873 |
| <i>Note: Numbers rounded to nearest whole number (except p- values)</i> | | | |
| *SWDI Enrolled: N=31 for ETOH present and N=29 present due to missing data in chart | | | |
| **SWDI Not Enrolled: N ranges from 19-26 due to missing data | | | |
| ***Two-sided statistical significance values by Mann-Whitney U and Chi-squared tests. | | | |

SWDI Implementation

During the study period, the SWDI was successfully implemented and is now part of standard protocol for persons with mTBI treated and discharged from the study site Emergency Department. Over the course of the entire study period, 27% of mTBI patients being discharged from the Emergency Department received the intervention. Given the difficult nature of implementing new interventions in the Emergency Department trauma center setting due to staff time demands, stress of the environment, and high volume of patients served, this is considered a

successful implementation. Graph 1 below depicts the total number of successful referrals from medical staff to social work in order for patients to receive the SWDI during the study period when all patients in the Usual Care Group were being screened. These months represent date of enrollment. After initial training and education was completed, referrals increased and remained relatively steady throughout the rest of the study period.



Examining Participant Outcomes

No significant differences were noted between the Usual Care Group and SWDI Group on the PHQ-4, RPQ, PCL-C, and Psychiatric Service Use. Both groups significantly increased Medical Service Use after injury ($p < 0.01$). While the SWDI Group maintained their pre-injury level of community integration and social functioning as measured on the CIQ, participants in the Usual Care Group reported a significant decline in social integration and functioning from before injury to after injury ($p < 0.05$). With respect to alcohol use, participants in the SWDI Group reported a significant decline in drinking from before injury “hazardous levels” to after injury “normal levels” as measured on the AUDIT ($p < 0.05$). However, the Usual Care Group maintained their before injury “hazardous level” of drinking. The details of the statistical analyses are outlined below.

PHQ-4

See Table 11 below for a summary of all Mann-Whitney U tests performed to compare SWDI to Usual Care on outcomes of interest. Results of the Kolmogorov-Smirnov test of normality revealed the data from the PHQ-4, $D(58) = 0.284$, $p < 0.001$, were not normally distributed. Therefore, the non-parametric Mann-Whitney U test was performed to examine the difference between Usual Care and the SWDI scores.

On average, those in the Usual Care Group scored in the mild depression/anxiety range (a score of 3-5) on the PHQ-4. Participants in the SWDI Group scored in the normal range (a score of 0-2). PHQ-4 scores in the Usual Care Group ($Mean = 3.138$, $SD = 4.405$) did not differ significantly from scores of those in the SWDI Group ($Mean = 2.2$, $SD = 2.952$), $U = 417.500$, $z = -0.276$, $p = 0.782$.

The sub-parts of the PHQ-4, the PHQ-2 and GAD-2, were also examined separately using the Mann-Whitney U test. PHQ-2 scores in the Usual Care Group ($Mean = 1.414$, $SD = 2.307$) did not differ significantly from scores of those in the SWDI Group ($Mean = 0.900$, $SD = 1.516$), $U = 412.500$, $z = -0.394$, $p = 0.694$. GAD-2 scores in the Usual Care Group ($Mean = 1.724$, $SD = 2.218$) did not differ significantly from scores of those in the SWDI Group ($Mean = 1.30$, $SD = 1.578$), $U = 425.0$, $z = -0.160$, $p = 0.873$.

RPQ

Results of the Kolmogorov-Smirnov test of normality revealed the data from the RPQ, $D(58) = 0.212$, $p < 0.001$, were not normally distributed. Therefore, the non-parametric Mann-Whitney U test was performed to examine the difference between Usual Care and the SWDI scores. RPQ scores in the Usual Care Group ($Mean = 13.758$, $SD = 16.840$) did not differ significantly from scores of those in the SWDI Group ($Mean = 11.00$, $SD = 11.930$), $U = 428.50$, $z = -0.099$, $p = 0.921$. See Table 11 below for a summary of all Mann-Whitney U tests performed to compare SWDI to Usual Care on outcomes of interest.

PCL-C

Results of the Kolmogorov-Smirnov test of normality revealed the data from the PCLC-C, $D(58) = 0.217$, $p < 0.001$, were not normally distributed. Therefore, the non-parametric Mann-Whitney U test was performed to examine the difference between Usual Care and the SWDI scores. PCL-C scores in the Usual Care Group ($Mean = 28.178$, $SD = 16.680$) did not differ significantly from scores of those in the SWDI Group ($Mean = 25.166$, $SD = 10.560$), $U = 418.50$, $z = -0.023$, $p = 0.981$. Both group means were below the threshold (a score of 50) for a diagnosis of PTSD. See Table 11 below for a summary of all Mann-Whitney U tests performed to compare SWDI to Usual Care on outcomes of interest.

| TABLE 11. EXAMINATION OF PARTICIPANT OUTCOMES USING MANN-WHITNEY U TEST | | | |
|--|------------------------------|------------------------|---------------------|
| Measure | Usual Care N = 29 | SWDI N = 30 | p value* |
| PHQ-4 , mean+-SD | 3+-4 | 2+-3 | 0.782 |
| PHQ-2 , mean+-SD | 1+-2 | 1+-2 | 0.694 |
| GAD-2 , mean+-SD | 2+-2 | 1+-2 | 0.873 |
| RPQ , mean+-SD | 14+-17 | 11+-12 | 0.921 |
| PCL-C , mean+-SD | 28+-17 | 25+-11 | 0.981 |
| *Two-sided statistical significance values by Mann-Whitney U test. <i>Note: Numbers rounded to nearest whole number (except p-values)</i> | | | |

CIQ

See Table 12 below for a summary of outcomes compared using the t-test and Wilcoxon Signed Ranks test. Participants were asked to rate community functioning both before and after injury. Results from graphical data and the Kolmogorov-Smirnov test of normality revealed the data from the CIQ Before Injury, $D(55) = 0.098$, $p = 0.200$ and CIQ After Injury, $D(55) = 0.117$, $p = 0.05$, were normally distributed. Therefore, the dependent t-test was used to determine whether participants' CIQ scores significantly changed after injury.

Results indicate a significant decline in community functioning for those in the Usual Care group. The CIQ After Injury score ($M = 20.90$, $SD = 4.921$) was significantly lower than the CIQ Before Injury score ($M = 22.62$, $SD = 3.416$) in the Usual Care Group, $t(24) = 2.658$, $p = 0.014$.

The SWDI Group maintained their before injury level of community integration. No significant decline was noted in the SWDI Group CIQ After Injury score ($M = 21.967$, $SD = 4.088$) compared to the CIQ Before Injury score ($M = 22.358$, $SD = 3.837$), $t(29) = 1.141$, $p = 0.263$.

AUDIT

Participants were asked to rate level of alcohol use both before and after injury. Results from the Kolmogorov-Smirnov test of normality revealed the data from the AUDIT Before Injury, $D(58) = 0.158$, $p = 0.001$ and AUDIT After Injury, $D(58) = 0.173$, $p < 0.001$, were not normally distributed. Therefore, the non-parametric Wilcoxon Signed Ranks test was used to determine whether participants' AUDIT scores significantly changed after injury.

Both groups Before Injury mean scores were in the "hazardous drinking" range (a score of 8 or higher) on the AUDIT. For those in the Usual Care Group, drinking levels were not significantly different as measured by the AUDIT Before Injury ($M = 7.821$, $SD = 6.738$) and AUDIT After Injury ($M = 7.464$, $SD = 7.320$), $T = 10$, $p = 0.432$.

For those in the SWDI Group, drinking levels significantly declined as measured by the AUDIT Before Injury ($M = 9.562$, $SD = 10.429$) and AUDIT After Injury ($M = 5.166$, $SD = 4.441$), $T = 18$, $p = 0.012$. See Table 12 below for a summary of outcomes compared using the t-test and Wilcoxon Signed Ranks test.

Medical Service Use

Participants were asked to rate level of medical service use both before and after injury. Results from the Kolmogorov-Smirnov test of normality revealed the data from medical service use before injury, $D(56) = 0.463$, $p < 0.001$ and medical service use after injury, $D(56) = 0.215$, $p < 0.001$, were not normally distributed. Therefore, the non-parametric Wilcoxon Signed Ranks test was used to determine whether participants' medical service use significantly changed after injury.

For those in the Usual Care Group, medical service use significantly increased from before injury ($M = 0.740$, $SD = 1.163$) to after injury ($M = 2.70$, $SD = 1.660$), $T = 10.42$, $p < 0.001$.

Similarly, for those in the SWDI Group, medical service use significantly increased from before injury ($M = 0.190$, $SD = 0.654$) to after injury ($M = 2.130$, $SD = 3.857$), $T = 8.89$, $p = 0.003$. See Table 12 below for a summary of outcomes compared using the t-test and Wilcoxon Signed Ranks test.

In terms of type of medical services used (i.e. whether participants used Emergency Department services vs. outpatient services), there were no significant differences in Emergency Department use $X^2(1, N = 59) = 0.291$, $p = 0.590$.

Psychiatric Service Use

Participants were asked to rate level of psychiatric service use both before and after injury. Results from the Kolmogorov-Smirnov test of normality revealed the data from psychiatric service use before injury, $D(56) = 0.512$, $p < 0.001$ and psychiatric service use after injury, $D(56) = 0.508$, $p < 0.001$, were not normally distributed. Therefore, the non-parametric Wilcoxon Signed Ranks test was used to determine whether participants' psychiatric service use significantly changed after injury.

For those in the Usual Care Group, psychiatric service use did not significantly change from before injury ($M = 0.220$, $SD = 0.801$) and after injury ($M = 0.110$, $SD = 0.577$), $T = 0$, $p = 0.317$.

Similarly, for those in the SWDI Group, psychiatric service use did not significantly change before injury ($M = 0.190$, $SD = 0.592$) and after injury ($M = 0.530$, $SD = 2.240$), $T = 2$, $p = 0.705$. See Table 12 below for a summary of outcomes compared using the t-test and Wilcoxon Signed Ranks test.

| TABLE 12. EXAMINATION OF PARTICIPANT OUTCOMES USING T-TEST AND WILCOXON SIGNED RANK TEST | | | | |
|--|----------------------|-----------------------------------|----------------------------------|---------------------------|
| Measure | | Before Injury Mean+-SD | After Injury Mean+-SD | p value* |
| CIQ | | | | |
| | Usual Care N = 25 | 23+-3 | 21+-5 | 0.014⁺ |
| | SWDI N=30 | 22+-4 | 22+-4 | 0.263 |
| AUDIT | | | | |
| | Usual Care N=28 | 8+-7 | 7+-7 | 0.432 |
| | SWDI N=30 | 10+-10 | 5+-4 | 0.012⁺ |
| Medical Service Use | | | | |
| | Usual Care N=27 | 1+-1 | 3+-2 | 0.0001⁺ |
| | SWDI N=30 | 0+-1 | 2+-4 | 0.003⁺ |
| Psychiatric Service Use | | | | |
| | Usual Care N=27 | 0+-1 | 0+-1 | 0.317 |
| | SWDI N=30 | 0+-1 | 1+-2 | 0.705 |
| <p>*Two-sided statistical significance values by Dependent t-test and Wilcoxon Signed Ranks test. ⁺Significant at $p < 0.05$ <i>Note: Numbers rounded to nearest whole number (except p-values)</i></p> | | | | |

Effect of One-Week Interview on Three-Month Interview

No significant differences were noted between the One Interview Group (N=20) and Two Interview Group (N=10) on the PHQ-4, RPQ, PCL-C, CIQ and Psychiatric Service Use. Both groups reported a decline in drinking from pre-injury “hazardous levels” to normal levels three months after injury, but a statistically significant difference was only found when comparing scores from the AUDIT in the One Interview Group. Both groups reported increased Medical Service Use. A statistically significant difference was only found when comparing number of Medical Services used before injury and after injury in the One Interview Group ($p < 0.018$); the Two Interview Group did not significantly increase medical services use ($p = 0.066$). The details of the statistical analyses are outlined below.

PHQ-4

See Table 13 below for a summary of Mann-Whitney U tests performed on outcomes of interest to test the effect of the one-week interview on responses in three-month interview. Results of the Kolmogorov-Smirnov test of normality revealed the data from the PHQ-4, $D(30) = 0.258$, $p < 0.001$, were not normally distributed. Therefore, the non-parametric Mann-Whitney U test was performed to examine the difference between One and Two Interview Group scores.

PHQ-4 scores in the One Interview Group ($Mean = 2.150$, $SD = 2.680$) did not differ significantly from scores of those in the Two Interview Group ($Mean = 2.30$, $SD = 3.591$), $U = 95.500$, $z = -0.160$, $p = 0.880$.

The sub-parts of the PHQ-4, the PHQ-2 and GAD-2, were also examined separately using the Mann-Whitney U test. PHQ-2 scores in the One Interview Group ($Mean = 2.150$, $SD = 2.68$) did not differ significantly from scores of those in the Two Interview Group ($Mean = 1.00$, $SD = 1.943$), $U = 0.759$, $z = -0.306$, $p = 0.812$. GAD-2 scores in the One Interview Group ($Mean = 1.300$, $SD = 1.525$) did not differ significantly from scores of those in the Two Interview Group ($Mean = 1.300$, $SD = 1.766$), $U = 98.00$, $z = -0.093$, $p = 0.948$.

RPQ

Results of the Kolmogorov-Smirnov test of normality revealed the data from the RPQ, $D(30) = 0.192$, $p = 0.006$, were not normally distributed. Therefore, the non-parametric Mann-Whitney U test was performed to examine the difference between One Interview and Two Interview Group scores. RPQ scores in the One Interview Group ($Mean = 11.850$, $SD = 13.195$) did not differ significantly from scores of those in the Two Interview Group ($Mean = 9.300$, $SD = 9.286$), $U = 94.500$, $z = -0.243$, $p = 0.812$. See Table 13 below for a summary of Mann-Whitney U tests performed.

