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COPING RESOURCES AND THE DEVELOPMENT OF PERSISTENT
POSTCONCUSSIONAL SYNDROME AFTER A MILD TRAUMATIC BRAIN
INJURY

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Dedication

This dissertation is dedicated to my family. Without their support and love, I would not be where I am and the person I am today. I can never repay my mom for her unwavering belief that I can do whatever I set my mind to, even when I don't think I can. It doesn't even bother me too much to let her know that she "told me so." Both of my parents have always encouraged me to figure out what I want out of life and to go get it.

Thank you to my friends who put up with my frequent freak-outs during the anthrax ordeal (which pretty much put me into a holding pattern for two months while all of America threw out mail – including dissertation study packets – from people they didn't know.) Thanks to my internship supervisors – Dr. Parks, Dr. Boldt, and Dr. Allen – for their understanding and for allowing me to spend spare time working on this dissertation!

Finally, this is dedicated to James. How did I luck out and marry the only person I know who would go to the post office to get stamps on an almost weekly basis or run to campus (without complaining!) for a year? In the midst of all my anxiety and self-doubt, I could always rest assured that you would be there for me whether I needed more envelopes from the store, help adding up columns of data, or reassurance that this too would pass. Your reservoir of patience with me and your sense of humor never fail to amaze me. Thank you for... everything.

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COPING RESOURCES AND THE DEVELOPMENT OF PERSISTENT
POSTCONCUSSIONAL SYNDROME AFTER A MILD TRAUMATIC BRAIN
INJURY

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This prospective study was designed to examine the effect of total coping resources, as measured by the Coping Resources Inventory, on the development of persistent postconcussional syndrome. Other variables – loss of consciousness, subjective life stress, litigation after the injury, prior head injury, and the receipt of information about what post-injury symptoms are common – were examined as well. Thirty-eight participants, ranging in age from 18 to 55, completed the Postconcussion Syndrome Checklist and the Coping Resources Inventory (for pre-trauma coping) within three weeks of being diagnosed with a concussion. They were contacted for a follow-up three months post-trauma and completed the Postconcussion Syndrome

Checklist again along with a questionnaire listing the other study variables. It was expected that participants with more total coping resources would report fewer symptoms at the follow-up than those with fewer coping resources. No relationship was found between the total Coping Resources Inventory score and symptoms reported three months post-trauma. The other variables were examined, using multiple regression, to determine their significance as predictors for the amount of symptoms reported at follow-up. The only variable that was a significant predictor for symptoms at follow-up was the participant's rating of subjective life stress. Limitations of the study are discussed and future areas of research are outlined.

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CHAPTER ONE

Introduction

Although a review of the literature reveals disparate estimates of the incidence of brain injury, Bennett and Raymond (1997) speculate that 7 million brain injuries (mild, moderate, and severe) occur every year in the United States. The majority of these injuries result from motor vehicle accidents and sports injuries, although some are due to physical altercations and accidents in the workplace. Bennett and Raymond (1997) and Harrison (1997) estimate that around eighty-five percent of all brain injuries can be classified as mild. These mild traumatic brain injuries are not the same as innocuous bumps on the head everyone experiences in life, they cannot be explained away as malingering or due to litigation, and they should not be considered trivial (Cullum & Thompson, 1997; Kibby & Long, 1997; Lezak, 1995). A mild traumatic brain injury can be characterized by one or more of the following: any period of loss of consciousness (less than 30 minutes), any loss of memory for events immediately before or after the accident (no longer than 24 hours), and any alteration in mental state at the time of the accident such as feeling dazed, disoriented, or confused (Reitan and Wolfson, 1997).

After sustaining a mild traumatic brain injury, victims often report vague symptoms such as headache, fatigue, irritability, insomnia, anxiety, dizziness, depression, confusion, forgetfulness, inability to concentrate, and more (Auerbach, Levin, & Miner, 1990; Bennett & Raymond, 1997; Lezak, 1995; McSherry, 1989). These common post-injury symptoms are often called postconcussional syndrome, and they usually subside in the weeks after the injury. However, a significant number of patients take longer than three months to recover. Postconcussional syndrome is a controversial diagnosis when it lasts more than three months or when the onset of the symptoms takes place in the days and weeks after the injury (Auerbach, Levin, & Miner, 1990; Binder, 1986; Cicerone & Kalmar, 1995; Lezak, 1995), as it is often viewed as a product of malingering, disability claims and litigation, and accident neurosis. Researchers in the area of mild traumatic brain injury have found little evidence that postconcussional syndrome is due to secondary gain issues such as lawsuits, however (Auerbach, Levin, & Miner, 1990; Binder, 1986; Cicerone & Kalmar, 1995; Lezak, 1995).

It has been suggested throughout the literature that persistent postconcussional symptoms have to do with stress, especially stress management and situational stress, rather than malingering and secondary gain. In particular, postconcussional syndrome seems to reflect the victim's subjective stress level after the injury compounded by cognitive weaknesses rather than neurological damage alone (Kibby and Long, 1997; Lezak, 1995). The literature also notes that postconcussional syndrome often occurs at the period in recovery when the patient is attempting to

resume social, work, or academic duties or any combination of these (Kibby & Long, 1997; Lezak, 1995). To summarize, the theorized progression of postconcussional syndrome begins when mild traumatically brain injured people return to stressful situations (such as work or school) while they are still in the acute phase of recovery. In these situations, cognitive and memory weaknesses become apparent to the victims. The individuals then feel even more stress as they are not able to meet expectations they met easily in the past, and, if coping resources are not adequate to deal with all of this stress, postconcussional symptoms are hypothesized to develop, linger, and even can become stronger (Binder, 1986; Haglin, 1996; Kay, n.d.; Kibby & Long, 1997; Lezak, 1995).

Along the same line is Kay's (n.d.) attribution of persisting postconcussional syndrome to "psychological overlay", a term he uses to refer to the secondary psychological reactions to primary neurological deficits. In other words, people notice unexpected problems in their everyday lives (such as memory problems, confusion, and decreased cognitive ability) which they have never been a part of their lives before. Injured people begin to doubt themselves, second-guess their every move, and lose confidence in themselves as it becomes necessary for them to think before doing many of the things that came naturally prior to the injury. This loss of self-esteem, in Kay's (n.d.) estimation, far outlasts any symptoms due to neurological damage.

This dissertation is a prospective examination of pre-morbid coping skills of participants who recently have suffered a mild traumatic brain injury. This study

evaluates whether or not participants rated as having differing total scores on the Coping Resources Inventory (CRI) develop different levels of postconcussional symptoms three months post-injury (as measured by the Postconcussion Syndrome Checklist). In addition, it examines whether additional variables such as subjective stress, prior head injury, being given information about possible deficits at the time of the trauma, and loss of consciousness at the time of the trauma have predictive value with regard to persistent postconcussional syndrome. In order to set a context and rationale for the study, literature pertaining to mild traumatic brain injury, postconcussional syndrome/symptoms, and coping resources will be reviewed.

CHAPTER TWO

Review of the Literature

In order to provide a context and structure for this study, the literature will be reviewed in the following areas: mild traumatic brain injury, development of postconcussional symptoms after mild traumatic brain injury, and coping (with an emphasis on coping resources.) The terms mild brain injury, mild traumatic brain injury, mild head injury, and concussion are often used interchangeably. For the purpose of clarity, the commonly used term mild traumatic brain injury will be used in this review, as it is most descriptive of the injury.

Mild Traumatic Brain Injury

In their overview of the phenomenon of mild traumatic brain injury (MTBI), Bennett and Raymond (1997) estimate that 7 million brain injuries (mild, moderate, and severe) occur every year in the United States. They report that the majority of these injuries result from motor vehicle accidents, while others are sports injuries, work-related, or due to physical altercations. Bennett and Raymond (1997) and Harrison (1997) estimate that around eighty-five percent of all brain injuries can be

classified as mild. Seventy percent of all traumatically brain-injured individuals are younger than 31 years of age, with the peak incidence in the age range of 15 to 24 (Bennett & Raymond, 1997; Rosenthal et al., 1990). Males present with head injuries more often than females (Binder, 1986; Harrison, 1997). Several sources speculate that this is due to an increase of risk-taking behaviors and alcohol use in this age group of men. Kushner (1998) states that mild traumatic brain injury is a significant burden to our society in terms of days lost from work, costs of medical treatment, and time spent by general practitioners trying to diagnose and refer for treatment.

Mild traumatic brain injuries are not minor bumps on the head and should not be considered trivial (Cullum & Thompson, 1997). According to the Mild Traumatic Brain Injury Committee [MTBIC] of the American Congress of Rehabilitation Medicine (1993), MTBI consists of damage to the brain when an individual strikes her/his head on an object, an object strikes the head, or the brain undergoes acceleration/ deceleration without direct trauma. The MTBIC definition goes on to distinguish mild traumatic brain injury from stroke, anoxia, tumor, and encephalitis.

If an injured individual seeks medical care after sustaining a MTBI, brain imaging and neurological examinations may be normal (MTBIC, 1993; Kay, n.d.). Not all injured individuals seek medical treatment after the trauma, however. If they do, they are often sent home after no focal damage is found, no (or little) loss of consciousness is reported, and a concussion is diagnosed (Feler & Watridge, 1992; Kay, n.d.). When the victim has lost consciousness, Kay (n.d.) reports that hospitalization (mostly for the purpose of observation) is usually brief. For these

reasons, many individuals may not receive information about mild brain injury. In addition, they may not be given a chance to be reassured that any deficits will most likely resolve spontaneously in the weeks after the trauma (McSherry, 1989).

Although approximately 85% of all brain injuries can be classified as mild, controversy exists regarding exactly what a mild brain injury is and what outcome can be expected after sustaining such a mild injury (Bennett & Raymond, 1997; Harrison, 1997; Sohlberg & Mateer, 1989). The classification of a MTBI is difficult, as a variety of medical classifications are used. Clinicians may require a specific period of loss of consciousness alone as measured by the Glasgow Coma Scale – a scale based upon eye opening, motor response, and verbal response that has a satisfactory degree of interrater reliability (Reitan & Wolfson, 1997). Some clinicians may require a period of loss of consciousness with post-traumatic amnesia, and some depend upon post-traumatic amnesia alone when making a diagnosis (Bennett & Raymond, 1997). The definition used in the present study is one set forth by the MTBIC. It requires any one of the following: a period of loss of consciousness (less than 30 minutes), any loss of memory for events before or after the accident (not greater than 24 hours), any alteration of mental state such as feeling dazed, disoriented, or confused at the time of the accident, and focal neurological deficit(s) that may be transient but that are not severe enough to exceed the time limits listed above (Reitan & Wolfson, 1997). Participants were also accepted into the study if the above details about their injury were unknown, but if they had been given an official diagnosis of concussion from an emergency room doctor (see the limitations section

of this dissertation for further discussion).