PCL-C

Results of the Kolmogorov-Smirnov test of normality revealed the data from the PCLC-C, $D(30) = 0.220$, $p = 0.001$, were not normally distributed. Therefore, the non-parametric Mann-Whitney U test was performed to examine the difference between One Interview and Two Interview Group scores. PCL-C scores in the One Interview Group ($Mean = 25.80$, $SD = 10.159$) did not differ significantly from scores of those in the Two Interview Group ($Mean = 23.90$, $SD = 11.779$), $U = 69.500$, $z = -1.348$, $p = 0.178$. See Table 13 below for a summary of Mann-Whitney U tests performed.

TABLE 13. EXAMINATION OF EFFECT OF FIRST INTERVIEW ON SECOND INTERVIEW USING MANN-WHITNEY U TEST

| Measure | One Interview N = 20 | Two Interview N = 10 | p value* |
|-----------------|-------------------------|-------------------------|-------------|
| PHQ-4, mean+-SD | 2+-3 | 2+-4 | 0.873 |
| PHQ-2, mean+-SD | 1+-1 | 1+-2 | 0.759 |
| GAD-2, mean+-SD | 1+-2 | 1+-2 | 0.926 |
| RPQ, mean+-SD | 12+-13 | 9+-9 | 0.812 |
| PCL-C, mean+-SD | 26+-10 | 24+-12 | 0.178 |

*Two-sided statistical significance values by Mann-Whitney U test.

Note: Numbers rounded to nearest whole number (except p-values)

CIQ

See Table 14 below for a summary of outcomes compared using the t-test and Wilcoxon Signed Ranks test. Results from graphical data and the Kolmogorov-Smirnov test of normality revealed the data from the CIQ Before Injury, $D(30) = 0.115$, $p = 0.200$ and CIQ After Injury, $D(30) = 0.140$, $p = 0.140$, were normally distributed. Therefore, the dependent t-test was used to determine whether participants' CIQ scores significantly changed after injury.

Both the One Interview and Two Interview Groups maintained their before injury level of community integration. No significant decline was noted in the One Interview Group CIQ After Injury score ($M = 22.762$, $SD = 4.133$) compared to the CIQ Before Injury score ($M = 23.250$, $SD = 3.446$), $t(19) = 1.060$, $p = 0.302$. No significant decline was noted in the Two Interview Group CIQ After Injury score ($M = 20.375$, $SD = 3.682$) compared to the CIQ Before Injury score ($M = 20.575$, $SD = 4.131$), $t(9) = 0.408$, $p = 0.693$.

AUDIT

Participants were asked to rate level of alcohol use both before and after injury. Results from the Kolmogorov-Smirnov test of normality revealed the data from the AUDIT Before Injury, $D(30) = 0.213$, $p = 0.001$ and AUDIT After Injury, $D(30) = 0.170$, $p = 0.026$, were not normally distributed. Therefore, the non-parametric Wilcoxon Signed Ranks test was used to determine whether participants' AUDIT scores significantly changed after injury.

For those in the One Interview Group, drinking levels significantly declined as measured by the AUDIT Before Injury ($M = 9.90$, $SD = 9.941$) and AUDIT After Injury ($M = 5.40$, $SD = 4.728$), $T = 14$, $p = 0.005$.

For those in the Two Interview Group, drinking levels were not significantly different as measured by the AUDIT Before Injury ($M = 7.20$, $SD = 9.681$) and AUDIT After Injury ($M = 4.70$, $SD = 4.001$), $T = 4$, $p = 0.799$.

Results from this test indicate the One Interview Group was driving the significant decline in drinking noted when comparing the Usual Care Group to the SWDI Group. See Table 14 below for a summary of outcomes measured using the t-test and Wilcoxon Signed Ranks test.

Medical Service Use

Participants were asked to rate level of medical service use both before and after injury. Results from the Kolmogorov-Smirnov test of normality revealed the data from medical service use before injury, $D(29) = 0.534$, $p < 0.001$ and medical service use after injury, $D(29) = 0.296$, $p < 0.001$, were not normally distributed. Therefore, the non-parametric Wilcoxon Signed Ranks test was used to determine whether participants' medical service use significantly changed after injury.

For those in the One Interview Group, medical service use significantly increased from before injury ($M = 0.250$, $SD = 0.786$) to after injury ($M = 1.70$, $SD = 2.080$), $T = 10$, $p = 0.018$. For those in the Two Interview Group, medical service use did not significantly increase from before injury ($M = 0.09$, $SD = 0.302$) to after injury ($M = 3.0$, $SD = 6.128$), $T = 4$, $p = 0.066$.

This indicates that the One Interview Group was driving the significant difference noted in medical service use. See Table 14 below for a summary of outcomes measured using the t-test and Wilcoxon Signed Ranks test.

In terms of type of medical services used (i.e. whether participants used Emergency Department services vs. outpatient services), there were no significant differences in Emergency Department use $X^2(1, N = 30) = 0.085$, $p = 0.770$.

Psychiatric Service Use

Participants were asked to rate level of psychiatric service use both before and after injury. Results from the Kolmogorov-Smirnov test of normality revealed the data from psychiatric service use before injury, $D(30) = 0.493$, $p < 0.001$ and psychiatric service use after injury, $D(30) = 0.492$, $p < 0.001$, were not normally distributed. Therefore, the non-parametric Wilcoxon Signed Ranks test was used to determine whether participants' psychiatric service use significantly changed after injury.

For those in the One Interview Group, psychiatric service use did not significantly change from before injury ($M = 0.25$, $SD = 0.716$) and after injury ($M = 0.80$, $SD = 2.726$), $T = 2$, $p = 0.414$. Similarly, for those in the Two Interview Group, psychiatric service use did not significantly change from before injury ($M = 0.08$, $SD = 0.289$) and after injury ($M = 0.0$, $SD = 0.0$), $T = 0$, $p = 0.317$.

See Table 14 below for a summary of outcomes measured using the t-test and Wilcoxon Signed Ranks test.

| TABLE 14. EXAMINATION OF EFFECT OF FIRST INTERVIEW ON SECOND INTERVIEW USING T-TEST AND WILCOXON SIGNED RANK TEST | | | | |
|--|-------------------------|-----------------------------------|----------------------------------|---------------------------|
| Measure | | Before Injury Mean+-SD | After Injury Mean+-SD | p value* |
| CIQ | | | | |
| | One Interview N = 20 | 23+-3 | 23 +-4 | 0.302 |
| | Two Interview N=10 | 21+-4 | 20+-4 | 0.693 |
| AUDIT | | | | |
| | One Interview N = 20 | 10+-10 | 5+-5 | 0.005⁺⁺ |
| | Two Interview N=10 | 7+-10 | 5+-4 | 0.799 |
| Medical Service Use | | | | |
| | One Interview N = 20 | 0+-1 | 2+-2 | 0.018⁺ |
| | Two Interview N=10 | 0+-0 | 3+-6 | 0.066 |
| Psychiatric Service Use | | | | |
| | One Interview N = 20 | 0+-1 | 1+-3 | 0.414 |
| | Two Interview N=10 | 0+-0 | 0+-0 | 0.317 |
| <p>*Two-sided statistical significance values by Dependent t-test and Wilcoxon Signed Ranks test. ⁺Significant at $p < 0.05$ ⁺⁺Significant at $p < 0.01$ <i>Note: Numbers rounded to nearest whole number (except p-values)</i></p> | | | | |

Patient Experience Survey Qualitative Results

Results from the Patient Experience Survey indicated that 96% of participants who remembered receiving the intervention (N=25) reported that they found it helpful. In response to the open-ended question, “Which part of the packet was most helpful?”, three major themes emerged. The first and most prominent theme was related to patients’ experience of decrease in anxiety about symptoms because of education they received about symptoms to expect during the SWDI. Sixty-percent of participants discussed this theme during the interview. One patient quote illustrates the theme, “It [the intervention] helped me to know what to look for. I had headaches, dizziness. It made me less worried.”

The second theme was related to learning that doctors recommend ceasing alcohol use after injury. Twenty-four percent of participants reported that they learned this during the SWDI. The

third theme that emerged was that patients found the recovery tips most helpful. Twenty-eight percent of participants talked about this during the interview.

High Risk Patients

Twenty-nine percent (N=17) of the total sample (N=59) are considered high risk based on criteria determined for this study. The average age was 41 ($SD = 15$), and 59% were men. In terms of race, 35% were white, 29% were African American, 24% were Latino, and 12% were Asian/PI/Native American. Seventy-six percent were not married, 35% were uninsured. Forty-one percent were intoxicated at time of injury, 29% had a GCS lower than 15, 76% had a loss of consciousness at time of injury. The most common mechanism of injury was assault (53%), followed by bike accidents (18%), falls (12%), struck by an object (12%) and pedestrian related accident (6%).

CHAPTER SIX

DISCUSSION AND IMPLICATIONS FOR SOCIAL WORK RESEARCH AND PRACTICE

Discussion

The present study built on existing research to test the therapeutic effects of a social work delivered education and reassurance mTBI intervention (SWDI). This study provides support for the use of the SWDI in the emergency department. The unique contributions of this study include 1) the successful utilization of social work practitioners already embedded in the Emergency Department setting to provide the SWDI, 2) successful provision of reassurance and acute education on coping strategies and return to regular activities, 3) effective provision of acute education on the impact of alcohol use on recovery, and 4) qualitative report that participants overwhelmingly found the SWDI to be helpful.

In order to sustain interventions for mTBI patients in this economic climate, it is extremely important to produce the maximum treatment effect using the lowest intensity of services and the most efficient provider. Social workers are well placed in hospitals and emergency departments to contribute to the care of individuals suffering from the acute and chronic consequences of mTBI. This study provides initial evidence that social workers can be effective providers of mTBI interventions in the Emergency Department.

Participants who received the SWDI maintained pre-injury levels of community functioning while participants in the Usual Care group reported a significant decline in functioning. In addition, the SWDI Group significantly reduced alcohol use after their injury, and the Usual Care Group maintained their pre-injury hazardous drinking.

These measures are clinically and functionally significant. The measure of community functioning included probes about work, school and social activity attendance as well as ability to complete household and daily living activities. These are all important aspects of general community living as well as recovery after injury. The reassurance and education about coping strategies and return to regular activities provided in the SWDI appear to have been important in helping participants maintain their functioning during the recovery process.

Alcohol use is a risk factor for re-injury and poor outcome. Substance abuse often co-occurs with TBI (Bjork & Grant, 2009; Corrigan & Cole, 2008; Parry-Jones, Vaughan & Cox, 2006; Ponsford, Whelan-Goodinson & Bahar-Fuchs, 2007). Alcohol-related disorders are linked to risk for traumatic injury and re-injury of all types (Dicker, et al., 2011; Gentilello, Donovan, Dunn & Rivara, 1995). Prevalence of alcohol intoxication at time of injury has consistently been documented at between 37-51% (Corrigan, 1995; Parry-Jones, et al., 2006) and pre-injury prevalence of alcohol abuse is also between 37-51% (Parry-Jones, et al., 2006). Substance abuse is associated with poor outcome after injury (Parry-Jones, et al., 2006). Screening and intervention for substance abuse disorders after TBI are important for prevention of re-injury and improved outcomes (Gentilello, et al., 1999; Gentilello, 2005). The education about alcohol use after mTBI in the SWDI is one effective way to provide patients with information, recommendations and referrals to assist in decreasing alcohol use.

Patient Experience

In addition to the important community functioning and alcohol use outcomes, the SWDI group overwhelmingly found the intervention helpful. Positive patient experience with an

intervention in health care is an important consideration when implementing and testing an intervention.

Education about symptoms to expect, alcohol use and tips for recovery were particularly salient for participants. The reported subjective decrease in anxiety about symptoms after education may be important for future intervention enhancement due to the link between anxiety and poor functional outcome. The quantitative measure of anxiety used in the study, the subpart of the PHQ-4, does not ask about anxiety specifically related to the injury. Therefore, while a statistically significant difference between the SWDI Group and the Usual Care Group on the PHQ-4 was not documented, this finding of a subjective sense of decrease in anxiety about symptoms related to the mTBI may have contributed to the success of the SWDI Group in maintaining their pre-injury level of community functioning. Future studies should enhance measurements of anxiety in order to better understand the various forms of anxiety that may impact recovery and functioning.

SWDI Implementation

The SWDI has been successfully implemented as Usual Care at the study site. Referral rates to the SWDI have remained relatively steady at just under 30% of total mTBI patients. When implementing a new intervention, efforts to increase the rate of referrals must be ongoing. Booster trainings and advertisement/reminders are recommended.

The Impact of a One-Week Interview on Responses at Three Months

The significant differences found between the One Interview and Two Interview Groups when comparing scores from the AUDIT and number of Medical Services used before injury and after injury were not surprising due to the differential sample sizes in the two groups. The One Interview Group had a larger sample size, and therefore, there was more power to detect a statistically significant difference on outcome measures. In addition, the One Interview Group relied on memory of alcohol use before injury at the three month interview. This may have led to increased inaccuracy in reporting of use. Reporting before and post-injury drinking at the same time point may have made the One Interview Group more prone to social pressure to please the interviewer with a report of change.

Of note, both groups reported a decline in drinking from pre-injury “hazardous levels” to normal levels three months after injury, and both groups reported increased Medical Service Use. While it is difficult to draw conclusions because of the small sample size, the similar trends in both groups indicate no or minimal impact of the first interview on responses in the second interview.

High risk patients

While this study provides only a basic description of the high risk group within the sample, the information indicates there is a substantial subgroup of patients with two or more high risk scores on clinically significant measures (RPQ, PHQ, PCL-C, AUDIT, CIQ) that may need increased attention and resources both in the Emergency Department and in the community.

Limitations

There are several limitations of the current study. The quasi-experimental design does not allow for causal inferences to be made regarding the direct effect of the SWDI on outcomes of interest. The relatively small sample size limited power to detect differences on some measures that trended in favor of the SWDI Group but were not statistically significantly different between

groups (all measures trended in favor of the SWDI Group). Future studies should increase sample size in order to achieve power to detect a difference on the measure of post-concussive symptoms. An enhanced measure of anxiety may be appropriate and helpful in detecting differences in the groups beyond generalized anxiety, which was measured in this study. In addition, due to non-normal distribution of most of the data, non-parametric tests were required. This led to use of multiple comparison to assess the impact of the SWDI. Multiple comparisons increases the type I error rate. A between group comparison of a measure of an overall effect of the intervention (good outcomes on the PHQ-4, PCL-C, AUDIT and CIQ) yielded an increased number of participants with good outcome in the SWDI group, but no statistically significant difference between the groups.