In mild traumatic brain injury, especially cases of MTBI sustained in a motor vehicle accident, acceleration-deceleration and rotational forces are applied to the soft tissue of the brain in its bony skull. With the sudden acceleration and deceleration, the brain rotates on its axis and makes contact with the skull at the site of the injury (coup) and bounces back to hit the opposite side of the skull (contrecoup) (Mapou, 1992; Pinel; 1993). One of the primary effects of MTBI is diffuse axonal injury in the brain due to stretching and shearing of nerve pathways causing damage at the cellular and neuronal level (Bennett & Raymond, 1997; Mapou, 1992). Even minor blows to the head with seemingly complete recovery and little or no period of unconsciousness, according to Kay (n.d.), can result in diffuse tearing and stretching of nerve fibers. Lezak (1983) states that although concussion without any apparent damage to the brain used to be thought of as relatively inconsequential, there is now evidence that destruction of brain stem cells and fibers accompanies the concussion. Damage resulting from rotational forces or shearing is greatest near the surface of the cortex and decreases in magnitude toward the center of the brain (Jones, 1992).

The underside of the frontal lobes and the anterior temporal lobes are particularly prone to damage because they are close to rough, bony skull and are abraded when the brain stretches and twists (Mapou, 1992). Because the cortex is primarily affected in mild traumatic brain injuries, according to Jones (1992), subtle cognitive and memory effects are more frequently seen than extreme memory problems. Several frontal lobe subsystems may be affected in MTBI. (See Figure 1.)

One such area is the frontal eye field(s) which, when damaged, probably leads to lessened ability to search and scan (although it is less vulnerable to damage than other subsystems) (Harrison, 1997). More often affected is the dorsolateral subsystem, an area that is a proposed seat of highest order cognitive reasoning, complex associations, problem solving, attention, and concentration (Harrison, 1997). Most likely affected by MTBI is the orbitofrontal subsystem, which is associated with inhibition-disinhibition and judgment (Harrison, 1997). The orbitofrontal cortex has a rich set of connections with deeper subcortical regions which are responsible for learning and memory as well as emotional (especially anger) interpretation and regulation (Harrison, 1997).

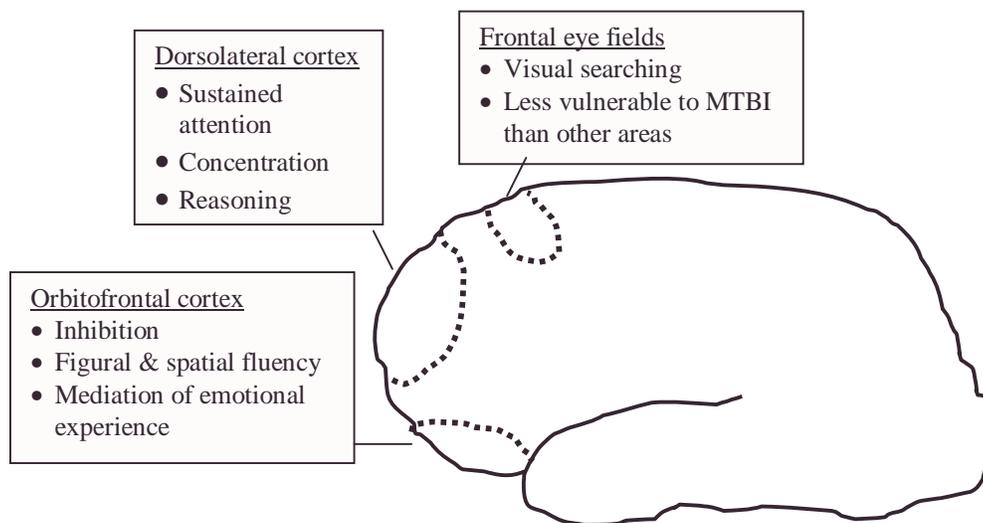


Figure 1. Frontal lobe subsystems affected in MTBI (adapted from Harrison, 1997)

The temporal lobes are also vulnerable to damage in MTBI. (See Figure 2.) Memory deficits, the hallmarks of closed-head injury, are associated primarily with temporal lobe lesions (Kay, n.d.). Those with MTBI “have great difficulty storing and retrieving new information, especially when it is presented quickly, in complex form, or in competition with additional information presented before or after” (Kay, n.d., p. 5). Memory deficits in MTBI are specific to new information; an individual may have total recall of childhood, but forget where she left her car keys (Kay, n.d.). The frontal lobes work with the temporal lobes, playing an important role in organizing memories, giving a “time tag” to memories, and allocating attention (Sohlberg & Mateer, 1989). In addition, the olfactory nerve is located behind the temporal lobe – on the ventral surface of the frontal lobes – and passes through holes in the cribriform plate of the skull (Pinel, 1993). When the brain twists in the skull, the olfactory nerve may be sheared and the individual may notice changes in her/his sense of smell (Harrison, 1997; Pinel, 1993).

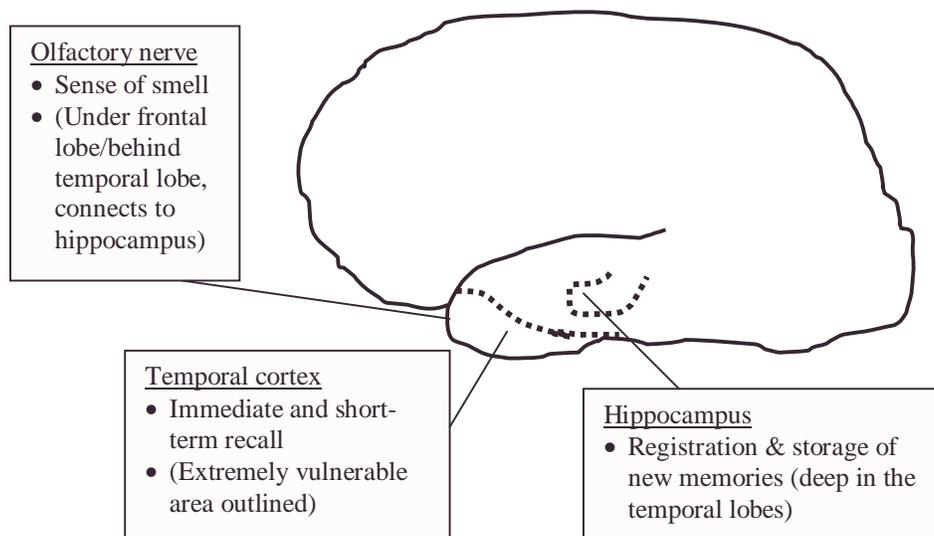


Figure 2. Temporal lobe areas affected in MTBI (adapted from Sohlberg & Mateer, 1989)

Postconcussional Syndrome

Because the damage in mild traumatic brain injury generally is presumed to be at the microscopic cellular level, there are questions throughout the literature about the sequelae. Each person has slightly different after-effects (Czubaj, 1996), but people often report similar, relatively vague symptoms after sustaining a MTBI. The most frequent symptoms are headache, fatigue, irritability, insomnia, anxiety, dizziness, depression, confusion, forgetfulness, and the inability to concentrate

(Auerbach, Levin, & Miner, 1990; Axelrod et al., 1996; Bennett & Raymond, 1997; Lezak, 1995; McSherry, 1989). Together, these common post-MTBI symptoms can be called postconcussional syndrome (PCS), and evidence is accumulating that these symptoms are organic in nature (Sohlberg & Mateer, 1989). Like mild traumatic brain injury, PCS has many alternate names such as postconcussive symptoms (Bohnen et al., 1992), persistent postconcussion syndrome (Cicerone & Kalmar, 1995), and postconcussional disorder. In this dissertation, the term “persistent postconcussional syndrome” will refer to the common post-MTBI symptoms (postconcussional syndrome) that persist beyond three months.

Postconcussional disorder is included in the Diagnostic and Statistical Manual, fourth edition, as a diagnostic category for additional study (American Psychiatric Association, 1994). The DSM-IV requires (tentatively, since it is not an official diagnosis) that at least three symptoms be present for at least three months post-injury for a diagnosis of postconcussional disorder. Some of these symptoms are: becoming fatigued easily, disordered sleep, headache, vertigo or dizziness, irritability or aggression with little provocation, anxiety, depression or affective lability, apathy or lack of spontaneity, and other changes in personality (American Psychiatric Association, 1994). The DSM-IV also states that these symptoms should be accompanied by “significant impairment in social or occupational functioning and represent a significant decline from a previous level of functioning” (American Psychiatric Association, 1994, p. 704).

It is reported throughout the literature that postconcussional symptoms like

those listed above usually remit between a few weeks to three months after the injury for most mildly injured people (Auerbach, Levin, & Miner, 1990; Jagoda & Riggio, 2000; Mittenberg & Strauman, 2000). However, a small but significant number of MTBI patients report persisting symptoms after the three-month period (Binder, 1986; Cicerone & Kalmar, 1995; Cullum & Thompson, 1997; Harrison, 1997). Postconcussional syndrome is a controversial diagnosis when it lasts more than three months or when the onset of the symptoms takes place in the days and weeks after the injury (Auerbach, Levin, & Miner, 1990; Binder, 1986; Cicerone & Kalmar, 1995; Lezak, 1995), as it is often viewed as a product of malingering, disability claims and litigation, and accident neurosis. Lezak (1995) reviews the literature regarding postconcussional symptoms and states that many researchers feel long-lasting complaints are psychogenic in nature and are either in reaction to the changes that accompanied the trauma, individual pre-morbid personality, or litigation. Persistent symptoms are more common after motor vehicle accidents than after sports-related injuries, making the phenomenon even more complex (Cullum & Thompson, 1997).

Although postconcussional symptoms generally either remit or persist, in some cases the individual may begin to feel worse as time goes on. Kay (n.d.) feels this is due to a shaken sense of self. He defines “sense of self” as “the balance, the integrity, the system of feedback that we all instinctively establish to keep constant our ‘identity,’ our sense of who we are. It involves the ability to do certain things and not others, to react and perform in ways that are predictable and expected, and generally to run our lives based on what we have learned we are able to do” (Kay,

n.d., p. 8). After a MTBI, deficits that profoundly effect victims' senses of their abilities crop up unexpectedly. Because of this, Kay's (n.d.) theory suggests that victims' sense of self is shaken and they begin to lose confidence, doubt themselves, second-guess their every move, and find themselves taking time to think about things that used to come naturally. These psychological reactions to neurological damage are part of Kay's (n.d.) conception of postconcussional syndrome, and the anxiety that builds because of this "psychological overlay" is responsible for persistent PCS, in his estimation. Similarly, Kibby and Long (1997) state that injured people may develop a secondary pathological reaction, causing PCS to continue or even get worse. Psychological overlay or secondary reactions may be more common in those who have not received any information about MTBI and who therefore do not expect deficits or know that such deficits will most likely resolve quickly (Kibby & Long, 1997).

When symptoms persist (as some people continue to report them even many years after an accident) or get worse, malingering must be ruled out. This is particularly important when any litigation is taking place or disability benefits are being sought. Ruff, Wylie, and Tennant contend that, "only an exceptional individual with a mild TBI who has become a litigant or filed for workers' compensation does not also become influenced by the possibility of financial gain" (1993, p. 60). They suggest clinicians need to be especially aware of the power of suggestion when they raise possible symptoms during an examination. These authors find that malingering is not an all-or-nothing phenomenon in MTBI – instead, people may report symptoms

that have subsided when other symptoms are still present or exaggerate symptoms in order to meet unfulfilled psychological needs (Ruff, Wylie, & Tennant, 1993).

However, they review the malingering literature and find that most studies dispute the assertion that persistent PCS is fueled by litigation and hope of financial gain (Ruff, Wylie, & Tennant, 1993). One such study cited by Ruff, Wylie, & Tennant (1993) was Thompson's (1965), which found that only 15% of accident victims reported their symptoms as remitting after litigation was finalized. The authors also cited studies by Kelly and Smith (1981) and Mendelson (1992) which reported that head-injured victims were still unable to return to work or find gainful employment after settlements had been finalized (Ruff, Wylie, & Tennant, 1993).

Postconcussional symptoms are more common in those with mild traumatic brain injuries than in cases of severe brain injury – they are also noted to occur at the period in recovery when the patient is attempting to resume social, work, or academic duties or any combination of these (Kay, n.d.; Kibby & Long, 1997; Lezak, 1995). Presumably, this is because those with severe head injuries do not resume working, do not return to the same jobs, or continue working with the understanding that they will have quite different strengths and abilities. Mild traumatically brain injured people commonly return to their jobs soon after the injury with undiminished expectations for themselves. Haglin (1996) reviews the literature on this topic and states that injured people often do not notice functional limitations until they return to work because of the more objective standards for their behavior and performance in the workplace. Injured people know something is wrong with them, but either no one

else notices or they are told they are malingering and imagining the symptoms (Czubaj, 1996; Kay, n.d.). The extent of functional disability can be severe (according to Kay, n.d.) if the injured person's work requires speed, complex attention, learning and memory, and integrative thinking, as these abilities are often impaired after a MTBI.

Binder (1986) discusses the selective vulnerability to postconcussional syndrome after a mild injury, stating that older patients, victims of more than one head injury, and lower-SES patients are more likely to suffer persisting subjective symptomatology. Binder's reasoning is similar to Kibby and Long's (1997) on this last point, as he suggests the relationship between SES and persisting PCS is due to the fact that people in high-status jobs generally are more free to reduce their workload or take time off work if necessary, while those in lower-status jobs often must return to work more quickly after an injury and have no control over their work or the expectations placed upon them. Kibby and Long (1997) state that postconcussional syndrome reflects "stress, poor stress management, or the interaction of cognitive weaknesses with situational stress. [The symptoms] do not reflect brain impairment alone and are not good measures of cognitive recovery from brain injury, although they do reflect the individual's ability to cope with stress following the injury" (p. 36). Gouvier et al. (1992) add to this, reporting that the number of postconcussional symptoms reported covaries with the level of subjective stress.

Coping and Coping Resources

In order to understand coping in the context of mild traumatic brain injury and postconcussional syndrome, it is helpful first to define the term “stress,” as coping is generally seen as an individual’s reaction to stress. McCarthy, Lambert, & Brack (1997) report that most models emphasize that stress resides in the transaction between people and their environment, not in the people or the environment alone. Matheny et al. (1996) review the stress literature and find that most researchers believe the stress response begins with an individual’s appraisal of a situation in relation to the resources she/he has available to meet, mitigate, or alter the demands of the situation. These appraisals are automatic and instantaneous (McCarthy, Lambert, & Brack, 1997). A stress response, defined by Matheny, Aycock, & McCarthy (1996), is “the body’s physiological and psychological adjustment to stressors...[which] stem from demands that are perceived to over-extend one’s resources” (p.110). If a person believes her/his resources are adequate for dealing with the situation, the situation is seen as a challenge rather than a threatening stressor and dealt with in an effective, healthy manner (Matheny, Aycock, and McCarthy, 1993).

In order to apply coping to MTBI and the development of PCS, likely sources of stress for this population need to be identified. After a mild injury, individuals must face the challenges of dealing with any deficits on top of recovering from any

other physical injuries that have been sustained. Deficits can be especially destabilizing when an individual does not understand what is to be expected after an injury and is unaware (as most MTBI victims are) of the course of postconcussional symptoms (Kibby & Long, 1997). As stated in the above sections, deficits usually become more salient to individuals when they try to return to school, work, or other duties due to the objective standards placed upon the individual in those settings. The primary sources of stress for a recently injured individual likely are the expectations of others that the victim perform at pre-injury level soon after the trauma (Kibby and Long, 1997). Gouvier et al. (1992) agree, finding in their research that the number of postconcussional symptoms reported covaries with the level of subjective stress. They also suggest that the MTBI victim's level of subjective stress will be high in the workplace, as demands are similar to what they were pre-morbidly without taking into account the victim's need to recuperate (Gouvier et al., 1992).

The above review of the MTBI and PCS literature proposes that problems stem from both neurological and psychological factors, rather than from one or the other. Accepting a combination of the physical and psychological has not always been common practice in the medical community. Marsella and Scheuer (1993) state that the medical and health sciences have, in recent years, been radically altered by the idea that the etiology, treatment, and prevention of diseases once thought to be purely biological or neurological in nature are also greatly effected by human behavior and our social-environmental context. They later go on to state that coping is one of these important social-environmental determinates, as it is "closely related

to the promotion and maintenance of health and the prevention of disease” (p.125). Coping resources are generally seen as health-promoting, as people with high resources are often characterized as resilient and hardy, while those with low resources are deemed fragile and vulnerable (Hammer & Marting, 1988).

But what are coping resources, exactly? One of the earliest definitions of coping resources was Marsella’s et al. (1972) which stated that coping resources are “any aspect of the organism’s functioning which could be viewed as a mediator of stress” (as cited in Marsella & Scheuer, 1993, p. 127). Hammer and Marting (1988) say that coping resources are inherent, and that they enable people to handle stress more effectively, experience less intense stress symptoms, and recover faster from exposure to stress. Perlin and Schooler (again in Marsella and Scheuer, 1993) state that coping resources consist of interpersonal, support providing networks people have to fall back on and/or personality characteristics people can draw upon when facing situations they perceive as stressful. Similarly, Moos and Billings (1982) find that coping resources are relatively stable characteristics that both effect the coping process and are affected by the outcome of the coping process (as cited in Marsella & Scheuer, 1993). By this, they mean that the coping process is circular, in that it flows from perceived resources and has the ability to change perceived resources, depending on the outcome. Hammer and Marting address the confusion caused by this idea, stating that “a strategy used by an individual in coping with a stressor can become a resource for that individual through prolonged successful use” (p. 2).

Coping resources are not the same as coping strategies. Perlin and Schooler

(1978) (as cited by Marsella and Scheuer, 1993) make the distinction between coping resources and strategies, stating that the term “coping resources” does not refer to what people specifically do in response to stress, but instead what is available to them in general in developing their coping repertoires. Coping strategies are the ways we use our resources when coping (Matheny, Aycock, & McCarthy, 1993). For example, having a network of social support such as family and friends is a coping resource, while asking for help with schoolwork from friends is a coping strategy. McCarthy, Lambert, and Brack (1997) nicely sum up the distinction, stating, “Coping resources therefore refer to one’s capacities for dealing with potentially demanding events and may be thought of as aspects of the functional intelligence needed for everyday use, whereas coping [strategies or skills] refers to specific efforts to deal with a stressor” (p. 54).

Because resources are more stable than strategies, it is more likely that MTBI victims will still have the same resources post-injury while their specific coping strategies may differ. For example, a person will likely still have a supportive network after an injury if she had one before it occurred. However, if a person dealt with stress premorbidly using a strategy such as making lists or getting more sleep and she no longer finds herself able to be organized enough to make lists or her sleep is disturbed by headaches, she will no longer be able to rely on these strategies. Gouvier et al. (1992) state that the reduction or change in possible coping strategies after a MTBI add to the subjective stress of returning to school or work, as the changes/reduction in coping will only become salient when one needs to use them.

Bohnen et al.'s (1992) study also suggests that coping strategies in this population may suffer, as the stress tolerance of patients with postconcussive symptoms usually decreases and frustration can develop when "previously mastered activities at home or work prove challenging if not impossible. Difficulties in cognitive functioning may reduce the effectiveness in coping with stress" (Bohnen et al., 1992, p. 103).

The Bohnen et al. (1992) study is one of the few that directly examines the hypothesis that coping affects the development of PCS, although many authors have suggested coping plays an important role. Bohnen et al. examine coping strategies after an injury rather than looking at pre-morbid coping resources. No studies appear to be available that attempt to predict which injured individuals are most likely to develop PCS based on coping and stress management. Therefore, this study is exploratory in nature.

Rationale for the Dissertation

Mild traumatic brain injury affects millions of people each year, hundreds of thousands of whom suffer the effects of persistent postconcussional symptoms (Harrison, 1997). Although terms like psychological overlay are used to describe symptoms and deficits common after MTBI, it should be stressed that these problems should not be written off as "purely in the victim's head." Postconcussional syndrome is usually conceptualized as a combination of psychological and neurological factors (Kibby & Long, 1997). When neurological damage has been

ruled out, coping and stress management may play a particularly large role in persisting symptoms.