Finally, twenty-eight percent of participants in the SWDI Group did not remember receiving the SWDI in the Emergency Department. This raises some known issues in urban, emergency, trauma care about the impact on mTBI patients of overcrowding, pressure to discharge patients quickly, and overburdened staff. While several of these patients reported reading the materials at home or at least knowing that they had the material at home, this finding indicates there may be a potential benefit of contacting patients after discharge to ensure they have all necessary education, reassurance, discharge and follow-up information and referral information. Future studies can build on this study to enhance the intervention with an early post-Emergency Department assessment of post-concussive symptoms, anxiety and depression plus early post-Emergency Department follow-up education, reassurance and resource linkage for those reporting significant post-concussive, anxiety or depressive symptoms. In addition, future studies can improve data gathering techniques with enhanced anxiety assessments, larger samples and randomized designs.

Future Directions for Social Work Research and Practice

The overwhelming majority of TBIs are mild injuries. Social workers are working with mTBI patients, and have the ability to provide effective services to this population. They are well placed, economically efficient and clinically trained to provide psychosocial interventions to patients, yet prior to this study they have not been utilized in studies of TBI interventions. There is a need for increased interdisciplinary collaboration between researchers and practitioners to highlight the utility of social workers with this population.

More research is needed to identify and quantify the impact of disability after mTBI, and more research is needed to test the effectiveness of acute and chronic social interventions. Research to date has not led to models that can immediately identify persons who will have a poor outcome or develop post-concussive syndrome, yet we know that they may need enhanced services in order to recover. Therefore, the question facing service providers and researchers is how to provide enough services to every mTBI patient to improve outcomes and prevent development of post-concussive syndrome and also identify those experiencing poor outcomes in order to provide enhanced services. Given limited resources in public health settings, it is of utmost importance to triage patients into appropriate levels of service.

Recently, Hou and colleagues (2011) proposed a model for development of post-concussion syndrome after mTBI that includes, 1) predisposing factors such as anxiety, depression, life experiences and expectations, 2) social environmental factors such as social support, and 3) perpetuating factors in three categories, cognition, emotion and behavior (p.2). In their study, they showed that the specific perpetuating factors associated with risk for post-concussive syndrome

included negative perceptions or cognitions about recovery after mTBI, stress, anxiety and depression and all-or-nothing behavior. They define all-or-nothing behavior as when “patients overdo things when they believe symptoms are abating and then spend prolonged periods recovering when symptoms reappear” (p. 2). The interaction of these perpetuating factors with a person’s pre-existing problems and social environment can lead to post-concussive syndrome after mTBI. This type of multidimensional stress model provides insight for social workers involved in the care of mTBI patients and for design of future studies. Promising areas of focus for intervention, then, include patients’ perception of the impact of the mTBI on their life, patients’ anxiety and depression and patients’ behavior patterns in relation to their experience of symptoms.

Studies that enhance the SWDI developed in this study and randomized trials testing the effect of such interventions are needed. Specifically, an intervention that enhances the SWDI with a brief, early, post-discharge assessment of some of the perpetuating factors associated with the development of post-concussive syndrome described above is of particular interest for researchers in this area. The study by Hou, et al., 2011 indicates that such an assessment can be predictive of post-concussive syndrome development as early as two weeks post-injury. For those identified as at risk for development of post-concussive syndrome (those suffering from significant symptoms), enhanced services such as a follow-up SWDI that provides phone counseling and targeted referral to necessary services would be appropriate. This assessment, counseling and triage, if successful, will allow for appropriate treatment of the “miserable minority” and discourage provision of services to those who have spontaneously recovered.

Mild TBI patients and their families across the country are coping with residual symptoms every day. Social workers are part of multidisciplinary teams serving the complex needs of these patients. The scientific synergy of all of these parts to develop evidence-based practices is in order. Providers need it, our health care system demands it and our patients deserve it.

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APPENDIX A
INTERVENTION EDUCATIONAL MATERIAL



**BRAIN AND SPINAL
INJURY CENTER**

San Francisco General Hospital
University of California at San Francisco

Frequently Asked Questions

What is Mild Traumatic Brain Injury or Concussion?

Concussion involves one of the following:

A change in mental state – Daze, confusion or loss of consciousness lasting less than 30 minutes.

A loss of memory- Gap in memory around the event lasting less than 24 hours.

Is the head always struck in a concussion?

No. Concussion can also result from a sudden violent motion, such as whiplash, which causes jarring and injury to the brain.

What happens during a concussion?

The brain moves and hits the inside of the skull, causing injury to the brain. As the brain is injured it begins to swell, causing important areas to stop working. There may be some bruising or injury to the brain which may or may not be seen on brain imaging. The person may look fine, but problems with thinking, behavior and emotions may be present.

Is a concussion a permanent problem?

With time, most people recover with little to no problems. Some people are okay right away while others take several weeks to months to recover. Most people are better within one to three months. No two cases are ever the same.

What can I do to get better?

Stay away from alcohol. Get plenty of rest, it helps the brain to heal. Accept that it will take time to build your stamina. Moderate exercise and a healthy diet are important. Avoid getting reinjured; avoid contact sports. Get help right away if you

feel sad or nervous. Don't let anxiety cause you to avoid situations. Return to your normal routine only after you feel better. Avoid high levels of stress and stimulation.

What are common concussion symptoms?

- Forgetfulness
- Irritability
- Depression and anxiety
- Spatial disorientation
- Blurred vision
- Altered taste and smell
- Ringing in ears
- Repeating oneself
- Difficulty making plans, getting organized, and carrying out goals
- Slowed thinking, trouble finding words
- Headaches
- Sleep problems
- Poor attention and concentration
- Vertigo
- Balance problems
- Sensitivity to light and noise
- Dizziness
- Judgment may be slightly off
- Fatigue
- Difficulty multi-tasking
- Feeling mentally foggy

When should I seek help?

If your symptoms do not largely improve within 3 months or if they get worse at any time, it is important to seek the help of a physician and/or neuropsychologist. Emotionally, people often feel traumatized by their injury and the impact it has had on their lives.

If this happens to you, it is important to get help right away. For help in dealing with symptoms, or if you have any questions about your recovery, CONTACT

OUR NEUROSURGERY PATIENT LINE

Number provided here



BRAIN AND SPINAL INJURY CENTER

San Francisco General Hospital
University of California at San Francisco

Concussion Recovery Tips

After a brain injury it is important to do things in a different way to help speed your recovery. Here are some tips to keep in mind while you recover.

- 1 **Rest, Rest, Rest-** You may have less energy and run out of energy more quickly. Don't push yourself past your limits. Get plenty of sleep at night, take naps and reduce your daily activities. **Keep It Simple!**
- 2 After your doctor says it is okay to **return to your usual activities** such as driving, work, and sports, **do it little by little** not all at once.
- 3 Avoid activities that could lead to another concussion, especially contact sports, while you are still experiencing symptoms of a concussion. **When in doubt, sit it out.**
- 4 **Wear a helmet** when riding a skateboard, bicycle, skiing, etc.
- 5 Do tasks that require **more brain effort when you are fresh** and in quiet environments.
- 6 **Avoid drinking alcohol and drugs** that are not approved by your doctor.
- 7 **Make lists**, use a calendar or planner, put items (such as keys) in the same place so you can find them, prepare your purse or bag the night before. Go to smaller stores during less busy times. Organize yourself. For example, **write things down**, and stick to a routine.
- 8 **Do one thing at a time.** For example, don't try to talk on the phone while cooking dinner.
- 9 **Don't be hard on yourself.** Notice what you are doing well with too. Don't be so focused on your weaknesses that you overlook your strengths. Most people compare how they are now to how they were before their injury. Instead, compare how you are doing now to how you were doing right after your injury.
- 10 **Get out of the house.** Do activities you love, and don't avoid important people, places, and things in your life. If you notice you are feeling sad, worried, and stressed get help right away. Tell your doctor or call the San Francisco mental health access line at number given here.
- 11 **Don't panic** if you have setbacks and you are not completely healed in 1 month. Some days may be better than others. This is normal and it does not mean you are not recovering. **Most people recover fully, but recovery takes time.**

Neurosurgery Patient Line Number given here



BRAIN AND SPINAL INJURY CENTER

San Francisco General Hospital
University of California at San Francisco

Tips for Managing Stress

Patients and family members often become so involved in the crisis that they neglect their own health and well-being. Some warning signs of stress include: inability to sleep, poor self-care, constant self-blaming, frequent feelings of loneliness, nightmares, excessive use of alcohol and/or medications, a sense of worthlessness, and not knowing where to turn for help.

- **Eat Properly:** Skipping meals, eating on the run, or filling up on junk food will diminish your energy reserves. A healthy, well-balanced diet will help your body deal with stress.
- **Get Regular Exercise:** Try to get 30 minutes of exercise daily. It helps you relax and can improve your mood.
- **Rest:** Plan to take turns at the hospital with family members and friends. Use some of your time away from the hospital to rest.
- **Limit Caffeine:** Do not drink more than two cups of coffee, tea, or cola. Too much caffeine can cause restlessness, jumpiness, anxiety, difficulty sleeping, irregular heartbeat, twitching muscles, nausea and abdominal pain.
- **Alcohol/Drug Use:** Using alcohol or recreational drugs will not relieve stress. It will only create more problems.
- **Feelings:** Discuss your feelings with trusted family members and friends. Try to avoid things that upset you such as rush hour traffic.
- **Seek Help:** Social workers, clergy and health care staff are here to help. They can offer assistance or refer you to other sources of help.
- **Be Kind to Yourself:** Take time for exercise or a meal with a friend. By taking care of your own needs you will be better able to respond to the patient's needs.
- **Let Others Help:** Accept help. Ask the hospital staff about support groups in your home area.
- **Ask Questions:** Write down your questions as you think of them and ask hospital staff for answers. Although many questions may not have clear-cut answers, increased understanding can help you deal with the situation.

Neurosurgery Patient Line [Number given here](#)



BRAIN AND SPINAL INJURY CENTER

San Francisco General Hospital
University of California at San Francisco

Traumatic Brain Injury Resources

| | | |
|--|--|---|
| <p>San Francisco TBI Network Janet Pomeroy Center 207 Skyline Blvd. San Francisco, CA. 94132 415-665-4100 x1782 www.janetpomeroy.org</p> <p>Traumatic Brain Injury Services of California www.tbisca.org</p> | <p>Brain and Spinal Injury Center University of California at San Francisco General Hospital and Trauma Center 1001 Potrero Ave, Bldg 1, Rm 101 San Francisco, CA 94110 415-206-8300 www.brainandspinalinjury.org</p> | <p>Victim Compensation Fund 800-777-9229 www.boc.ca.gov</p> <p>Victim Witness Assistance Center 415-553-9044</p> <p>San Francisco General Hospital Trauma Recovery Center (TRC) 415-437-3000</p> |
| <p>Brain injury resources www.tbimatters.org</p> <p>TBI Survival Guide www.tbiguide.com</p> | <p>TBI Support Group First Thursday of every Month Barnett Briggs Medical Library 4:00 -5:00 pm For Information Call 415-437-3035 415-206-6310 415-206-4476</p> | <p>State Disability Insurance (SDI) 1-800-480-3287</p> <p>Employment Development Dept. 1-800-300-5616</p> <p>Bay Area Legal Aid 415-354-6360</p> |
| <p>Family Caregiver Alliance 690 Market Street Suite 600 San Francisco, CA 94104 415-434-3388</p> | <p>Brain Trauma Foundation 212-772-0608 www.braintrauma.org</p> | <p>Keep tabs on seizures www.seizuretracker.com</p> |
| <p>Marin Brain Injury Network 415-461-6771 www.mbin.org</p> | <p>Brain Injury Association of America 800-444-6443 www.biausa.org</p> | <p>National Center for the Dissemination of Disability Research www.ncddr.org</p> |

| | | |
|--|---|--|
| <p>TBI Skills Group John Adams Community College 415-561-1005</p> | <p>Traumatic Brain Injury Resource Directory www.tbi-sci.org/tbird/</p> | <p>UCSF Department of Neurosurgery http://neurosurgery.ucsf.edu/</p> |
|--|---|--|



BRAIN AND SPINAL INJURY CENTER

San Francisco General Hospital
University of California at San Francisco

FREE Support and Education group for patients, families, and friends following Traumatic Brain Injury

FIRST THURSDAY OF EVERY MONTH

4:00 – 5:00 pm

LOCATION AND RELEVANT INFORMATION GIVEN HERE

Bring your Family and Friends

Questions?

Call us:

Clinical Nurse Specialist: Name and phone number here

Clinical Social Worker: Name and phone number here

Neuropsychologist: Name and phone number here.

APPENDIX B
RESEARCH INTERVIEWS

Three Month Interview

Section A. Short Orientation Memory Concentration Test

Now I'd like to ask some questions that people probably asked you when you were in the hospital. Some of the questions may seem easy and some may seem difficult.

A What year is it now?

1 4 pts. correct answer Patient
0 pts incorrect answer answer

Score

A What month is it now?

2 3 pts. correct answer Patient
0 pts incorrect answer answer

Score

A I am going to read a name and address. When I'm done, I'll ask you to repeat the address.

3 (No score. Scored in question 7.)

Arthur Jones

42 Market Street

San Francisco

Repeat? No=0

Yes=1

Try to remember this. I'll ask you to recall it later.