Although many authors agree that PCS is related to coping and stress management, few studies back up this assertion. As stated by Bohnen et al. (1992), “little has been reported in the literature about the coping strategies used by head-injured patients. The few studies of coping and head injury only concern severely head-injured patients” (p. 98). Mild traumatic brain injury is so prevalent and the effects can be so devastating that research in this area is badly needed. This exploratory dissertation seeks to add to our understanding of mild traumatic brain injury and persistent postconcussional symptoms and the strength of coping resources and other variables in predicting long-lasting problems.

CHAPTER THREE

Purpose

It is apparent from the literature review that both mild traumatic brain injury and persistent postconcussional syndrome are controversial topics. A commonly accepted theory for the development of persistent PCS posits that symptoms become most noticeable as the victim returns to stressful situations, and that persisting symptoms reflect stress-management as much as anything else. Unfortunately, there is little research to support or refute the “coping hypothesis.” This dissertation was undertaken with the hope that it might provide key information about the importance of pre-injury coping resources, subjective stress, and other variables in predicting development of postconcussional symptoms after automobile accidents or other trauma.

Accordingly, the purpose of this dissertation study was to explore the effects of coping resources on the development and maintenance of persistent postconcussional symptoms after a diagnosis of mild traumatic brain injury. The primary questions addressed in this study were as follows: do victims of MTBI who have differing levels of coping resources report experiencing differing levels of symptomatology at three months post-trauma? Do other variables predict symptoms better than coping resources? The other variables used in the study were selected

carefully after a review of the literature, and their predictive value were examined as well.

Overview of the Study

As stated above, this study investigated how strongly individuals' pre-injury coping resources (and other selected variables) were related to the development and maintenance of persistent postconcussional syndrome. Symptoms were ascertained with the Postconcussion Syndrome Checklist (Gouvier et al., 1992), which lists common postconcussional symptoms and requires the participant to rate the frequency, intensity, and duration of each symptom, with a total symptom score being the sum of all three categories. Coping resources were measured using the Coping Resources Inventory (Hammer & Marting, 1987). This questionnaire provides a total coping resource score as well as scores for the following coping resource subcategories: cognitive, social, emotional, spiritual/philosophical, and physical. Participants also completed a Past History Checklist, which simply was used to determine the presence or absence of a few other variables that the literature and clinical wisdom state have some effect on persistent postconcussional syndrome. The variables on this checklist were: seeking of trauma-related litigation, no loss of consciousness versus some loss of consciousness, information given about possible after-effects of a mild TBI, subjective life stress on a scale from 1-10, and history of prior head injury. The trauma-related litigation variable was dropped from the study,

as none of the participants endorsed it. See Table 1 for a list of the instruments participants were asked to complete.

Participants, in a mail-out packet, were instructed to fill out the Coping Resources Inventory describing themselves in the few months before the head trauma was sustained, with the understanding that answering the questions retrospectively left some room for error. The retrospective rating was done because it was deemed likely that individuals might feel they have fewer resources at their disposal after a traumatic injury/experience – especially if they have become depressed about the trauma, the resulting PCS, or the life changes due to both events. Because the purpose of this study was focused on pre-injury coping rather than coping changes after the trauma, participants' coping resources were examined for the pre-injury time period only. Since most participants had suffered their MTBI within two or three weeks of the initial contact, rating was retrospective to a very recent time.

Table 1

Instruments

Instruments Completed By Dissertation Participants
<p><i>At initial contact (Mail-out administration)</i></p> <ul style="list-style-type: none">• Coping Resources Inventory (rated for the few months before the trauma)• Postconcussion Syndrome Checklist (rated for the days/weeks after the trauma)• Demographic information <p><i>At three months post-trauma (Phone administration)</i></p> <ul style="list-style-type: none">• Postconcussion Syndrome Checklist (rated for two weeks before the three-month follow-up)• Past History Checklist (completed at this time due to questions regarding post-trauma litigation)

Because it was suspected that MTBI patients might not feel they had the stamina for multiple questionnaires (due to depression, lack of motivation due to frontal lobe injury, recovery from other injuries, etc.), all possible efforts were taken to make the process as simple as possible. The Coping Resources Inventory is a relatively brief instrument and the Past History and Postconcussional Syndrome Checklists are short and straightforward. All questions were condensed to as few sheets of paper as was feasible – the original mail-out packet was four sheets (two of which were the consent form) and the follow-up phone call usually lasted about five minutes. The Coping Resources Inventory, Past History Checklist, Postconcussion Syndrome Checklist, and phone script for the follow-up phone call can be found in

the Appendices.

Participants with very recent MTBI were recruited from Austin (Texas) Brackenridge Hospital's LYNX emergency room records. (The primary investigator, Barbara J. Sparrow, had been cleared to do so by the hospital's legal office prior to beginning data collection.) Hospital records for a two-week period were obtained according to the procedure the hospital's legal department and research staff preferred, and patients diagnosed with MTBI/concussion were culled out. Accordingly, most participants had suffered the MTBI within one to three weeks of initial contact. Participants were placed in a drawing for one of two \$100 gift certificates. (Because the winners of both incentives did not live in the Austin area, money orders rather than gift certificates were sent by return-receipt certified mail.)

Research hypotheses

The first hypothesis was that total coping resource scores (as measured by the Coping Resources Inventory) and the total number of postconcussion symptoms reported at follow-up would correlate. Specifically, it was hypothesized that participants with high total coping resource scores would report the fewest number of symptoms and those with low total resource scores would report the most symptoms. Figure 3 is a graphical representation of the expected relationship.

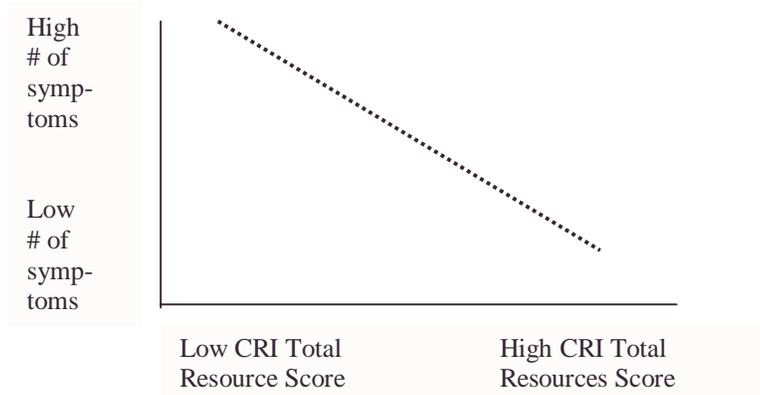


Figure 3. Graphic representation of the expected negative relationship

The first hypothesis was based on the agreement of many authors (such as Binder, 1986; Kibby & Long, 1997; Lezak, 1995) that postconcussional syndrome likely begins or intensifies when injured people return to work, school, or social duties and are expected to perform at pre-injury level immediately. Exactly how stressful these situations are perceived to be has to do with the amount of resources people believe they have. If a person believes her/his resources are adequate for dealing with a situation, it is appraised as challenging rather than threatening, making the situation more easy to deal with in an effective, healthy manner (Matheny, Aycock, and McCarthy, 1993). However, if a situation is perceived as threatening and unable to be dealt with effectively, the person is more likely to develop a secondary psychological reaction to the stress (for example, Kay’s (n.d.) theory of “psychological overlay” and the development of persistent postconcussional

syndrome.)

In addition, coping resources are usually seen as health-promoting (Hammer & Marting, 1988). Those with high resources are often characterized as resilient and hardy in general, and therefore would be expected to recover more quickly. Those with low resources are deemed fragile and vulnerable, which may lead to a slower recovery (Hammer & Marting, 1988).

The second hypothesis was that the variables from the Past History Checklist (prior head injury, information given about what sequelae victims might expect, loss of consciousness versus no such loss, and a subjective stress rating) would predict the number of symptoms reported at three-months post-trauma. Each of these variables is supported by the literature as a probable predictor for postconcussional syndrome. Assuming that hypothesis two was supported, the beta weights for each of the Past History Checklist variables were to be examined to determine if any was a significant predictor of symptoms reported by MTBI victims three months post-trauma.

CHAPTER FOUR

Method

This chapter presents the requirements participants needed to have met to be included in the sample. In addition, it also contains sections that outline the measures used in this study. The chapter ends with a discussion of the procedure followed in the dissertation study.

Participants

During data collection, questionnaire packets (see Table 1 in chapter three for the contents of the packets) with self-addressed, return postage envelopes were sent to Austin Brackenridge Hospital emergency room patients who had been diagnosed with a concussion or mild traumatic brain injury. Every two weeks, all prospective participants were culled from records and their contact information was printed out in accordance with Brackenridge's preferred procedures. Confidentiality was maintained. Participants were required to be between the ages of 18 and 55, and all had to have sustained a mild traumatic brain injury within a few days to three weeks of the initial contact.

The definition of mild traumatic brain injury participants were expected to meet was the one set forth in 1993 by the Mild Traumatic Brain Injury Committee of the Head Injury Multidisciplinary Special Interest Group of the American Congress

of Rehabilitation Medicine. The definition, as cited in Reitan and Wolfson (1997), is as follows:

A patient with mild traumatic brain injury is a person who has had a traumatically induced physiological disruption of brain function, as manifested by at least one of the following:

1. Any period of loss of consciousness.
2. Any loss of memory for events immediately before or after the accident.
3. Any alteration in mental state at the time of the accident (e.g., feeling dazed, disoriented, or confused.)
4. Focal neurological deficit(s) that may or may not be transient; but where the severity of the injury does not exceed the following:
 - Loss of consciousness of approximately 30 minutes or less;
 - After 30 minutes, an initial Glasgow Coma Scale (GCS) of 13-15;
 - Post-traumatic amnesia (PTA) not greater than 24 hours.

However, because it was necessary to depend on diagnoses made by emergency room physicians, patients were often accepted whose records indicated “concussion” or “closed head injury without loss of consciousness” with little supporting information about the basis of the diagnosis other than GCS score. This issue is addressed further in the Limitations section.

Exclusionary criteria for participants were as follows: an age of 18 years or less, an age of 55 years or more, and/or a diagnosis of another primary neurological disorder. (The exclusionary criteria were kept to a minimum due to the exploratory nature of the study.) Sensitivity to the circumstances of the trauma was considered to be important when sending out packets. As such, attempts were made to avoid sending study materials to anyone who sustained severe physical injury or those who

were involved in an accident with any associated fatalities.

Measures

Coping Resources Inventory (CRI)

The Coping Resources Inventory (CRI) was developed, according to its authors Hammer and Marting (1987), to provide a standardized measure for identifying coping resources available to individuals for managing and mediating their stress responses. The inventory is made up of sixty questions which participants rate on a four-point Likert Scale (with a rating of one equal to never or rarely and a score of four indicating always or almost always.) The total score is computed by simply summing the participant's responses. Subscale scores are similarly the sum of the responses for each category. Raw scores are converted to standard scores having a mean of 50 and a standard deviation of 10 points.

The CRI yields a total resource score as well as scores for five domains: cognitive, social, emotional, spiritual/philosophical, and physical. Again according to Hammer and Marting (1987) the cognitive domain score indicates the level of the person's "sense of self-worth, positive outlook toward others, and optimism about life in general" (p. 3.) The social domain score indicates the degree to which the participant feels she/he is imbedded in a supportive social network. Hammer and Marting (1987) state that the emotional domain taps into "the degree to which individuals are able to accept and express a range of affect" (p. 3). The

spiritual/philosophical domain indicates the individual's sense of being guided by values they have derived from religion, personal philosophy, or familial and cultural tradition. The final domain, physical, looks at health-promoting behaviors such as exercising and nutrition.

Internal consistency reliabilities, estimated with Cronbach's alpha, range from .71 to .84 for the domain scores and is .91 for the total resource score. This suggests the scales are relatively homogenous and are reliably testing the constructs they purport to test. Test-retest data for a sample of high school students ranged from .60 to .78 for the domains and .73 for the total score after a six-week period. Although Hammer and Marting report moderate intercorrelations for the cognitive, social, and emotional scales, they state the continued separation is justified until further data are available. In addition, they state the relationship among these scales may simply suggest a supportive social network and the ability to express emotions may lead to a higher sense of self-worth.

Postconcussion Syndrome Checklist

The Postconcussion Syndrome Checklist is a 9-item checklist of the most common postconcussional symptoms devised by Gouvier et al. (1992). Participants are asked to rate the frequency, intensity, and duration of each symptom on a scale from one (not at all) to five (constant/crippling.) Four scores can be derived for each participant: total frequency, total intensity, total duration, and a total score across dimensions. The Postconcussion Syndrome Checklist is included in Appendix C.

The Postconcussion Syndrome Checklist is one of the few validated measures for postconcussional symptoms. The authors found that it reliably differentiated a head injured population complaining of post-injury symptoms from a sample of normal controls. They state the measure classified 64% of their participants into the correct groups. The total score obtained from this measure appears, from the authors' research, to be the most effective way of differentiating between groups. The total score was used in this dissertation. (In addition, this form included spaces for the participant to fill in her/his age, sex, and ethnicity for demographic purposes.)

Past History Variables Checklist

This checklist is comprised of the additional, non-coping resource variables that were to be included as a part of the multiple regression. The variables selected to make up the checklist were: prior head injury, information about what to expect after a MTBI given at the time of the injury (per patients' recollections), litigation/disability benefits being sought, subjective life stress (on a scale from 1-10 with half scores allowed), and loss of consciousness at the time of the trauma. As all variables on the checklist are dichotomous (except life stress), participants stated whether they had or had not experienced the variable in question. The litigation variable was dropped from the data analysis, as none of the participants endorsed it. During data analysis the variables from the checklist were not found to correlate with each other.

Prior head injury was included in the Past History Checklist as many researchers (such as Binder, 1986 and Mittenberg & Strauman, 2000) have reported that those with previous head injuries may be particularly vulnerable to lasting problems. In addition, participants were asked if they remembered receiving information about what MTBI is and what symptoms they might expect after the injury. This question was included because psychological overlay or secondary reactions may be more common in those who have not received any information (or who don't recall it) about MTBI and who do not expect deficits or know that such deficits will most likely resolve quickly (Kibby & Long, 1997). In addition, Jagoda and Riggio (2000) state that patients who are educated about PCS and told that their prognosis is good report improved symptom reduction.

Malingering is a controversial topic in the MTBI/PCS literature, particularly when any litigation is taking place or disability benefits are being sought after the injury. Ruff, Wylie, and Tennant state that "only an exceptional individual with a mild TBI who has become a litigant or filed for workers' compensation does not also become influenced by the possibility of financial gain" (1993, p. 60). Participants were asked about litigation and disability benefits at three months post-trauma to assess if the presence of this variable is a particularly strong predictor of PCS. Again, this variable was dropped from analysis, as none of the participants reported that they were involved in litigation or benefit-seeking.

Loss of consciousness (versus no such loss) at the time of injury is often thought to correlate with the development of persistent PCS (Legome, 2001).

However, this too is a controversial topic. Jagoda and Riggio (2000) state that none of the studies they reviewed definitively found that the length of the loss of consciousness was a predictor for symptoms after MTBI.

Subjective life stress was part of the Past History checklist because, according to Gouvier et al. (1992), the number of postconcussional symptoms reported in their study covaried with the level of subjective stress. Jagoda and Riggio (2000) cited a 1993 study by Fenton et al. finding that patients with a higher incidence of life stressors were at greater risk of developing PCS, while Machulda et al. (1998) reported that perceived stress was more important than the number of stressful events in their study. Therefore, although subjective stress seems to be an important variable in the development of persistent PCS, findings are mixed.

Procedure

Participants who had very recently sustained a MTBI were identified through Brackenridge's emergency room records. The incentive provided for those who participated was entry in a drawing for one of two \$100 gift certificates. In order to cut down on the possibility of malingering, participants were assured that participation would not help or hurt any current litigation related to the injury and that the experimenter would not become legally involved in any of the cases. Participants also were assured in writing and verbally at the follow-up that all answers to written and verbal instruments would be kept completely confidential and the primary

investigator (Barbara J. Sparrow) would be the only person who had access to the responses. In addition, assurances were made that no identifying information would be placed on response forms and names would not be kept with questionnaire data.

The administration of the first set of forms took place via mail-out packets. Participants were given the Coping Resources Inventory in the packet, which was filled out retrospectively to the months pre-trauma. Instructions for the inventory made it clear that the questions referred to how participants dealt with stress before the accident/trauma rather than in the few weeks since the trauma. Because the initial contact took place soon after the trauma was sustained, participants rated their coping retrospectively to just a few weeks prior. At this time, they also completed the Postconcussion Syndrome Checklist for any acute symptoms. This helped to determine a baseline for each person that could be compared to the three-month follow-up (see the “Additional exploratory question” section of Chapter Five for a discussion of symptom change between administration number one and the follow-up).

Three months after each participant sustained her/his MTBI, the phone-administered follow-up took place. Participants were required to be at least three months post-trauma at follow-up because postconcussional symptoms are thought to resolve within this time period for most people (Auerbach, Levin, & Miner, 1990; Jagoda & Riggio, 2000; Mittenberg & Strauman, 2000) and when these symptoms do not remit, they can then be called persistent postconcussional syndrome. Phone administration was thought to do a better job of ensuring that participants received the

follow-up in a timely manner as compared to a second mail-out. Each person answered questions from the Postconcussion Syndrome Checklist (for symptoms in the weeks before the follow-up) and the Past History Checklist. Participants were given an approximate date they would find out if they won one of the \$100 gift certificates. They also were given the opportunity to ask any questions about the study.

CHAPTER FIVE

Results

The results of data analysis are presented in this chapter in four parts. The first part contains the demographic characteristics of the sample respondents. The second part presents the descriptive statistics for all variables examined in the study. The third part contains the results of the analyses of the research hypotheses, and the final part outlines an additional exploratory question that was raised during data analysis.

Sample Characteristics

Over a period of nine months, approximately 385 questionnaire packets with self-addressed, return postage envelopes were sent to Austin Brackenridge Hospital emergency room patients who had been diagnosed with a concussion or mild traumatic brain injury. (The questionnaire packets included the Coping Resources Inventory to be rated for pre-trauma coping, the first administration of the Postconcussion Syndrome Checklist for acute symptoms, the consent form, and a few demographic questions.) Most patients had been involved in automobile accidents, falls, bicycle accidents, or other recreational mishaps. Participants were required to be between the ages of 18 and 55, although the actual sample included participants from age 19 to 52. All had sustained a mild traumatic brain injury within a few days

to three weeks of the initial contact. Twenty-one (55%) of the participants were female and 17 (45%) were male. Twenty-eight participants reported their ethnicity as Caucasian (74%), two were Asian/Indian (6%), two were Hispanic (6%), and five participants chose to report their ethnicity as Other/"Prefer not to Say" (14%).

Although about 385 packets were sent out to prospective participants, only 45 were returned. The return rate was roughly 11%. Two individuals were removed from the study before the follow-up because their rating scales were incomplete. Five participants were lost at follow-up when the phone number given for them did not work or they were unavailable after several attempts to reach them. In total, 38 individuals completed both the questionnaires and the phone follow-up.

Descriptive Statistics

The descriptive statistics for the Coping Resources Inventory and the follow-up/time two administration of the Postconcussion Syndrome Checklist are reported in Table 2. Coping Resources Inventory raw scores were used in both the analysis and the descriptive statistics since total scores were being compared, and the scaled scores were developed primarily to make more accurate comparisons between subscales. (Scaled scores also were examined independently to see if a difference would be found, but they yielded very similar results to the raw scores.)

Table 2

Descriptive statistics for the CRI and follow-up administration of the Postconcussion Syndrome Checklist

	CRI total score	Time 2 administration of the Postconcussion Syndrome Checklist
Mean	184.553	58.605
Std. Deviation	20.072	17.404
Minimum	130.00	30.00
Maximum	218.00	91.00

The participants' past history variables – prior head injury (abbreviated PHI), information given about what sequelae might be expected after MTBI (abbreviated INF), loss of consciousness (LOC), and subjective life stress (Stress) were obtained for analysis. Response data for the dichotomous variables are reported in Table 3. The variable “subjective stress level at follow-up” was the only variable on the Past History Checklist that was not dichotomous. It had a mean of 4.92, with a standard deviation of 1.94. The minimum score was 2.0 and the maximum was 8.5.

Table 3

Response data for the past history variables

Response	Past head injury (PHI)		Information given at time of injury (INF)		Loss of consciousness (LOC)	
	N	%	N	%	N	%
Yes	12	31.6	21	55.3	29	76.3
No	26	68.4	17	44.7	9	23.7
Total	38	100	38	100	38	100

An intercorrelation matrix for all the study variables can be found in Table 4. Most of the variables were found not to correlate with each other, with the exception of the participants' rating of subjective stress level and the three-month follow-up administration of the Postconcussion Syndrome Checklist. This correlation is discussed in the data analysis section. In addition, the first administration of the Postconcussion Syndrome Checklist correlated with the follow-up administration of this same measure.