A (Without looking at a clock) Patient
4 About what time is it? answer

3 pts. if w/in an hour
0 pts. if not w/in an hour

Score

| | | | |
|--|--|---------|---------------|
| A 5 | Count backwards from 20 down to 1. | | 20 19 18 |
| | <i>4 pts. if all correct</i> | Patient | 17 16 15 |
| | <i>2 pts. if one error</i> | answer | 14 13 12 |
| | <i>0 pts. if 2 or more errors</i> | check | 11 10 9 |
| | | | 8 7 6 5 |
| | | | 4 3 |
| | | | 2 1 |
| Score | | | |
| A 6 | Say the months of the year in reverse order starting with December. | | Dec Nov Oct |
| | <i>4 pts. if all correct</i> | Patient | Sept Aug July |
| | <i>2 pts. if one error</i> | answer | June May |
| | <i>0 pts. if 2 or more errors</i> | check | Apr Mar Feb |
| | | | Jan |
| Score | | | |
| A 7 | Repeat the address given above | | Arthur Jones |
| | <i>10 pts. if all correct</i> | Patient | |
| | <i>2 pts. off for each error</i> | answer | 42 Market |
| | | check | San Francisco |
| | | | |
| Score | | | |
| Total Score (out of 28): Must score 23 in order to continue | | | |

Thank you. Now, I'm going to ask you some questions about yourself and how you've been feeling. The interview is voluntary--you're free to refuse to answer any question or end the interview at any time.

| Demographics: please ask the following questions: | | |
|---|--------------------------------------|--------------|
| Demo1 | How old are you? | |
| Demo2 | Sex | Male Female |
| Demo3 | What is your Race/Ethnicity? | |
| Demo4 | Are you currently Married? | no=0 yes=1 ➤ |
| Demo5 | Do you have health insurance? | no=0 yes=1 ➤ |

| | | | |
|----|--|-------------------------|--|
| B1 | <p>Since you were seen in the Emergency Room on _____,</p> <p>have you had any other visits to the Emergency Department?</p> | <p>no=0 yes=1 ➤</p> | <p>Why did you visit the Emergency Department?</p> |
| B2 | <p>Since you were seen in the Emergency Room on _____,</p> <p>have you had another concussion?</p> | <p>no=0 yes=1 ➤</p> | <p>What happened?</p> |

Section C. Rivermead Post-Concussion Symptoms Questionnaire (RPQ)

After a head injury or accident some people experience symptoms which can cause worry or nuisance. We would like to know if you now suffer from any of the symptoms given below. As many of these symptoms occur normally, we would like you to compare yourself now with before the accident. For each one, please tell me the number closest to your answer.

- 0= Not experienced at all**
- 1= No more of a problem**
- 2= A mild problem**
- 3= A moderate problem**
- 4= A severe problem**

Compared with before the accident, do you now (over the last 24 hours) suffer from:

| Compared with before the accident, do you now (i.e., over the last 24 hours) suffer from: | | How much of a problem is _____? |
|---|-----------------------|---|
| C1 | Headaches | no=0 yes=1➤ |
| | | Not at all = 0 No more than before = 1 Mild Problem = 2 Moderate Problem = 3 Severe Problem = 4 |
| C2 | Feelings of Dizziness | no=0 yes=1➤ |
| | | Not at all = 0 No more than before = 1 Mild Problem = 2 Moderate Problem = 3 Severe Problem = 4 |

| | | | |
|-----------|--|-------------|---|
| C3 | Nausea or vomiting | no=0 yes=1➤ | Not at all = 0 No more than before = 1 Mild Problem = 2 Moderate Problem = 3 Severe Problem = 4 |
| C4 | Sensitivity to noise/easily upset by noise | no=0 yes=1➤ | Not at all = 0 No more than before = 1 Mild Problem = 2 Moderate Problem = 3 Severe Problem = 4 |
| C5 | Sleep problems | no=0 yes=1➤ | Not at all = 0 No more than before = 1 Mild Problem = 2 Moderate Problem = 3 Severe Problem = 4 |
| C6 | Fatigue/tiring more easily | no=0 yes=1➤ | Not at all = 0 No more than before = 1 Mild Problem = 2 Moderate Problem = 3 Severe Problem = 4 |
| C7 | Being irritable/easily angered | no=0 yes=1➤ | Not at all = 0 No more than before = 1 Mild Problem = 2 |

| | | | |
|------------|---------------------------------|-------------|---|
| | | | Moderate Problem = 3 |
| | | | Severe Problem = 4 |
| C8 | Feeling depressed or tearful | no=0 yes=1➤ | Not at all = 0 No more than before = 1 Mild Problem = 2 Moderate Problem = 3 Severe Problem = 4 |
| C9 | Feeling frustrated or impatient | no=0 yes=1➤ | Not at all = 0 No more than before = 1 Mild Problem = 2 Moderate Problem = 3 Severe Problem = 4 |
| C10 | Forgetfulness/poor memory | no=0 yes=1➤ | Not at all = 0 No more than before = 1 Mild Problem = 2 Moderate Problem = 3 Severe Problem = 4 |
| C11 | Poor concentration | no=0 yes=1➤ | Not at all = 0 No more than before = 1 Mild Problem = 2 Moderate Problem = 3 Severe Problem = 4 |
| C12 | Taking longer to think | no=0 yes=1➤ | Not at all = 0 No more than before = 1 Mild Problem = 2 Moderate Problem = 3 Severe Problem = 4 |
| C13 | Blurred vision | no=0 yes=1➤ | Not at all = 0 |

| | | | |
|------------|--|---|---|
| | | | No more than before = 1 Mild Problem = 2 Moderate Problem = 3 Severe Problem = 4 |
| C14 | Light Sensitivity/Easily upset by bright light | no=0 yes=1➤ | Not at all = 0 No more than before = 1 Mild Problem = 2 Moderate Problem = 3 Severe Problem = 4 |
| C15 | Double Vision | no=0 yes=1➤ | Not at all = 0 No more than before = 1 Mild Problem = 2 Moderate Problem = 3 Severe Problem = 4 |
| C16 | Restlessness | no=0 yes=1➤ | Not at all = 0 No more than before = 1 Mild Problem = 2 Moderate Problem = 3 Severe Problem = 4 |
| C17 | Are you experiencing any other difficulties? | no=0 yes=1➤ Fill in _____ _____ _____ _____ | Not at all = 0 No more than before = 1 Mild Problem = 2 Moderate Problem = 3 |

| | | | |
|------------|--|--|---|
| C18 | Are you experiencing any other difficulties? | no=0 yes=1 ➤ Fill in _____ _____ _____ _____ | Severe Problem = 4 Not at all = 0 No more than before = 1 Mild Problem = 2 Moderate Problem = 3 Severe Problem = 4 |
|------------|--|--|---|

| | |
|--|---|
| INTERVIEWER: <i>How much of <u>Section C</u> were you able to complete?</i> | <i>All = 1 Some = 2 None = 3</i> |
| Notes: | <div style="border: 1px solid black; height: 60px; width: 100%;"></div> |

Section D. Patient Health Questionnaire-4 (PHQ-4)

The next 4 questions are about your mood over the last 2 weeks.

Let me know how you have experienced the following feelings over the last two weeks.

0=Not at all

1=Several Days

2=More than Half the Days

3=Nearly Every Day

| Over the last 2 weeks, have you been bothered by the following problems? | How often has ____ bothered you? |
|--|---|
| D1 Feeling nervous, anxious or on edge no=0 yes=1 ➤ | Not at all = 0 Several Days = 1 More than half the days = 2 Nearly Every Day = 3 |
| D2 Not Being able to stop or control worrying no=0 yes=1 ➤ | Not at all = 0 Several Days = 1 More than half the days = 2 Nearly Every Day = 3 |
| D3 Feeling down, depressed or hopeless no=0 yes=1 ➤ | Not at all = 0 Several Days = 1 More than half the days = 2 Nearly Every Day = 3 |
| D4 Little interest or pleasure in doing things no=0 yes=1 ➤ | Not at all = 0 Several Days = 1 More than half the days = 2 Nearly Every Day = 3 |

INTERVIEWER: How much of Section D were you able to complete?

All = 1

Some = 2

None = 3

Notes:

Section E. PCLC-PTSD Measure

The next questions are about some other symptoms that people may have after an injury or other traumatic event. Again, I'll read a list of symptoms, ask if you have had them in the last 30 days, and if so, how much they bothered you.

| In the last 30 days, have you _____ ? | How much has that bothered you? |
|--|--|
| E1 Had repeated disturbing memories, thoughts, or images of your injury? no=0 yes=1➤ | Not at all = 1 A little bit = 2 Somewhat = 3 A lot = 4 Extremely = 5 |
| E2 Had repeated disturbing dreams related to your injury ? no=0 yes=1➤ | Not at all = 1 A little bit = 2 Somewhat = 3 A lot = 4 Extremely = 5 |
| E3 Suddenly acted or felt as if your injury were happening again? (as if you were reliving it) no=0 yes=1➤ | Not at all = 1 A little bit = 2 Somewhat = 3 A lot = 4 Extremely = 5 |
| E4 Felt very upset when something reminded you of your injury? no=0 yes=1➤ | Not at all = 1 A little bit = 2 Somewhat = 3 A lot = 4 Extremely = 5 |
| E5 Had physical reactions (like your heart pounding, having trouble breathing or sweating) when something reminded you of your injury? no=0 yes=1➤ | Not at all = 1 A little bit = 2 Somewhat = 3 A lot = 4 Extremely = 5 |
| E6 Avoided thinking about or talking about your injury or avoiding having feelings related to it? no=0 yes=1➤ | Not at all = 1 A little bit = 2 Somewhat = 3 A lot = 4 Extremely = 5 |

| In the last 30 days, have you _____ ? | How much has that bothered you? |
|--|--|
| E7 Avoided activities or situations because they reminded you of your injury? no=0 yes=1➤ | Not at all = 1 A little bit = 2 Somewhat = 3 A lot = 4 Extremely = 5 |
| E8 Had trouble remembering important parts of the events surrounding your injury? no=0 yes=1➤ | Not at all = 1 A little bit = 2 Somewhat = 3 A lot = 4 Extremely = 5 |
| E9 Lost interest in activities that you used to enjoy? no=0 yes=1➤ | Not at all = 1 A little bit = 2 Somewhat = 3 A lot = 4 Extremely = 5 |
| E10 Felt distant or cut off from other people? no=0 yes=1➤ | Not at all = 1 A little bit = 2 Somewhat = 3 A lot = 4 Extremely = 5 |
| E11 Felt emotionally numb or unable to have loving feelings for those close to you? no=0 yes=1➤ | Not at all = 1 A little bit = 2 Somewhat = 3 A lot = 4 Extremely = 5 |
| E12 Felt as if your future will somehow be cut short ? no=0 yes=1➤ | Not at all = 1 A little bit = 2 Somewhat = 3 A lot = 4 Extremely = 5 |
| E13 Had trouble falling or staying asleep? no=0 yes=1➤ | Not at all = 1 A little bit = 2 Somewhat = 3 A lot = 4 Extremely = 5 |
| E14 Felt irritable or had angry outbursts ? no=0 yes=1➤ | Not at all = 1 A little bit = 2 |

| | | | |
|------------|--|-------------|--|
| | | | Somewhat = 3 A lot = 4 Extremely = 5 |
| E15 | Had difficulty concentrating? | no=0 yes=1➤ | Not at all = 1 A little bit = 2 Somewhat = 3 A lot = 4 Extremely = 5 |
| E16 | Been super alert, watchful or on guard? | no=0 yes=1➤ | Not at all = 1 A little bit = 2 Somewhat = 3 A lot = 4 Extremely = 5 |
| E17 | Felt jumpy or easily startled? | no=0 yes=1➤ | Not at all = 1 A little bit = 2 Somewhat = 3 A lot = 4 Extremely = 5 |

| |
|---|
| <p>INTERVIEWER: How much of <u>Section E</u> were you able to complete?</p> <p><i>All = 1</i> <i>Some = 2</i> <i>None = 3</i></p> <p>Notes:</p> <div style="border: 1px solid black; height: 60px; width: 570px; margin-left: 20px;"></div> |
|---|

Section F. AUDIT Alcohol Screen

The next few questions are about your alcohol use. I'm going to first ask you about how things have been going *since your injury*, and then ask you about how things were going *before your injury*. We ask everyone the questions, but they may or may not apply to you.

(don't need to read response options--as before ask questions and follow-up to get answers)

| | Since your Injury? | Before your injury? |
|---|---|---|
| F1 How often do you have a drink containing alcohol? | Never = 0 Skip to questions 9, 10 Monthly or less = 1 2 - 4 times per month = 2 2 - 3 times per week = 3 4 or more times per week = 4 | Never = 0 Skip to questions 9, 10 Monthly or less = 1 2 - 4 times per month = 2 2 - 3 times per week = 3 4 or more times per week = 4 |
| Skip to questions 9, 10 if "Never" | | |
| F2 How many drinks containing alcohol Do you have on a typical day when you are drinking? <i>One drink is:</i> a 12 oz can or bottle of beer, a glass of wine, a wine cooler Or one cocktail or shot of hard liquor | 1 or 2 drinks = 0 3 or 4 drinks = 1 5 or 6 drinks = 2 7-to-9 drinks = 3 10 or more drinks = 4 | 1 or 2 drinks = 0 3 or 4 drinks = 1 5 or 6 drinks = 2 7-to-9 drinks = 3 10 or more drinks = 4 |
| F3 How often do you have 6 or more drinks on one occasion? | Never = 0 Less than monthly = 1 Monthly = 2 Weekly = 3 | Never = 0 Less than monthly = 1 Monthly = 2 Weekly = 3 |

| | | |
|--|--|--|
| | Daily or almost daily = 4 | Daily or almost daily = 4 |
| Skip to questions 9, 10 if both F2 and F3 = "Never" | | |
| F4 | How often have you found that you were not able to stop drinking once you had started? | |
| | Never = 0 Less than monthly = 1 Monthly = 2 Weekly = 3 Daily or almost daily = 4 | Never = 0 Less than monthly = 1 Monthly = 2 Weekly = 3 Daily or almost daily = 4 |
| | Since your Injury? | Before your injury? |
| F5 | How often have you failed to do what was normally expected from you because of drinking? | |
| | Never = 0 Less than monthly = 1 Monthly = 2 Weekly = 3 Daily or almost daily = 4 | Never = 0 Less than monthly = 1 Monthly = 2 Weekly = 3 Daily or almost daily = 4 |
| F6 | How often have you needed a first drink in the morning to get yourself going after a heavy drinking session? | |
| | Never = 0 Less than monthly = 1 Monthly = 2 Weekly = 3 Daily or almost daily = 4 | Never = 0 Less than monthly = 1 Monthly = 2 Weekly = 3 Daily or almost daily = 4 |
| F7 | How often have you had a feeling of guilt or remorse after drinking? | |
| | Never = 0 Less than monthly = 1 Monthly = 2 Weekly = 3 | Never = 0 Less than monthly = 1 Monthly = 2 Weekly = 3 |

| | | |
|---|--|--|
| | Daily or almost daily = 4 | Daily or almost daily = 4 |
| F8 How often have you been unable to remember what happened the night before because you had been drinking? | Never = 0 Less than monthly = 1 Monthly = 2 Weekly = 3 Daily or almost daily = 4 | Never = 0 Less than monthly = 1 Monthly = 2 Weekly = 3 Daily or almost daily = 4 |
| F9 Have you or someone else been injured as a result of your drinking? | No = 0 Yes, but not since my injury = 2 Yes, since my injury = 4 | No = 0 Yes, but not before my injury = 2 Yes, before my injury = 4 |
| F10 Has a relative or friend or a doctor or another health worker been concerned about your drinking or suggested you cut down? | No = 0 Yes, but not since my injury = 2 Yes, since my injury = 4 | No = 0 Yes, but not before my injury = 2 Yes, before my injury = 4 |