Table 4

Intercorrelation matrix for all variables

		CRI	TIME1	TIME2	LOC	INF	PHI	Stress
CRI	Pearson Correlation	1	.118	.099	.047	-.193	.022	.024
	Sig. (2-tailed)	.	.482	.556	.780	.245	.897	.888
	N	38	38	38	38	38	38	38
TIME1	Pearson Correlation	.118	1	.722	-.184	-.103	-.015	.253
	Sig. (2-tailed)	.482	.	*.000	.270	.540	.928	.125
	N	38	38	38	38	38	38	38
TIME2	Pearson Correlation	.099	.722	1	-.027	-.098	-.172	.361
	Sig. (2-tailed)	.556	*.000	.	.873	.558	.301	*.026
	N	38	38	38	38	38	38	38
LOC	Pearson Correlation	.047	-.184	-.027	1	.121	-.021	.007
	Sig. (2-tailed)	.780	.270	.873	.	.468	.900	.968
	N	38	38	38	38	38	38	38
INF	Pearson Correlation	-.193	-.103	-.098	.121	1	-.072	-.226
	Sig. (2-tailed)	.245	.540	.558	.468	.	.668	.173
	N	38	38	38	38	38	38	38
PHI	Pearson Correlation	.022	-.015	-.172	-.021	-.072	1	.223
	Sig. (2-tailed)	.897	.928	.301	.900	.668	.	.178
	N	38	38	38	38	38	38	38
Stress	Pearson Correlation	.024	.253	.361	.007	-.226	.223	1
	Sig. (2-tailed)	.888	.125	*.026	.968	.173	.178	.
	N	38	38	38	38	38	38	38

Note: The total score obtained on the Coping Resources Inventory has been abbreviated CRI; TIME 1 is the first administration of the Postconcussion Syndrome Checklist and TIME 2 is the follow-up administration of this same measure; LOC is

loss of consciousness (a past history variable); INF is information given about what symptoms to expect (past history variable); PHI is prior head injury (a past history variable); and Stress is the participant's rating of subjective stress (also a past history variable).

* Correlation is significant at the 0.05 level (2-tailed).

Data Analysis

It was expected, in keeping with the coping hypothesis of persistent postconcussional syndrome, that a relationship would be found for total resource scores on the Coping Resource Inventory and the number of postconcussional symptoms reported at three months post-trauma. Specifically, it was hypothesized that participants with high total resource scores would report the fewest number of symptoms and those with low total resource scores would report the most symptoms, exhibiting a negative correlation between the two variables. In analyzing this hypothesis, each participant's total number of symptoms at three months post-trauma (as measured by the Postconcussion Syndrome Checklist) were correlated with the individual's total coping resources score as measured by the CRI. Likert scales like those used in this dissertation, although not absolutely continuous, are considered a close enough approximation to interval data that a Pearson product-moment correlation could be used in the analysis (Personal Communication, Barbara Dodd,

2001).

The first hypothesis, that total CRI scores and postconcussional symptoms measured at three months post-trauma would correlate significantly, was not supported ($r = .10$; $p < .56$). Therefore, it appears that scores on the Coping Resource Inventory rated for pre-trauma coping did not predict the amount of symptoms participants reported three months after their injuries.

Hypothesis two stated that the variables from the Past History Checklist (past head injury, information given about what sequelae to expect, loss of consciousness, and subjective stress) would predict the number of symptoms reported at least three months post-trauma. It was hypothesized that these variables would have some predictive value, as all are supported by the available literature and by clinical wisdom. Multiple regression was used to analyze the second hypothesis because it allowed more than one independent variable to be incorporated into an equation, thereby giving a fuller explanation of the dependent variable (Lewis-Beck, 1980). [It was hoped that more variables might be used in the multiple regression (such as the subcategories of the CRI), but because only 38 participants completed both the initial packet and the follow-up, this was not feasible.]

Hypothesis two was not supported. The past history variables were not found to predict symptoms reported at the follow-up administration of the Postconcussion

Syndrome Checklist ($R = .447$; $R^2 = .20$; $F_{(4,33)} = 2.057$; $p < .109$.)

On the assumption that Hypothesis 2 would be confirmed, additional exploratory questions were originally proposed. In these exploratory sub-hypotheses, the beta weights of each of the Past History Checklist variables were to be examined in order to determine if any of the variables were significant predictors of symptoms participants reported three months after their injuries. These beta weights, however, could not be examined due to the non-significant F value found in the multiple regression.

Although beta weights of each variable could not be used as indicators of significance, it is evident from the intercorrelation matrix (found in Table 4) that participants' ratings of their subjective stress level on the Past History Checklist significantly correlated with symptoms reported on the Postconcussion Syndrome Checklist at the follow-up administration ($r = .361$; $p < .026$). In other words, a significant, positive relationship was found between an individual's appraisal of her/his everyday stress and the amount of postconcussional symptoms she/he reported three months after sustaining a mild traumatic brain injury.

Additional exploratory questions

As the data was being analyzed, additional questions about the structure of the data analysis became apparent. The first question had to do with the usefulness of the participants being lumped together as one group, regardless of their level of reported

postconcussional symptomatology. To address this, the data was broken into three groups. The first group was composed of participants who reported total postconcussional symptom scores at both the initial contact and the follow-up that were not above what non-concussed patients reported in Gouvier et. al's 1992 study. The second group reported total symptom scores that were at least one standard deviation above the "normals" at initial contact and follow-up. (One participant who was included in group two was slightly below one standard deviation at the initial contact, but was above this cutoff at the follow-up.) The third group were those who did not fall into either extreme. The total number of participants for each group was 15, 8, and 15, respectively. When each of these groups were correlated with the CRI total scores, no significant relationships were found for any group.

The second exploratory question was as follows: do the correlations change when a difference score between the first and last administration of the Postconcussion Syndrome Checklist is used as a criterion measure instead of the symptoms at the follow-up alone? In other words, does the total amount of coping resources reported by participants relate to their recovery as measured by the change between their initial total symptom rating and the total amount of symptoms reported at follow-up?

Some of the participants in this study reported high levels of acute symptoms while others reported far fewer initial symptoms. Many of the participants who reported high levels of acute symptoms reported far less at the follow-up while some did not report much recovery at all (see Table 5 for a listing of participants'

symptoms and Figure 4 for a graphical representation of symptoms reported at times one and two.) It was speculated that recovery between the acute phase and the three-month follow-up interview might be significantly related to a person's total coping resources for the same reason that symptoms at time two were hypothesized to be related to coping resources. The difference score between the initial administration of the Postconcussion Syndrome Checklist and the follow-up administration did not show a significant correlation with the total resource score from the Coping Resources Inventory ($r = -.053$; $p < .75$).

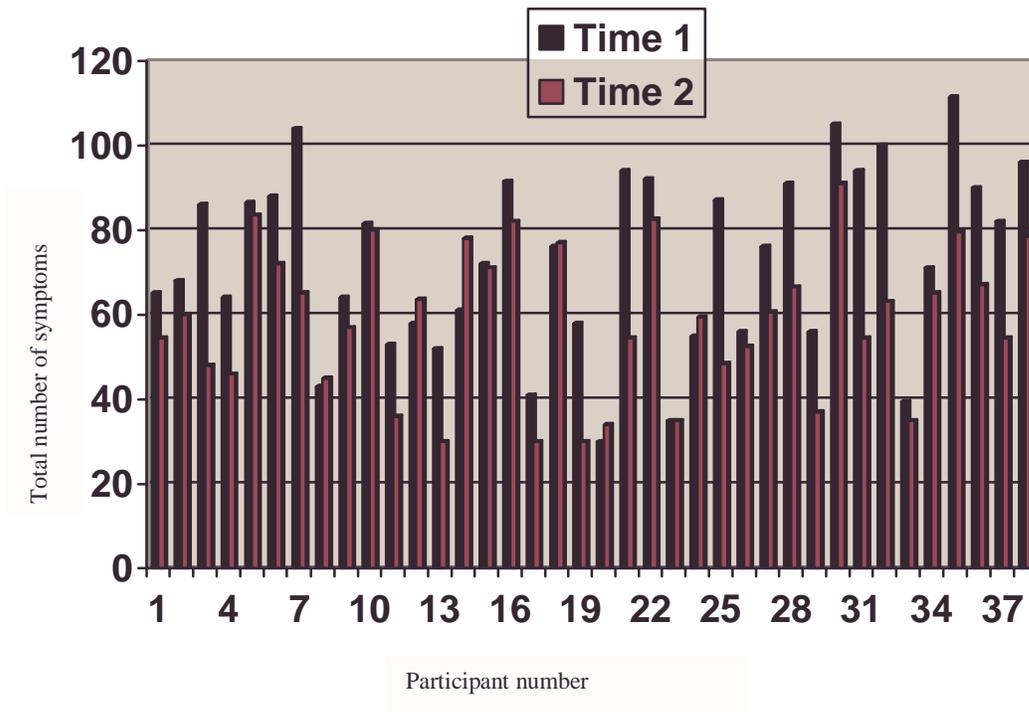


Figure 4. Postconcussional symptoms reported at time 1 and time 2

Table 5

Participants' total symptom scores on the Postconcussion Syndrome Checklist

Participant Number	Time 1 administration	Time 2 administration	Difference score
1	65	54.5	-10.5
2	68	60	-8
3	86	48	-38
4	64	46	-18
5	86.5	83.5	-3
6	88	72	-16
7	104	65	-39
8	43	45	2
9	64	57	-7
10	81.5	80	-1.5
11	53	36	-17
12	58	63.5	5.5
13	52	30	-22
14	61	78	17
15	72	71	-1
16	91.5	82	-9.5
17	41	30	-11
18	76	77	1
19	58	30	-28
20	30	34	4
21	94	54.5	-39.5
22	92	82.5	-9.5
23	35	35	0
24	55	59.5	4.5
25	87	48.5	-38.5
26	56	52.5	-3.5
27	76	60.5	-15.5
28	91	66.5	-24.5
29	56	37	-19
30	105	91	-14
31	94	54.5	-39.5
32	100	63	-37

Participant Number	Time 1 administration	Time 2 administration	Difference score
33	39.5	35	-4.5
34	71	65	-6
35	111.5	79.5	-32
36	90	67	-23
37	82	54.5	-27.5
38	96	78.5	-17.5

Note: The 1992 Gouvier et al. study norming the Postconcussion Syndrome

Checklist found “normals” to have an average acute score of 53.76

Note: Those participants with negative difference scores reported symptom recovery while those with positive scores reported more symptoms at follow-up.