INTERVIEWER: How much of Section F were you able to complete? All = 1
Some = 2
None = 3

Notes:

Section G. Community Integration Questionnaire (CIQ)

I would like to ask you a few questions about your daily activities. I'm going to first ask you about how things have been going in the last 30 days, and then ask you about how things were going before your injury.

| | In the last month? | Before your injury? (during the typical month...) |
|--|---|---|
| G1 Who usually did the shopping for groceries or other necessities? | Yourself alone = 1 Yourself & someone else = 2 Someone else = 3 Nobody = 4 Not applicable = 5 | Yourself alone = 1 Yourself & someone else = 2 Someone else = 3 Nobody = 4 Not applicable = 5 |
| G2 Who usually prepared meals? | Yourself alone = 1 Yourself & someone else = 2 Someone else = 3 Nobody = 4 Not applicable = 5 | Yourself alone = 1 Yourself & someone else = 2 Someone else = 3 Nobody = 4 Not applicable = 5 |
| G3 Who usually did the everyday chores or housework? | Yourself alone = 1 Yourself & someone else = 2 Someone else = 3 Nobody = 4 Not applicable = 5 | Yourself alone = 1 Yourself & someone else = 2 Someone else = 3 Nobody = 4 Not applicable = 5 |
| G4 Who usually cared for the children? | Yourself alone = 1 Yourself & someone else = 2 Someone else = 3 Nobody = 4 Not applicable = 5 | Yourself alone = 1 Yourself & someone else = 2 Someone else = 3 Nobody = 4 Not applicable = 5 |
| G5 Who usually planned social arrangements such as get-togethers with family and friends? | Yourself alone = 1 Yourself & someone else = 2 Someone else = 3 | Yourself alone = 1 Yourself & someone else = 2 Someone else = 3 |

| | Nobody = 4 Not applicable = 5 | Nobody = 4 Not applicable = 5 |
|--|---|---|
| G6 Who usually looked after your personal finances, such as banking and paying bills? | Yourself alone = 1 Yourself & someone else = 2 Someone else = 3 Nobody = 4 Not applicable = 5 | Yourself alone = 1 Yourself & someone else = 2 Someone else = 3 Nobody = 4 Not applicable = 5 |
| G7 Approximately how many times a month do you usually shop outside your home? | Never = 1 1 - 4 times = 2 5 or more times = 3 | Never = 1 1 - 4 times = 2 5 or more times = 3 |
| G8 Approximately how many times did you participate in leisure activities, such as movies, sports, eating out, etc. | Never = 1 1 - 4 times = 2 5 or more times = 3 | Never = 1 1 - 4 times = 2 5 or more times = 3 |
| G9 Approximately how many times did you visit with friends or relatives? | Never = 1 1 - 4 times = 2 5 or more times = 3 | Never = 1 1 - 4 times = 2 5 or more times = 3 |
| G10 When you participated in leisure activities did you usually do that alone or with others? | Mostly alone = 1 Mostly with family members = 2 Mostly with friends = 3 With a combination of friends and family = 4 Not applicable = 5 | Mostly alone = 1 Mostly with family members = 2 Mostly with friends = 3 With a combination of friends and family = 4 Not applicable = 5 |
| G11 Did you have a best friend with whom you confide? | Yes = 1 No = 2 | Yes = 1 No = 2 |
| G12 How often did you go places away from home? | Almost every day = 1 Almost every week = 2 Seldom/never (<1x/wk) = 3 | Almost every day = 1 Almost every week = 2 Seldom/never (<1x/wk) = 3 |

| | | Since your injury? | Before your injury? (during the typical month...) |
|-----|---|--|--|
| G13 | What was your work situation? <i>(do not read response choices; ask questions and discuss to arrive at answer)</i> | Competitive work = 1 Job: _____ | Competitive work = 1 Job: _____ |
| | | Non-market work = 2 (volunteer, recycle, panhandling) | Non-market work = 2 (volunteer, recycling, panhandling) |
| | | Not working = 3 | Not working = 3 |
| | | Why not: _____ | Why not: _____ |
| | | Retired = 4 | Retired = 4 |
| | | Student = 5 | Student = 5 |
| | | Homemaker = 6 | Homemaker = 6 |
| G14 | How would you best describe your current work or school situation? | Full time = 1 | Full time = 1 |
| | | Part time = 2 | Part time = 2 |
| | | Not attending = 3 | Not attending = 3 |
| | | Not applicable = 4 | Not applicable = 4 |
| G15 | How often did you engage in volunteer activities? | Never = 1 | Never = 1 |
| | | 1-4 times = 2 | 1-4 times = 2 |
| | | 5 or more = 3 | 5 or more = 3 |

| |
|--|
| <p>INTERVIEWER: How much of <u>Section G</u> were you able to complete?</p> <p style="text-align: right;"><i>All = 1</i> <i>Some = 2</i> <i>None = 3</i></p> <p>Notes:</p> <div style="border: 1px solid black; height: 60px; width: 550px; margin-left: 20px;"></div> |
|--|

H. Service Use

The last questions are about services you used before your injury and since your injury.

| | | Since your injury? | Before your injury? (during the typical month...) |
|-----------|--|-------------------------|--|
| H1 | How many times have you seen a medical doctor? | None = 0 | None = 0 |
| | | Once = 1 | Once = 1 |
| | | Twice = 2 | Twice = 2 |
| | | More than two times = 3 | More than two times = 3 |
| H2 | How many times have you seen a psychiatrist? | None = 0 | None = 0 |
| | | Once = 1 | Once = 1 |
| | | Twice = 2 | Twice = 2 |
| | | More than two times = 3 | More than two times = 3 |
| H3 | How many times have you seen a counselor or therapist? | None = 0 | None = 0 |
| | | Once = 1 | Once = 1 |
| | | Twice = 2 | Twice = 2 |
| | | More than two times = 3 | More than two times = 3 |
| H4 | How many times have you called the Neurosurgery patient line or other medical advice line? | None = 0 | None = 0 |
| | | Once = 1 | Once = 1 |
| | | Twice = 2 | Twice = 2 |
| | | More than two times = 3 | More than two times = 3 |
| H5 | How many times have you attended a support group? | None = 0 | None = 0 |
| | | Once = 1 | Once = 1 |
| | | Twice = 2 | Twice = 2 |

| | | | |
|-----------|--|-------------------------|-----------------------------------|
| | | More than two times = 3 | More than two times = 3 |
| H6 | Have you attended the TBI support group? | no=0 yes=1➤ | How helpful was the group? |
| | | | Not at all = 0 |
| | | | A little bit = 1 |
| | | | Somewhat = 2 |
| | | | Extremely = 3 |
| | | | Extremely = 3 |

| | | | |
|-----------|---|-----------------------------|--|
| H7 | Have you attended the concussion clinic? | no=0 (skip to I8) yes=1➤ | How helpful was the clinic? |
| | | | Not at all = 0 |
| | | | A little bit = 1 |
| | | | Somewhat = 2 |
| | | | Extremely = 3 |
| | | | Extremely = 3 |
| H8 | If no to I7, Are you interested in attending the clinic? | no=0 yes=1➤ | Call us at this number to schedule an appointment. 415-206-4093 |
| H9 | Are you involved in any lawsuits related to your injury? | no=0 yes=1 | If yes, tell me about it. |

That is the end of the interview. Thank you for your time. Your participation will help us improve our services to our patients.

 **End interview.**

| |
|--|
| Section I. Interviewer Comments, pg. 1 |
|--|

About the interview:

| | | |
|-----------|--------------------------------|-----------------------------------|
| I1 | Total length of the interview | _____ |
| | | minutes |
| I2 | Number of interview sessions | _____ |
| | | sessions |
| I3 | Privacy during interview | None = 1 Some = 2 A Lot = 3 |
| I4 | Interruptions during interview | None = 1 Some = 2 A Lot = 3 |

About the subject:

| | | |
|------------|--------------------------------|-----------------------------------|
| I5 | Attention to the interview | None = 1 Some = 2 A Lot = 3 |
| I6 | Understanding of questions | None = 1 Some = 2 A Lot = 3 |
| I7 | Ability to use response scales | None = 1 Some = 2 A Lot = 3 |
| I8 | Memory ability | None = 1 Some = 2 A Lot = 3 |
| I9 | Openness and honesty | None = 1 Some = 2 A Lot = 3 |
| I10 | Cooperativeness | None = 1 Some = 2 A Lot = 3 |

I11 Additional interviewer comments:



The Educational Packet Survey was only administered to those in the Intervention Group.

H. Educational Packet Survey

The next questions are about the educational packet you received in the emergency room.

H1 Do you still have the educational packet you received in the emergency room? no=0 yes=1

H2 Did you look over the packet since we last talked? no=0 yes=1➤

How often have you looked at it?

Not at all = 0

Once = 1

Twice = 2

Everyday = 3

*If no to #1, #2 STOP HERE.
Proceed to next section.*

H3 What color is the packet you have?

Fill in answer _____

H4 Have you read the concussion recovery tips list? no=0 yes=1➤

Have you used any?
no=0 yes=1➤

If yes, which ones?

Fill in

Answer _____

H5 What color are the paper handouts in your packet?

Fill in answer _____

H6 Was the packet helpful? no=0 yes=1➤

How helpful was the packet?

Not at all = 0

A little bit = 1

Somewhat = 2

Extremely = 3

H8 Which part of the packet was most helpful?
Fill in answer below

H9 Do you have any ideas for improving the packet?
Fill in answer below

INTERVIEWER: How much of Section H were you able to complete?

All = 1

Some = 2

None = 3

Notes:

One-Week Interview Intervention Group Only

Section A. Short Orientation Memory Concentration Test

Now I'd like to ask some questions that people probably asked you when you were in the hospital. Some of the questions may seem easy and some may seem difficult.

| | | | | |
|---|--|----------------------|----------|--|
| A1 | What year is it now? <i>4 pts. correct answer</i> <i>0 pts incorrect answer</i> | Patient answer | | |
| | | Score | | |
| A2 | What month is it now? <i>3 pts. correct answer</i> <i>0 pts incorrect answer</i> | Patient answer | | |
| | | Score | | |
| A3 | I am going to read a name and address. When I'm done, I'll ask you to repeat the address. | | | |
| | <i>(No score. Scored in question 7.)</i> | | | |
| | Arthur Jones | | | |
| | 42 Market Street | | | |
| | San Francisco | | | |
| <i>Repeat? No=0 Yes=1</i> | | | | |
| Try to remember this. I'll ask you to recall it later. | | | | |
| A4 | (Without looking at a clock) About what time is it? <i>3 pts. if w/in an hour</i> <i>0 pts. if not w/in an hour</i> | Patient answer | | |
| | | Score | | |
| A5 | Count backwards from 20 down to 1. <i>4 pts. if all correct</i> <i>2 pts. if one error</i> <i>0 pts. if 2 or more errors</i> | Patient answer check | 20 19 18 | |
| | | | 17 16 15 | |
| | | | 14 13 12 | |
| | | | 11 10 9 | |
| | | | 8 7 6 5 | |
| | | | 4 3 2 1 | |
| | | Score | | |

| | | | | |
|---|---|----------------------|--|--|
| A6 | Say the months of the year in reverse order starting with December. <i>4 pts. if all correct</i> <i>2 pts. if one error</i> <i>0 pts. if 2 or more errors</i> | Patient answer check | Dec Nov Oct Sept Aug July June May Apr Mar Feb Jan | |
| | | Score | | |
| A7 | Repeat the address given above <i>10 pts. if all correct</i> <i>2 pts. off for each error</i> | Patient answer check | Arthur Jones | |
| | | | 42 Market | |
| | | | San Francisco | |
| | | Score | | |
| Total Score (out of 28): Must score 23 to continue | | | | |

Thank you. Now, I'm going to ask you some questions about yourself and how you've been feeling. The interview is voluntary--you're free to refuse to answer any question or end the interview at any time.

| Demographics: please ask the following questions: | | |
|---|-------------------------------|--------------|
| Demo1 | How old are you? | |
| Demo2 | Sex | Male Female |
| Demo3 | What is your Race/Ethnicity? | |
| Demo4 | Are you currently Married? | no=0 yes=1 ➤ |
| Demo5 | Do you have health insurance? | no=0 yes=1 ➤ |

Section B. Rivermead Post-Concussion Symptoms Questionnaire (RPQ)

After a head injury or accident some people experience symptoms which can cause worry or nuisance. We would like to know if you now suffer from any of the symptoms given below. As many of these symptoms occur normally, we would like you to compare yourself now with before the accident. For each one, please tell me the number closest to your answer.