CHAPTER SIX

Discussion

Although a relationship between Coping Resources Inventory score and the number of postconcussional symptoms reported at follow-up was expected, it was not found in this study. It is not clear, based upon the review of the literature, why no relationship was found. However, one possible explanation for this finding may be the small number of participants who completed both the initial packet and the follow-up interview. Although having a total of 38 participants did not provide enough data points to include all of the variables that were proposed to be examined (most notably, the subscales of the CRI had to be left out of the multiple regression in hypothesis two), this number of participants appears to be the norm for studies in this area. A quick review of mild head injury studies showed that roughly 39 participants was the mean, and some studies were based on far fewer subjects. Those studies with more participants often looked at head injuries which had occurred in years past. Because a prospective look at the development of symptoms after MTBI was deemed to be more powerful and less available in the literature, patients in the acute phase of the head injury were needed for this study and were much more difficult to find. The average number of participants used in this area of research may simply not be

enough to uncover significant findings, however. The low number of participants in this study is very likely to have contributed to the lack of findings.

Twenty-one (55%) of the participants reported that their symptoms had not abated as much at three months as would be expected. More specifically, 55% of the participants reported total symptom scores higher than what non-injured people report, on average. (Refer back to Figure 4 and Table 5 for symptoms reported, noting that the 1992 Gouvier et al. study norming the Postconcussion Syndrome Checklist found “normals” to have an average acute score of 53.76). This suggests that three months may be too soon for neurological problems to have resolved for many people, and that the more psychologically-based persistent PCS might begin months later. Although most researchers in this area suggest that symptoms abate for most people at three months, another review of the literature shows that this, too, is controversial. Jagoda and Riggio (2000) state that 30% to 80% of patients are back to baseline at three months, but these patients still report susceptibility to symptoms that non-patients do not. They go on to state that only 15% continue to be symptomatic at one year post injury (Jagoda & Riggio, 2000). Mittenberg and Strauman (2000) cite a study showing that 94%-96% of patients are asymptomatic at three months. These are very different figures and it is unclear why these researchers found such different results. Legome (2001) reports that patients who do not get better before one year post-trauma probably will never get better. Therefore, a more conservative follow-up of one year as the point at which persistent PCS begins may have yielded different, and perhaps significant, results in the current study.

The lack of predictive value of the variables on the Past History Checklist, with the exception of subjective stress, was an unexpected finding. This, too, may be due to the small number of study participants or to the follow-up being placed at three months post-injury. In addition, all of the variables on the Past History Checklist were reduced to dichotomous variables or one-number ratings assessed by one simple question. This quick assessment did not provide much information about each of these variables or address them at any length. If each variable was assessed more comprehensively (which was beyond the scope of this study), the variables may have had a stronger relationship with resulting postconcussional symptoms.

The only variable with a significant relationship to total symptoms reported three months post-trauma was the participant's level of subjective stress at the follow-up. This finding is not necessarily contradictory to the coping hypothesis for the development of persistent postconcussional syndrome. Kibby and Long (1997) and Lezak (1995) state that postconcussional syndrome seems to reflect the victim's subjective stress level after the injury compounding upon the neurological damage. Furthermore, it is generally accepted that subjective stress is based upon a person's appraisals of the situations that make up her/his everyday life. If a person makes the appraisal that her/his resources are adequate for dealing with situations, they are seen as challenges that can be met (rather than threatening stressors which would raise the level of subjective stress) and dealt with in an effective, healthy manner (Matheny, Aycock, and McCarthy, 1993). Subjective stress is, therefore, an important part of the coping hypothesis. The appraisal of situational stress has to do with the amount

of coping resources people have at their disposal. Because the coping resources and subjective stress are so intertwined, it becomes more difficult to understand why the Coping Resources Inventory had so little relationship to PCS in this study.

Limitations and Areas of Future Research

Since this dissertation was exploratory in nature, there are several limitations and even more suggested directions for further research. Possibly the most obvious limitation of the current study is the number of participants who completed both the initial questionnaire and the follow-up phone call at three months. Although demographic information was collected, it was not analyzed due to the small number of participants and the focus on the coping hypothesis. It may well be that sex and/or age are important to recovery after MTBI, and some researchers have found effects for sex. Therefore, this limitation is a suggested area for further research.

It was difficult to control strictly some important aspects of the study. Perhaps most notable is the diagnosis of MTBI/concussion. The primary investigator was *not* the person responsible for making the diagnosis in most cases, and, as was discussed earlier, people have very different ideas about what constitutes a mild brain injury. Although problematic, this was somewhat tempered by the use of only one hospital's emergency room data as a referral source. Even if the different doctors had different ideas about what was and what was not a concussion, it might be assumed that there was some degree of similarity since they all worked in the same emergency

room.

Participants filled out the Postconcussion Syndrome Checklist on their own during the mail-out administration, but they completed the same checklist verbally over the phone during the follow-up. These, arguably, are very different experiences. In addition, during the verbal administration, the primary examiner was a “middle man” of sorts between the participant and her/his answers. For example, it is unknown if a participant who said that a symptom occurred “kind of often,” and was given a score of “3 – often” actually would have given herself a “3.” All attempts were made to cut down on this by asking the participants to be very specific, but there still may have been errors due to the verbal administration.

The only significant variable, a subjective stress rating, was assessed relatively crudely. Participants were simply asked how stressful they felt their lives were on average. It is realistic to assume that people had different ideas of what was being asked and, consequently, not a lot of information was provided about their subjective stress. The use of a standardized and piloted instrument assessing subjective stress is a suggestion for future research. Additionally, the other Past History Checklist variables were assessed very quickly. Each of these variables should be examined in more detail before being ruled out as important factors in predicting symptoms after MTBI.

Along with the limitation of Past History Checklist variables being assessed so quickly was the limitation that participants were being asked three months post-trauma about a traumatic event that more than likely left them confused and dazed.

Many may have forgotten if information was given to them or they may not have known if they truly lost consciousness. Memory was relied upon even more heavily for the variable of “prior concussions.” Some participants who stated they had been concussed in the past may not, in actuality, have met the criteria and some who said they had *not* may not have recalled that they had, indeed, suffered an injury of this type. Access to records and to witnesses of the trauma would have made for fewer limitations, but that simply was not a realistic option for the current study.

Because this study relied on participants to return materials with no prompting or supervision, selection bias was a distinct possibility. An example of selection bias is the absence of participants who endorsed the litigation/benefits variable. This is a flaw inherent in any study of this kind, however. (It should be noted that there was a good mix of participants with regards to age and sex (but not ethnicity) in this study. Additionally, individuals who endorsed a wide range of both acute and enduring symptoms participated.)

Summary

Although a review of the literature reveals disparate estimates of the incidence of brain injury, some speculate that up 7 million brain injuries ranging from mild to severe occur every year in the United States (Bennett and Raymond, 1997). The majority of these injuries result from motor vehicle accidents and sports injuries. Bennett and Raymond (1997) and Harrison (1997) estimate that around eighty-five

percent of all brain injuries can be classified as mild. These mild traumatic brain injuries should not be considered trivial, as there are often lasting sequelae which significantly affect an individual's daily functioning (Cullum & Thompson, 1997; Kibby & Long, 1997; Lezak, 1995).

After sustaining a mild traumatic brain injury, victims often report vague symptoms such as headache, fatigue, irritability, insomnia, anxiety, dizziness, depression, confusion, forgetfulness, inability to concentrate, and more (Auerbach, Levin, & Miner, 1990; Bennett & Raymond, 1997; Lezak, 1995; McSherry, 1989). These common post-injury symptoms are often called postconcussional syndrome, and they are thought to subside in the weeks after the injury. However, a significant number of patients take months (perhaps up to a year) to recover.

Postconcussional syndrome is a controversial diagnosis (Auerbach, Levin, & Miner, 1990; Binder, 1986; Cicerone & Kalmar, 1995; Lezak, 1995), as it is often viewed as a product of malingering, disability claims and litigation, and accident neurosis. It has been suggested throughout the literature that persistent postconcussional symptoms may have to do with stress, especially stress management and situational stress, rather than malingering and secondary gain. There has been clinical and research-based evidence that variables such as a history of head injury, length of loss of consciousness, litigation- or benefit-seeking after the injury, and the victim's awareness of possible sequelae (and their likelihood to resolve) have an impact on the development of postconcussional syndrome as well.

This study examined the coping hypothesis for the development of persisting

postconcussional symptoms. This theory posits that the progression of postconcussional syndrome begins when mild traumatically brain injured people return to stressful situations (such as work or school) while they are still in the acute phase of recovery. In these situations, cognitive and memory weaknesses become readily apparent to the victims. The theory goes on to state that individuals begin to feel even more stress as they are not able to meet expectations they met easily in the past. If coping resources are not adequate to deal with the daily stress and the added stress of the acute symptoms, postconcussional symptoms are hypothesized to develop, linger, and even become stronger (Binder, 1986; Haglin, 1996; Kay, n.d.; Kibby & Long, 1997; Lezak, 1995). Kay (n.d.) called this phenomenon “psychological overlay,” which is a secondary psychological reaction to neurologically based symptoms that causes even further distress.

Following the coping hypothesis, it was hypothesized in this study that there would be a significant relationship between the coping resources available to participants and the amount of symptoms they reported three months post-trauma. Specifically, it was expected that participants who had high total scores on the Coping Resources Inventory would be better able to deal with the added stress of the acute sequelae and would not develop “psychological overlay” that might further exacerbate their syndrome and cause them to report continued or increased postconcussional symptoms. No relationship was found between total Coping Resources Inventory total scores and symptoms reported at three months, however.

Additionally, several other variables that are supported by the literature and by

clinical wisdom were analyzed to see if they were significant predictors of participants' development of persistent postconcussional syndrome. These variables were: a history of one or more previous concussions, the receipt of information at the time of the trauma about what symptoms might be expected and when they should resolve, loss of consciousness versus no such loss, a subjective rating of everyday life stress, and whether or not disability benefits and/or legal action was being taken related to the trauma. The benefits/litigation variable was dropped from the study when none of the participants endorsed it. The only variable with a significant relationship to symptoms reported at three months post-trauma was the individual's subjective stress rating.