- 0= Not experienced at all**
- 1= No more of a problem**
- 2= A mild problem**
- 3= A moderate problem**
- 4= A severe problem**

| Compared with before the accident, do you now (i.e., over the last 24 hours) suffer from: | | How much of a problem is _____? |
|---|-----------------------|---------------------------------|
| B1 | Headaches | no=0 yes=1 ➤ |
| | | Not at all = 0 |
| | | No more than before = 1 |
| | | Mild Problem = 2 |
| | | Moderate Problem = 3 |
| | | Severe Problem = 4 |
| B2 | Feelings of Dizziness | no=0 yes=1 ➤ |
| | | Not at all = 0 |
| | | No more than before = 1 |
| | | Mild Problem = 2 |
| | | Moderate Problem = 3 |
| | | Severe Problem = 4 |
| B3 | Nausea or vomiting | no=0 yes=1 ➤ |
| | | Not at all = 0 |
| | | No more than before = 1 |
| | | Mild Problem = 2 |
| | | Moderate Problem = 3 |
| | | Severe Problem = 4 |

| | | | |
|-----------|--|--------------|-------------------------|
| B4 | Sensitivity to noise/easily upset by noise | no=0 yes=1 ➤ | Not at all = 0 |
| | | | No more than before = 1 |
| | | | Mild Problem = 2 |
| | | | Moderate Problem = 3 |
| | | | Severe Problem = 4 |
| B5 | Sleep problems | no=0 yes=1 ➤ | Not at all = 0 |
| | | | No more than before = 1 |
| | | | Mild Problem = 2 |
| | | | Moderate Problem = 3 |
| | | | Severe Problem = 4 |
| B6 | Fatigue/tiring more easily | no=0 yes=1 ➤ | Not at all = 0 |
| | | | No more than before = 1 |
| | | | Mild Problem = 2 |
| | | | Moderate Problem = 3 |
| | | | Severe Problem = 4 |
| B7 | Being irritable/easily angered | no=0 yes=1 ➤ | Not at all = 0 |
| | | | No more than before = 1 |
| | | | Mild Problem = 2 |
| | | | Moderate Problem = 3 |
| | | | Severe Problem = 4 |
| B8 | Feeling depressed or tearful | no=0 yes=1 ➤ | Not at all = 0 |
| | | | No more than before = 1 |
| | | | Mild Problem = 2 |
| | | | Moderate Problem = 3 |
| | | | Severe Problem = 4 |

| | | | |
|------------|--|--------------|-------------------------|
| B9 | Feeling frustrated or impatient | no=0 yes=1 ➤ | Not at all = 0 |
| | | | No more than before = 1 |
| | | | Mild Problem = 2 |
| | | | Moderate Problem = 3 |
| | | | Severe Problem = 4 |
| B10 | Forgetfulness/poor memory | no=0 yes=1 ➤ | Not at all = 0 |
| | | | No more than before = 1 |
| | | | Mild Problem = 2 |
| | | | Moderate Problem = 3 |
| | | | Severe Problem = 4 |
| B11 | Poor concentration | no=0 yes=1 ➤ | Not at all = 0 |
| | | | No more than before = 1 |
| | | | Mild Problem = 2 |
| | | | Moderate Problem = 3 |
| | | | Severe Problem = 4 |
| B12 | Taking longer to think | no=0 yes=1 ➤ | Not at all = 0 |
| | | | No more than before = 1 |
| | | | Mild Problem = 2 |
| | | | Moderate Problem = 3 |
| | | | Severe Problem = 4 |
| B13 | Blurred vision | no=0 yes=1 ➤ | Not at all = 0 |
| | | | No more than before = 1 |
| | | | Mild Problem = 2 |
| | | | Moderate Problem = 3 |
| | | | Severe Problem = 4 |
| B14 | Light Sensitivity/Easily upset by bright light | no=0 yes=1 ➤ | Not at all = 0 |

| | | | |
|------------|--|---|--|
| | | | No more than before = 1 |
| | | | Mild Problem = 2 |
| | | | Moderate Problem = 3 |
| | | | Severe Problem = 4 |
| B15 | Double Vision | no=0 yes=1 ➤ | Not at all = 0 |
| | | | No more than before = 1 |
| | | | Mild Problem = 2 |
| | | | Moderate Problem = 3 |
| | | | Severe Problem = 4 |
| B16 | Restlessness | no=0 yes=1 ➤ | Not at all = 0 |
| | | | No more than before = 1 |
| | | | Mild Problem = 2 |
| | | | Moderate Problem = 3 |
| | | | Severe Problem = 4 |
| B17 | Are you experiencing any other difficulties? | no=0 yes=1 ➤ Fill in _____ _____ _____ | How much of a problem is _____? Not at all = 0 |
| | | | No more than before = 1 |
| | | | Mild Problem = 2 |
| | | | Moderate Problem = 3 |
| | | | Severe Problem = 4 |

| | | | |
|------------|--|----------------------|--|
| B18 | Are you experiencing any other difficulties? | no=0 yes=1 ➤ Fill in | How much of a problem is _____? |
| | | _____ | Not at all = 0 |
| | | _____ | No more than before = 1 |
| | | _____ | Mild Problem = 2 |
| | | _____ | Moderate Problem = 3 |
| | | | Severe Problem = 4 |

INTERVIEWER: How much of Section B were you able to complete?

All = 1
Some = 2
None = 3

Notes:

Section C. Patient Health Questionnaire-4 (PHQ-4)

The next 4 questions are about your mood since your injury. Let me know how you have experienced the following feelings over the last two weeks.

0=Not at all

1=Several Days

2=More than Half the Days

3=Nearly Every Day

| Over the last 2 weeks, have you been bothered by the following problems? | | | How often has _____ bothered you? |
|--|---|--------------|-----------------------------------|
| C1 | Feeling nervous, anxious or on edge | no=0 yes=1 ➤ | Not at all = 0 |
| | | | Several Days = 1 |
| | | | More than half the days = 2 |
| | | | Nearly Every Day = 3 |
| C2 | Not Being able to stop or control worrying | no=0 yes=1 ➤ | Not at all = 0 |
| | | | Several Days = 1 |
| | | | More than half the days = 2 |
| | | | Nearly Every Day = 3 |
| C3 | Feeling down, depressed or hopeless | no=0 yes=1 ➤ | Not at all = 0 |
| | | | Several Days = 1 |
| | | | More than half the days = 2 |
| | | | Nearly Every Day = 3 |
| C4 | Little interest or pleasure in doing things | no=0 yes=1 ➤ | Not at all = 0 |
| | | | Several Days = 1 |
| | | | More than half the days = 2 |
| | | | Nearly Every Day = 3 |

INTERVIEWER: How much of Section C were you able to complete?

All = 1

Some = 2

None = 3

Notes:

D. AUDIT Alcohol Screen

The next few questions are about your alcohol use *before your injury*.
We ask everyone the questions, but they may or may not apply to you.

(don't need to read response options--as before ask questions and follow-up to get answers)

| | | |
|--|--|---|
| D1 | How often do you have a drink containing alcohol? | Never = 0 Monthly or less = 1 2 - 4 times per month = 2 2 - 3 times per week = 3 4 or more times per week = 4 |
| Skip to questions 9, 10 if "Never" | | |
| D2 | How many drinks containing alcohol do you have on a typical day when you are drinking? <u>One drink is:</u> - a 12 oz. can or bottle of beer - a glass of wine - a wine cooler - one cocktail or shot of hard liquor | 1 or 2 drinks = 0 3 or 4 drinks = 1 5 or 6 drinks = 2 7-to-9 drinks = 3 10 or more drinks = 4 |
| D3 | How often do you have 6 or more drinks on one occasion? | Never = 0 Less than monthly = 1 Monthly = 2 Weekly = 3 Daily or almost daily = 4 |
| Skip to questions 9, 10 if both F2 and F3 = "Never" | | |
| D4 | How often during the last year have you found that you were not able to stop drinking once you had started? | Never = 0 Less than monthly = 1 Monthly = 2 Weekly = 3 Daily or almost daily = 4 |

| | | |
|-----------|---|--|
| D5 | How often during the last year have you failed to do what was normally expected from you because of drinking? | Never = 0 Less than monthly = 1 Monthly = 2 Weekly = 3 Daily or almost daily = 4 |
| D6 | How often during the last year have you needed a first drink in the morning to get yourself going after a heavy drinking session? | Never = 0 Less than monthly = 1 Monthly = 2 Weekly = 3 Daily or almost daily = 4 |
| D7 | How often during the last year have you had a feeling of guilt or remorse after drinking? | Never = 0 Less than monthly = 1 Monthly = 2 Weekly = 3 Daily or almost daily = 4 |
| D8 | How often during the last year have you been unable to remember what happened the night before because you had been drinking? | Never = 0 Less than monthly = 1 Monthly = 2 Weekly = 3 Daily or almost daily = 4 |
| D9 | Have you or someone else been injured as a result of your drinking? | No = 0 Yes, but not in the last year = 2 Yes, in the last year = 4 |

| | | |
|------------|---|-----------------------------------|
| D10 | Has a relative or friend or a doctor or another health worker been concerned about your drinking or suggested you cut down? | No = 0 |
| | | Yes, but not in the last year = 2 |
| | | Yes, in the last year = |
| | | 4 |

| | |
|---|----------------------|
| INTERVIEWER: How much of <u>Section D</u> were you able to complete? | All = 1 |
| | Some = 2 |
| | None = 3 |
| Notes: | <input type="text"/> |

Section E. Community Integration Questionnaire (CIQ)

I would like to ask you a few questions about your daily activities. I'm going to first ask you about how things have been going in the last 30 days, and then ask you about how things were going before your injury.

| | In the last month? | Before your injury? (during the typical month...) |
|--|---|---|
| E1 Who usually did the shopping for groceries or other necessities? | Yourself alone = 1 Yourself & someone else = 2 Someone else = 3 Nobody = 4 Not applicable = 5 | Yourself alone = 1 Yourself & someone else = 2 Someone else = 3 Nobody = 4 Not applicable = 5 |
| E2 Who usually prepared meals? | Yourself alone = 1 Yourself & someone else = 2 Someone else = 3 Nobody = 4 Not applicable = 5 | Yourself alone = 1 Yourself & someone else = 2 Someone else = 3 Nobody = 4 Not applicable = 5 |
| E3 Who usually did the everyday chores or housework? | Yourself alone = 1 Yourself & someone else = 2 Someone else = 3 Nobody = 4 Not applicable = 5 | Yourself alone = 1 Yourself & someone else = 2 Someone else = 3 Nobody = 4 Not applicable = 5 |
| E4 Who usually cared for the children? | Yourself alone = 1 Yourself & someone else = 2 Someone else = 3 Nobody = 4 Not applicable = 5 | Yourself alone = 1 Yourself & someone else = 2 Someone else = 3 Nobody = 4 Not applicable = 5 |
| E5 Who usually planned social arrangements such as get-togethers with family and friends? | Yourself alone = 1 Yourself & someone else = 2 Someone else = 3 Nobody = 4 Not applicable = 5 | Yourself alone = 1 Yourself & someone else = 2 Someone else = 3 Nobody = 4 Not applicable = 5 |

| | | | |
|------------|--|--|--|
| E6 | Who usually looked after your personal finances, such as banking and paying bills? | <p>Yourself alone = 1</p> <p>Yourself & someone else = 2</p> <p>Someone else = 3</p> <p>Nobody = 4</p> <p>Not applicable = 5</p> | <p>Yourself alone = 1</p> <p>Yourself & someone else = 2</p> <p>Someone else = 3</p> <p>Nobody = 4</p> <p>Not applicable = 5</p> |
| E7 | Approximately how many times a month do you usually shop outside your home? | <p>Never = 1</p> <p>1 - 4 times = 2</p> <p>5 or more times = 3</p> | <p>Never = 1</p> <p>1 - 4 times = 2</p> <p>5 or more times = 3</p> |
| E8 | Approximately how many times did you participate in leisure activities, such as movies, sports, eating out, etc. | <p>Never = 1</p> <p>1 - 4 times = 2</p> <p>5 or more times = 3</p> | <p>Never = 1</p> <p>1 - 4 times = 2</p> <p>5 or more times = 3</p> |
| E9 | Approximately how many times did you visit with friends or relatives? | <p>Never = 1</p> <p>1 - 4 times = 2</p> <p>5 or more times = 3</p> | <p>Never = 1</p> <p>1 - 4 times = 2</p> <p>5 or more times = 3</p> |
| E10 | When you participated in leisure activities did you usually do that alone or with others? | <p>Mostly alone = 1</p> <p>Mostly with family members = 2</p> <p>Mostly with friends = 3</p> <p>With a combination of friends and family = 4</p> <p>Not applicable = 5</p> | <p>Mostly alone = 1</p> <p>Mostly with family members = 2</p> <p>Mostly with friends = 3</p> <p>With a combination of friends and family = 4</p> <p>Not applicable = 5</p> |
| E11 | Did you have a best friend with whom you confide? | <p>Yes = 1</p> <p>No = 2</p> | <p>Yes = 1</p> <p>No = 2</p> |
| E12 | How often did you go places away from home? | <p>Almost every day = 1</p> <p>Almost every week = 2</p> <p>Seldom/never (<1x/wk) = 3</p> | <p>Almost every day = 1</p> <p>Almost every week = 2</p> <p>Seldom/never (<1x/wk) = 3</p> |

| | | Since your injury? | Before your injury? (during the typical month...) |
|-----|---|--|--|
| E13 | What was your work situation? <i>(do not read response choices; ask questions and discuss to arrive at answer)</i> | Competitive work = 1 Job: _____ | Competitive work = 1 Job: _____ |
| | | Non-market work = 2 (volunteer, recycle, panhandling) | Non-market work = 2 (volunteer, recycling, panhandling) |
| | | Not working = 3 | Not working = 3 |
| | | Why not: _____ | Why not: _____ |
| | | Retired = 4 | Retired = 4 |
| | | Student = 5 | Student = 5 |
| | | Homemaker = 6 | Homemaker = 6 |
| E14 | How would you best describe your current work or school situation? | Full time = 1 | Full time = 1 |
| | | Part time = 2 | Part time = 2 |
| | | Not attending = 3 | Not attending = 3 |
| | | Not applicable = 4 | Not applicable = 4 |
| E15 | How often did you engage in volunteer activities? | Never = 1 | Never = 1 |
| | | 1-4 times = 2 | 1-4 times = 2 |
| | | 5 or more = 3 | 5 or more = 3 |

INTERVIEWER: How much of Section E were you able to complete?

All = 1
Some = 2
None = 3

Notes:

F. Patient Experience Survey

The last questions are about the educational packet you received in the emergency department the day you were injured.

The next questions are about the educational packet you received in the emergency room.

| | | | |
|-----------|---|----------------|---|
| F1 | Do you remember receiving the educational packet in the emergency room? | no=0 yes=1 | |
| F2 | Do you still have the packet? | no=0 yes=1 | |
| F3 | Did you look over the packet after you left the emergency room? | no=0 yes=1➤ | How often have you looked at it? |
| | | | Not at all = 0 |
| | | | Once = 1 |
| | | | Twice = 2 |
| | | | Everyday = 3 |

If no to #1, #2, and #3 STOP HERE.

If they do not have packet, Ask if they would like one mailed to them.

no=0 yes=1➤ Address:

| | | | | |
|-----------|---|---------|------------------------------------|------------------|
| F4 | What color is the packet you received? | | <i>Fill in</i> | |
| | <i>answer</i> _____ | | | |
| | correct | no=0 | yes=1 | |
| F5 | Have you read the concussion recovery tips list? | no=0 | Have you used any? no=0 yes=1 ➤ | |
| | | yes=1 ➤ | | |
| | | | If yes, which ones? | |
| | | | <i>Fill in</i> | |
| | | | <i>Answer</i> _____ | |
| | | | _____ | |
| F6 | What color are the paper handouts in your packet? | | <i>Fill in answer</i> _____ | |
| F7 | Was the packet helpful? | no=0 | How helpful was the packet? | |
| | | yes=1 ➤ | | |
| | | | | Not at all = 0 |
| | | | | A little bit = 1 |
| | | | | Somewhat = 2 |
| | | | Extremely = 3 | |

| | |
|-----------|--|
| F8 | Which part of the packet was most helpful? <i>Fill in answer below</i> |
| F9 | Do you have any ideas for improving the packet? <i>Fill in answer below</i> |

INTERVIEWER: How much of Section F were you able to complete?

All = 1

Some = 2

None = 3

Notes:

G. Service Use

The last questions are about services you used before your injury and since your injury.

| | | Since your injury? | Before your injury? (during the typical month...) |
|-----------|--|-------------------------|--|
| G1 | How many times have you seen a medical doctor? | None = 0 | None = 0 |
| | | Once = 1 | Once = 1 |
| | | Twice = 2 | Twice = 2 |
| | | More than two times = 3 | More than two times = 3 |
| G2 | How many times have you seen a medical doctor for a head injury? | None = 0 | None = 0 |
| | | Once = 1 | Once = 1 |
| | | Twice = 2 | Twice = 2 |
| | | More than two times = 3 | More than two times = 3 |
| G3 | How many times have you seen a psychiatrist? | None = 0 | None = 0 |
| | | Once = 1 | Once = 1 |
| | | Twice = 2 | Twice = 2 |
| | | More than two times = 3 | More than two times = 3 |
| G4 | How many times have you seen a counselor or therapist? | None = 0 | None = 0 |
| | | Once = 1 | Once = 1 |
| | | Twice = 2 | Twice = 2 |
| | | More than two times = 3 | More than two times = 3 |
| G5 | How many times have you called the Neurosurgery patient line, social work line or other medical advice line? | None = 0 | None = 0 |
| | | Once = 1 | Once = 1 |
| | | Twice = 2 | Twice = 2 |
| | | More than two times = 3 | More than two times = 3 |

| | | | |
|-----------|--|-------------------------|--|
| | | times = 3 | times = 3 |
| G6 | How many times have you attended a support group? | None = 0 | None = 0 |
| | | Once = 1 | Once = 1 |
| | | Twice = 2 | Twice = 2 |
| | | More than two times = 3 | More than two times = 3 |
| G7 | Are you involved in any lawsuits related to your injury? | no=0 yes=1 | If yes, tell me about it. |
| G8 | Did you see the flyer for the TBI support group in the packet? | no=0 yes=1 | |
| G9 | Did you know there is a concussion clinic at SFGH? | no=0 yes=1 | Call us at this number if you would like to schedule an appointment. 415-206-4093 |

That is the end of the interview. Thank you for your time. Your participation will help us improve our services to our patients. Can we call you in a couple months to check in again?

 **End interview.**

| |
|--|
| Section H. Interviewer Comments, pg. 1 |
|--|

About the interview:

| | | |
|-----------|--------------------------------|-----------------------------------|
| H1 | Total length of the interview | _____ |
| | | minutes |
| H2 | Number of interview sessions | _____ |
| | | sessions |
| H3 | Privacy during interview | None = 1 Some = 2 A Lot = 3 |
| H4 | Interruptions during interview | None = 1 Some = 2 A Lot = 3 |

About the subject:

| | | |
|------------|--------------------------------|-----------------------------------|
| H5 | Attention to the interview | None = 1 Some = 2 A Lot = 3 |
| H6 | Understanding of questions | None = 1 Some = 2 A Lot = 3 |
| H7 | Ability to use response scales | None = 1 Some = 2 A Lot = 3 |
| H8 | Memory ability | None = 1 Some = 2 A Lot = 3 |
| H9 | Openness and honesty | None = 1 Some = 2 A Lot = 3 |
| H10 | Cooperativeness | None = 1 Some = 2 A Lot = 3 |

H12 Additional interviewer comments:



| | | | |
|---|---|----------------------|--|
| A6 | Say the months of the year in reverse order starting with December. | Patient answer check | Dec Nov Oct Sept Aug July June May Apr Mar Feb Jan |
| | <i>4 pts. if all correct 2 pts. if one error 0 pts. if 2 or more errors</i> | | Score |
| A7 | Repeat the address given above | Patient answer check | Arthur Jones 42 Market San Francisco |
| | <i>10 pts. if all correct 2 pts. off for each error</i> | | Score |
| Total Score (out of 28): Must score 23 to continue | | | |

Thank you. Now, I'm going to ask you some questions about yourself and how you've been feeling. The interview is voluntary--you're free to refuse to answer any question or end the interview at any time.

| | | | |
|-----------|--|-------------|--|
| B1 | Since we last spoke, have you had any other visits to the Emergency Department? | no=0 yes=1➤ | Why did you visit the Emergency Department? |
| B2 | Since we last spoke have you had another concussion? | no=0 yes=1➤ | What happened? |

Section C. Rivermead Post-Concussion Symptoms Questionnaire (RPQ)

After a head injury or accident some people experience symptoms which can cause worry or nuisance. We would like to know if you now suffer from any of the symptoms given below. As many of these symptoms occur normally, we would like you to compare yourself now with before the accident. For each one, please tell me the number closest to your answer.

- 0= Not experienced at all**
- 1= No more of a problem**
- 2= A mild problem**
- 3= A moderate problem**
- 4= A severe problem**

Compared with before the accident, do you now (over the last 24 hours) suffer from:

| Compared with before the accident, do you now (i.e., over the last 24 hours) suffer from: | | How much of a problem is _____? |
|--|--|---|
| C1 | Headaches no=0 yes=1➤ | Not at all = 0 No more than before = 1 Mild Problem = 2 Moderate Problem = 3 Severe Problem = 4 |
| C2 | Feelings of Dizziness no=0 yes=1➤ | Not at all = 0 No more than before = 1 Mild Problem = 2 Moderate Problem = 3 Severe Problem = 4 |

| | | | |
|-----------|--|-------------|---|
| C3 | Nausea or vomiting | no=0 yes=1➤ | Not at all = 0 No more than before = 1 Mild Problem = 2 Moderate Problem = 3 Severe Problem = 4 |
| C4 | Sensitivity to noise/easily upset by noise | no=0 yes=1➤ | Not at all = 0 No more than before = 1 Mild Problem = 2 Moderate Problem = 3 Severe Problem = 4 |
| C5 | Sleep problems | no=0 yes=1➤ | Not at all = 0 No more than before = 1 Mild Problem = 2 Moderate Problem = 3 Severe Problem = 4 |
| C6 | Fatigue/tiring more easily | no=0 yes=1➤ | Not at all = 0 No more than before = 1 Mild Problem = 2 Moderate Problem = 3 Severe Problem = 4 |
| C7 | Being irritable/easily angered | no=0 yes=1➤ | Not at all = 0 No more than before = 1 Mild Problem = 2 |

| | | | |
|------------|---------------------------------|-------------|---|
| | | | Moderate Problem = 3 Severe Problem = 4 |
| C8 | Feeling depressed or tearful | no=0 yes=1➤ | Not at all = 0 No more than before = 1 Mild Problem = 2 Moderate Problem = 3 Severe Problem = 4 |
| C9 | Feeling frustrated or impatient | no=0 yes=1➤ | Not at all = 0 No more than before = 1 Mild Problem = 2 Moderate Problem = 3 Severe Problem = 4 |
| C10 | Forgetfulness/poor memory | no=0 yes=1➤ | Not at all = 0 No more than before = 1 Mild Problem = 2 Moderate Problem = 3 Severe Problem = 4 |
| C11 | Poor concentration | no=0 yes=1➤ | Not at all = 0 No more than before = 1 Mild Problem = 2 Moderate Problem = 3 Severe Problem = 4 |
| C12 | Taking longer to think | no=0 yes=1➤ | Not at all = 0 No more than before = 1 Mild Problem = 2 |

| | | | |
|------------|--|-------------|---|
| | | | Moderate Problem = 3 Severe Problem = 4 |
| C13 | Blurred vision | no=0 yes=1➤ | Not at all = 0 No more than before = 1 Mild Problem = 2 Moderate Problem = 3 Severe Problem = 4 |
| C14 | Light Sensitivity/Easily upset by bright light | no=0 yes=1➤ | Not at all = 0 No more than before = 1 Mild Problem = 2 Moderate Problem = 3 Severe Problem = 4 |
| C15 | Double Vision | no=0 yes=1➤ | Not at all = 0 No more than before = 1 Mild Problem = 2 Moderate Problem = 3 Severe Problem = 4 |
| C16 | Restlessness | no=0 yes=1➤ | Not at all = 0 No more than before = 1 Mild Problem = 2 Moderate Problem = 3 Severe Problem = 4 |

| | | | |
|------------|--|--|---|
| C17 | Are you experiencing any other difficulties? | no=0 yes=1 ➤ Fill in _____ _____ _____ _____ | How much of a problem is _____? Not at all = 0 No more than before = 1 Mild Problem = 2 Moderate Problem = 3 Severe Problem = 4 |
| C18 | Are you experiencing any other difficulties? | no=0 yes=1 ➤ Fill in _____ _____ _____ _____ | How much of a problem is _____? Not at all = 0 No more than before = 1 Mild Problem = 2 Moderate Problem = 3 Severe Problem = 4 |

| | |
|--|--|
| <p>INTERVIEWER: How much of <u>Section C</u> were you able to complete?</p> | <p>All = 1 Some = 2 None = 3</p> |
| <p>Notes:</p> <div data-bbox="386 1409 1318 1570" style="border: 1px solid black; height: 77px; width: 574px;"></div> | |

Section D. Patient Health Questionnaire-4 (PHQ-4)

The next 4 questions are about your mood over the last 2 weeks. Let me know how you have experienced the following feelings over the last two weeks.

0=Not at all

1=Several Days

2=More than Half the Days

3=Nearly Every Day

| Over the last 2 weeks, have you been bothered by the following problems? | How often has ____ bothered you? |
|---|---|
| D1 Feeling nervous, anxious or on edge no=0 yes=1➤ | Not at all = 0 Several Days = 1 More than half the days = 2 Nearly Every Day = 3 |
| D2 Not Being able to stop or control worrying no=0 yes=1➤ | Not at all = 0 Several Days = 1 More than half the days = 2 Nearly Every Day = 3 |
| D3 Feeling down, depressed or hopeless no=0 yes=1➤ | Not at all = 0 Several Days = 1 More than half the days = 2 Nearly Every Day = 3 |
| D4 Little interest or pleasure in doing things no=0 yes=1➤ | Not at all = 0 Several Days = 1 More than half the days = 2 Nearly Every Day = 3 |

| | |
|---|--|
| INTERVIEWER: How much of <u>Section D</u> were you able to complete? | <i>All = 1</i> <i>Some = 2</i> <i>None = 3</i> |
| Notes: | <div style="border: 1px solid black; height: 76px;"></div> |

Section E. PCLC-PTSD Measure

The next questions are about some other symptoms that people may have after an injury or other traumatic event. Again, I'll read a list of symptoms, ask if you have had them in the last 30 days, and if so, how much they bothered you.