Although coping resources as measured by the CRI were not correlated with symptoms at three months, this study does not necessarily refute the coping hypothesis. Subjective stress is an important part of the coping hypothesis. A rating of subjective stress is based upon a person's appraisals of the situations that make up her/his everyday life. If a person makes the appraisal that her/his resources are adequate for dealing with situations, they are seen as challenges that can be met (rather than threatening stressors) and dealt with in an effective, healthy manner (Matheny, Aycock, and McCarthy, 1993). However, because coping resources and subjective stress are so interrelated, it is difficult to understand why the Coping Resources Inventory had so little relationship to PCS in this study.

The current findings suggest that the time post-trauma at which symptoms are expected to resolve needs to be clarified and one strict definition of mild head injury

needs to be used for research in this area. In addition, more participants appear to be needed for studies of this type. Any or all of these problems may have contributed to the lack of significant findings in this study. Future research should, however, continue in the vein of prospective analysis of the development of persistent postconcussional syndrome, even though it is more difficult than larger, retrospective studies.

It is hoped that this study might help future researchers further refine the coping hypothesis for the development of persistent postconcussional syndrome and make greater strides toward aiding the millions of people who have experienced a mild traumatic brain injury. In talking with the participants of this study, it was clear that many of them were confused about what a concussion really meant and unsure of what they might expect following a head injury of this type. With more research in this field, their questions can be answered and the incidence of persistent postconcussional syndrome can be greatly reduced.

Appendix A

Consent and Confidentiality

Consent and Confidentiality

Re: Participation in the “Coping resources and the development of persistent postconcussional syndrome after a mild traumatic brain injury” study

Hello!

My name is Barbara Sparrow and I am a graduate student in Counseling Psychology at the University of Texas at Austin working with Brackenridge hospital on my dissertation study. Because you recently suffered a concussion or head injury, you have been selected to take part in a dissertation study investigating the place of coping in recovery after a concussion/mild traumatic brain injury. I invite you to be one of 90 participants in the study, and **in return for your completion of the study, I will enter you in a drawing for one of two \$100 gift certificates to a store, mall, or restaurant of your choice.**

If you choose to participate, you will answer some questions (by completing and returning the pages that follow and in a few months by phone) about your concussion. You are being asked to fill out two short questionnaires today. For the first questionnaire, you will be asked to check off any physical and cognitive symptoms you are currently experiencing. The second questionnaire will ask you some brief questions about yourself.

If you choose to continue to participate, I will call you about two - three months from now and ask you if you are still having any symptoms. In addition, I will ask you 5 short questions about yourself. The phone interview should take no longer than 10-15 minutes. You may discontinue participation at any time.

Any information obtained in connection with this study and that can be identified with you will remain completely confidential, and neither your name nor any of your identifying information will appear in any reports. Any disclosure of your information will be made with your permission only. You may choose to discontinue participation at any time. **Participation in this study will not harm/help any litigation in connection with your injury.**

If you have any questions now or at any time in the future, please contact me at (512) 335-7988. My address is 10051 Woodland Village Drive, Austin, Texas, 78750. You may also contact my advisor, Margaret Semrud-Clikeman, at (512) 471-4407.

Please sign below to indicate you understand your participation in the study, and return the stapled pages in the envelope provided. Your signature indicates your willingness to participate. You may save the enclosed copy of this form for your records.

Thank you so much for your time. Your participation is much appreciated!

Barbara J. Sparrow, M.A.

Signature

Date

Appendix B

Coping Resources Inventory

For each of the sixty statements that follow, indicate the number from 1 to 4 that **best** described you **one or two months before** you sustained your **concussion/mild brain injury**, even if you don't feel that way now. For each statement, circle the number before each statement that best describes you at that time:

1	2	3	4
Never or rarely	Sometimes	Often	Always or almost always

- | | | | | |
|----------|----------|----------|----------|---|
| <i>1</i> | <i>2</i> | <i>3</i> | <i>4</i> | 1. I had plenty of energy. |
| <i>1</i> | <i>2</i> | <i>3</i> | <i>4</i> | 2. I said what I needed or wanted without making excuses or dropping hints. |
| <i>1</i> | <i>2</i> | <i>3</i> | <i>4</i> | 3. I liked myself. |
| <i>1</i> | <i>2</i> | <i>3</i> | <i>4</i> | 4. I was comfortable with the number of friends I had. |
| <i>1</i> | <i>2</i> | <i>3</i> | <i>4</i> | 5. I ate junk food. |
| <i>1</i> | <i>2</i> | <i>3</i> | <i>4</i> | 6. I felt as worthwhile as anyone else. |
| <i>1</i> | <i>2</i> | <i>3</i> | <i>4</i> | 7. I was happy. |
| <i>1</i> | <i>2</i> | <i>3</i> | <i>4</i> | 8. I was comfortable talking to strangers. |
| <i>1</i> | <i>2</i> | <i>3</i> | <i>4</i> | 9. I was part of a group, other than my family, that cared about me. |
| <i>1</i> | <i>2</i> | <i>3</i> | <i>4</i> | 10. I accepted the mysteries of life and death. |
| <i>1</i> | <i>2</i> | <i>3</i> | <i>4</i> | 11. I saw myself as loveable. |
| <i>1</i> | <i>2</i> | <i>3</i> | <i>4</i> | 12. I actively looked for the positive side of people and situations. |
| <i>1</i> | <i>2</i> | <i>3</i> | <i>4</i> | 13. I exercised vigorously 3-4 times per week. |
| <i>1</i> | <i>2</i> | <i>3</i> | <i>4</i> | 14. I accepted compliments easily. |
| <i>1</i> | <i>2</i> | <i>3</i> | <i>4</i> | 15. I showed others when I cared about them. |
| <i>1</i> | <i>2</i> | <i>3</i> | <i>4</i> | 16. I believed that people were willing to have me talk about my feelings. |
| <i>1</i> | <i>2</i> | <i>3</i> | <i>4</i> | 17. I could show it when I was sad. |
| <i>1</i> | <i>2</i> | <i>3</i> | <i>4</i> | 18. I was aware of my good qualities. |
| <i>1</i> | <i>2</i> | <i>3</i> | <i>4</i> | 19. I expressed my feelings to close friends. |
| <i>1</i> | <i>2</i> | <i>3</i> | <i>4</i> | 20. I could make sense out of my world. |
| <i>1</i> | <i>2</i> | <i>3</i> | <i>4</i> | 21. My weight was within 5 lbs. of what it should have been. |
| <i>1</i> | <i>2</i> | <i>3</i> | <i>4</i> | 22. I believed in a power greater than myself. |
| <i>1</i> | <i>2</i> | <i>3</i> | <i>4</i> | 23. I actively pursued happiness. |
| <i>1</i> | <i>2</i> | <i>3</i> | <i>4</i> | 24. I could tell other people when I was hurt. |
| <i>1</i> | <i>2</i> | <i>3</i> | <i>4</i> | 25. I encouraged others to talk about their feelings. |
| <i>1</i> | <i>2</i> | <i>3</i> | <i>4</i> | 26. I liked my body. |
| <i>1</i> | <i>2</i> | <i>3</i> | <i>4</i> | 27. I initiated contact with people. |
| <i>1</i> | <i>2</i> | <i>3</i> | <i>4</i> | 28. I confided in my friends. |

<i>1</i>	<i>2</i>	<i>3</i>	<i>4</i>	29. I could cry when sad.
<i>1</i>	<i>2</i>	<i>3</i>	<i>4</i>	30. I want to be of service to others.
<i>1</i>	<i>2</i>	<i>3</i>	<i>4</i>	31. I could say what I needed or wanted without putting people down.
<i>1</i>	<i>2</i>	<i>3</i>	<i>4</i>	32. I accepted problems I could not change.
<i>1</i>	<i>2</i>	<i>3</i>	<i>4</i>	33. I knew what is important in life.
<i>1</i>	<i>2</i>	<i>3</i>	<i>4</i>	34. I admitted when I'm afraid of something.
<i>1</i>	<i>2</i>	<i>3</i>	<i>4</i>	35. I enjoyed being with people.
<i>1</i>	<i>2</i>	<i>3</i>	<i>4</i>	36. I was tired.
<i>1</i>	<i>2</i>	<i>3</i>	<i>4</i>	37. I expressed my feelings clearly and directly.
<i>1</i>	<i>2</i>	<i>3</i>	<i>4</i>	38. Certain traditions played an important part in my life.
<i>1</i>	<i>2</i>	<i>3</i>	<i>4</i>	39. I expressed my feelings of joy.
<i>1</i>	<i>2</i>	<i>3</i>	<i>4</i>	40. I could identify my emotions.
<i>1</i>	<i>2</i>	<i>3</i>	<i>4</i>	41. I attended church or religious meetings.
<i>1</i>	<i>2</i>	<i>3</i>	<i>4</i>	42. I did stretching exercises.
<i>1</i>	<i>2</i>	<i>3</i>	<i>4</i>	43. I ate well-balanced meals.
<i>1</i>	<i>2</i>	<i>3</i>	<i>4</i>	44. I prayed or meditated.
<i>1</i>	<i>2</i>	<i>3</i>	<i>4</i>	45. I accepted my feelings of anger.
<i>1</i>	<i>2</i>	<i>3</i>	<i>4</i>	46. I sought to grow spiritually.
<i>1</i>	<i>2</i>	<i>3</i>	<i>4</i>	47. I could express my feelings of anger.
<i>1</i>	<i>2</i>	<i>3</i>	<i>4</i>	48. My values and beliefs helped me to meet daily challenges.
<i>1</i>	<i>2</i>	<i>3</i>	<i>4</i>	49. I put myself down.
<i>1</i>	<i>2</i>	<i>3</i>	<i>4</i>	50. I got along well with others.
<i>1</i>	<i>2</i>	<i>3</i>	<i>4</i>	51. I snacked between meals.
<i>1</i>	<i>2</i>	<i>3</i>	<i>4</i>	52. I took time to reflect on my life.
<i>1</i>	<i>2</i>	<i>3</i>	<i>4</i>	53. Other people liked me.
<i>1</i>	<i>2</i>	<i>3</i>	<i>4</i>	54. I laughed wholeheartedly.
<i>1</i>	<i>2</i>	<i>3</i>	<i>4</i>	55. I was optimistic about my future.
<i>1</i>	<i>2</i>	<i>3</i>	<i>4</i>	56. I got enough sleep.
<i>1</i>	<i>2</i>	<i>3</i>	<i>4</i>	57. My emotional life was stable.
<i>1</i>	<i>2</i>	<i>3</i>	<i>4</i>	58. I felt that no one cared about me.
<i>1</i>	<i>