| In the last 30 days, have you _____ ? | How much has that bothered you? |
|--|--|
| E1 Had repeated disturbing memories, thoughts, or images of your injury? no=0 yes=1➤ | Not at all = 1 A little bit = 2 Somewhat = 3 A lot = 4 Extremely = 5 |
| E2 Had repeated disturbing dreams related to your injury ? no=0 yes=1➤ | Not at all = 1 A little bit = 2 Somewhat = 3 A lot = 4 Extremely = 5 |
| E3 Suddenly acted or felt as if your injury were happening again? (as if you were reliving it) no=0 yes=1➤ | Not at all = 1 A little bit = 2 Somewhat = 3 A lot = 4 Extremely = 5 |
| E4 Felt very upset when something reminded you of your injury? no=0 yes=1➤ | Not at all = 1 A little bit = 2 Somewhat = 3 A lot = 4 Extremely = 5 |
| E5 Had physical reactions (like your heart pounding, having trouble breathing or sweating) when something reminded you of your injury? no=0 yes=1➤ | Not at all = 1 A little bit = 2 Somewhat = 3 A lot = 4 Extremely = 5 |
| E6 Avoided thinking about or talking about your injury or avoiding having feelings related to it? no=0 yes=1➤ | Not at all = 1 A little bit = 2 Somewhat = 3 A lot = 4 Extremely = 5 |

| In the last 30 days, have you _____ ? | How much has that bothered you? |
|--|---|
| E7 Avoided activities or situations because they reminded you of your injury? | no=0 yes=1➤ Not at all = 1 A little bit = 2 Somewhat = 3 A lot = 4 Extremely = 5 |
| E8 Had trouble remembering important parts of the events surrounding your injury? | no=0 yes=1➤ Not at all = 1 A little bit = 2 Somewhat = 3 A lot = 4 Extremely = 5 |
| E9 Lost interest in activities that you used to enjoy? | no=0 yes=1➤ Not at all = 1 A little bit = 2 Somewhat = 3 A lot = 4 Extremely = 5 |
| E10 Felt distant or cut off from other people? | no=0 yes=1➤ Not at all = 1 A little bit = 2 Somewhat = 3 A lot = 4 Extremely = 5 |
| E11 Felt emotionally numb or unable to have loving feelings for those close to you? | no=0 yes=1➤ Not at all = 1 A little bit = 2 Somewhat = 3 A lot = 4 Extremely = 5 |
| E12 Felt as if your future will somehow be cut short ? | no=0 yes=1➤ Not at all = 1 A little bit = 2 Somewhat = 3 A lot = 4 Extremely = 5 |
| E13 Had trouble falling or staying asleep? | no=0 yes=1➤ Not at all = 1 A little bit = 2 Somewhat = 3 A lot = 4 Extremely = 5 |
| E14 Felt irritable or had angry outbursts ? | no=0 yes=1➤ Not at all = 1 A little bit = 2 |

| | | | |
|------------|---------------------------------------|-------------|--|
| | | | Somewhat = 3 A lot = 4 Extremely = 5 |
| E15 | Had difficulty concentrating ? | no=0 yes=1▶ | Not at all = 1 A little bit = 2 Somewhat = 3 A lot = 4 Extremely = 5 |

| | | | |
|------------|---|-------------|--|
| E16 | Been super alert, watchful or on guard ? | no=0 yes=1▶ | Not at all = 1 A little bit = 2 Somewhat = 3 A lot = 4 Extremely = 5 |
| E17 | Felt jumpy or easily startled ? | no=0 yes=1▶ | Not at all = 1 A little bit = 2 Somewhat = 3 A lot = 4 Extremely = 5 |

| | |
|---|---|
| INTERVIEWER: How much of <u>Section E</u> were you able to complete? | All = 1 Some = 2 None = 3 |
| Notes: | <div style="border: 1px solid black; height: 60px; width: 100%;"></div> |

Section F. AUDIT Alcohol Screen

The next few questions are about your alcohol use *since your injury*. We ask everyone the questions, but they may or may not apply to you.

(don't need to read response options--as before ask questions and follow-up to get answers)

F1 How often do you have a drink containing alcohol? Never = 0
Skip to questions 9, 10
Monthly or less = 1
2 - 4 times per month = 2
2 - 3 times per week = 3
4 or more times per week = 4

Skip to questions 9, 10 if "Never"

F2 How many drinks containing alcohol do you have on a typical day when you are drinking? 1 or 2 drinks = 0
3 or 4 drinks = 1
One drink is: - a 12 oz. can or bottle of beer 5 or 6 drinks = 2
- a glass of wine 7-to-9 drinks = 3
- a wine cooler 10 or more drinks = 4
- one cocktail or shot of hard liquor

F3 How often do you have 6 or more drinks on one occasion? Never = 0
Less than monthly = 1
Monthly = 2
Weekly = 3
Daily or almost daily = 4

Skip to questions 9, 10 if both F2 and F3 = "Never"

F4 How often since your injury have you found that you were not able to stop drinking once you had started? Never = 0
Less than monthly = 1
Monthly = 2
Weekly = 3
Daily or almost daily = 4

| | | |
|------------|--|--|
| F5 | How often since your injury have you failed to do what was normally expected from you because of drinking? | Never = 0 Less than monthly = 1 Monthly = 2 Weekly = 3 Daily or almost daily = 4 |
| F6 | How often since your injury have you needed a first drink in the morning to get yourself going after a heavy drinking session? | Never = 0 Less than monthly = 1 Monthly = 2 Weekly = 3 Daily or almost daily = 4 |
| F7 | How often since your injury have you had a feeling of guilt or remorse after drinking? | Never = 0 Less than monthly = 1 Monthly = 2 Weekly = 3 Daily or almost daily = 4 |
| F8 | How often since your injury have you been unable to remember what happened the night before because you had been drinking? | Never = 0 Less than monthly = 1 Monthly = 2 Weekly = 3 Daily or almost daily = 4 |
| F9 | Have you or someone else been injured as a result of your drinking? | No = 0 Yes, but not since my injury = 2 Yes, since my injury = 4 |
| F10 | Has a relative or friend or a doctor or another health worker been concerned about your drinking or suggested you cut down? | No = 0 Yes, but not since my injury = 2 Yes, since my injury = 4 |

INTERVIEWER: How much of Section F were you able to complete?

All = 1

Some = 2

None = 3

Notes:

Section G. Community Integration Questionnaire (CIQ)

I would like to ask you a few questions about your daily activities. I'm going to first ask you about how things have been going in the last 30 days, and then ask you about how things were going before your injury.

| | In the last month? | Before your injury? (during the typical month...) |
|--|---|---|
| G1 Who usually did the shopping for groceries or other necessities? | Yourself alone = 1 Yourself & someone else = 2 Someone else = 3 Nobody = 4 Not applicable = 5 | Yourself alone = 1 Yourself & someone else = 2 Someone else = 3 Nobody = 4 Not applicable = 5 |
| G2 Who usually prepared meals? | Yourself alone = 1 Yourself & someone else = 2 Someone else = 3 Nobody = 4 Not applicable = 5 | Yourself alone = 1 Yourself & someone else = 2 Someone else = 3 Nobody = 4 Not applicable = 5 |
| G3 Who usually did the everyday chores or housework? | Yourself alone = 1 Yourself & someone else = 2 Someone else = 3 Nobody = 4 Not applicable = 5 | Yourself alone = 1 Yourself & someone else = 2 Someone else = 3 Nobody = 4 Not applicable = 5 |
| G4 Who usually cared for the children? | Yourself alone = 1 Yourself & someone else = 2 Someone else = 3 Nobody = 4 Not applicable = 5 | Yourself alone = 1 Yourself & someone else = 2 Someone else = 3 Nobody = 4 Not applicable = 5 |
| G5 Who usually planned social arrangements such as get-togethers with family and friends? | Yourself alone = 1 Yourself & someone else = 2 Someone else = 3 Nobody = 4 | Yourself alone = 1 Yourself & someone else = 2 Someone else = 3 Nobody = 4 |

| | Not applicable = 5 | Not applicable = 5 |
|--|---|---|
| G6 Who usually looked after your personal finances, such as banking and paying bills? | Yourself alone = 1 Yourself & someone else = 2 Someone else = 3 Nobody = 4 Not applicable = 5 | Yourself alone = 1 Yourself & someone else = 2 Someone else = 3 Nobody = 4 Not applicable = 5 |
| G7 Approximately how many times a month do you usually shop outside your home? | Never = 1 1 - 4 times = 2 5 or more times = 3 | Never = 1 1 - 4 times = 2 5 or more times = 3 |
| G8 Approximately how many times did you participate in leisure activities, such as movies, sports, eating out, etc. | Never = 1 1 - 4 times = 2 5 or more times = 3 | Never = 1 1 - 4 times = 2 5 or more times = 3 |
| G9 Approximately how many times did you visit with friends or relatives? | Never = 1 1 - 4 times = 2 5 or more times = 3 | Never = 1 1 - 4 times = 2 5 or more times = 3 |
| G10 When you participated in leisure activities did you usually do that alone or with others? | Mostly alone = 1 Mostly with family members = 2 Mostly with friends = 3 With a combination of friends and family = 4 Not applicable = 5 | Mostly alone = 1 Mostly with family members = 2 Mostly with friends = 3 With a combination of friends and family = 4 Not applicable = 5 |
| G11 Did you have a best friend with whom you confide? | Yes = 1 No = 2 | Yes = 1 No = 2 |
| G12 How often did you go places away from home? | Almost every day = 1 Almost every week = 2 Seldom/never (<1x/wk) = 3 | Almost every day = 1 Almost every week = 2 Seldom/never (<1x/wk) = 3 |

| | | Since your injury? | Before your injury? (during the typical month...) |
|-----|--|--|--|
| G13 | What was your work situation? <i>(do not read response choices; ask question and discuss to arrive at answer)</i> | Competitive work = 1 Job: _____ | Competitive work = 1 Job: _____ |
| | | Non-market work = 2 (volunteer, recycling, panhandling) | Non-market work = 2 (volunteer, recycling, panhandling) |
| | | Not working = 3 | Not working = 3 |
| | | Why not: _____ | Why not: _____ |
| | | Retired = 4 | Retired = 4 |
| | | Student = 5 | Student = 5 |
| | | Homemaker = 6 | Homemaker = 6 |
| G14 | How would you best describe your current work or school situation? | Full time = 1 | Full time = 1 |
| | | Part time = 2 | Part time = 2 |
| | | Not attending = 3 | Not attending = 3 |
| | | Not applicable = 4 | Not applicable = 4 |
| G15 | How often did you engage in volunteer activities? | Never = 1 | Never = 1 |
| | | 1-4 times = 2 | 1-4 times = 2 |
| | | 5 or more = 3 | 5 or more = 3 |

INTERVIEWER: How much of Section G were you able to complete?

All = 1

Some = 2

None = 3

Notes:

H. Patient Experience Survey

The next questions are about the educational packet you received in the emergency room.

| | | | |
|---|--|----------------|--|
| H1 | Do you still have the educational packet you received in the emergency room? | no=0 yes=1 | |
| H2 | Did you look over the packet since we last talked? | no=0 yes=1➤ | How often have you looked at it? Not at all = 0 Once = 1 Twice = 2 Everyday = 3 |
| <p><i>If no to #1, #2 STOP HERE. Proceed to next section.</i></p> | | | |
| H3 | What color is the packet you have? | | Fill in answer _____ |
| H4 | Have you read the concussion recovery tips list? | no=0 yes=1➤ | Have you used any? no=0 yes=1➤ If yes, which ones? Fill in Answer _____ _____ _____ |
| H5 | What color are the paper handouts in your packet? | | Fill in answer _____ |
| H6 | Was the packet helpful? | no=0 yes=1➤ | How helpful was the packet? Not at all = 0 A little bit = 1 |

Somewhat = 2
Extremely = 3

H7 Did the last phone call remind you to look at the packet? no=0 yes=1

H8 Which part of the packet was most helpful?
Fill in answer below

H9 Do you have any ideas for improving the packet?
Fill in answer below

INTERVIEWER: How much of Section H were you able to complete?

All = 1

Some = 2

None = 3

Notes:

I. Service Use

The last questions are about services you used before your injury and since your injury.

| | | Since your injury? | Before your injury? (during the typical month...) |
|-----------|--|----------------------------|--|
| I1 | How many times have you seen a medical doctor? | None = 0 | None = 0 |
| | | Once = 1 | Once = 1 |
| | | Twice = 2 | Twice = 2 |
| | | More than two times = 3 | More than two times = 3 |
| | | | |
| I2 | How many times have you seen a psychiatrist? | None = 0 | None = 0 |
| | | Once = 1 | Once = 1 |
| | | Twice = 2 | Twice = 2 |
| | | More than two times = 3 | More than two times = 3 |
| | | | |
| I3 | How many times have you seen a counselor or therapist? | None = 0 | None = 0 |
| | | Once = 1 | Once = 1 |
| | | Twice = 2 | Twice = 2 |
| | | More than two times = 3 | More than two times = 3 |
| | | | |
| I4 | How many times have you called the Neurosurgery patient line or other medical advice line? | None = 0 | None = 0 |
| | | Once = 1 | Once = 1 |
| | | Twice = 2 | Twice = 2 |
| | | More than two times = 3 | More than two times = 3 |
| | | | |
| I5 | How many times have you attended a support group? | None = 0 | None = 0 |
| | | Once = 1 | Once = 1 |
| | | Twice = 2 | Twice = 2 |
| | | More than two times = 3 | More than two times = 3 |
| | | | |

| | | | |
|-----------|--|-------------|-----------------------------------|
| I6 | Have you attended the TBI support group? | no=0 yes=1➤ | How helpful was the group? |
| | | | Not at all = 0 |
| | | | A little bit = 1 |
| | | | Somewhat = 2 |
| | | | Extremely = 3 |
| | | | Extremely = 3 |

| | | | |
|-----------|---|-----------------------------|---|
| I7 | Have you attended the concussion clinic? | no=0 (skip to I8) yes=1➤ | How helpful was the clinic? |
| | | | Not at all = 0 |
| | | | A little bit = 1 |
| | | | Somewhat = 2 |
| | | | Extremely = 3 |
| | | | Extremely = 3 |
| I8 | If no to I7, Are you interested in attending the clinic? | no=0 yes=1➤ | Call us at this number to schedule an appointment. 415-206-4093 |
| I9 | Are you involved in any lawsuits related to your injury? | no=0 yes=1 | If yes, tell me about it. |

That is the end of the interview. Thank you for your time. Your participation will help us improve our services to our patients.



End interview.

| |
|--|
| Section J. Interviewer Comments, pg. 1 |
|--|

About the interview:

| | | |
|-----------|--------------------------------|-----------------------------------|
| J1 | Total length of the interview | _____ |
| | | minutes |
| J2 | Number of interview sessions | _____ |
| | | sessions |
| J3 | Privacy during interview | None = 1 Some = 2 A Lot = 3 |
| J4 | Interruptions during interview | None = 1 Some = 2 A Lot = 3 |

About the subject:

| | | |
|------------|--------------------------------|-----------------------------------|
| J5 | Attention to the interview | None = 1 Some = 2 A Lot = 3 |
| J6 | Understanding of questions | None = 1 Some = 2 A Lot = 3 |
| J7 | Ability to use response scales | None = 1 Some = 2 A Lot = 3 |
| J8 | Memory ability | None = 1 Some = 2 A Lot = 3 |
| J9 | Openness and honesty | None = 1 Some = 2 A Lot = 3 |
| J10 | Cooperativeness | None = 1 Some = 2 A Lot = 3 |

J11 Additional interviewer comments:

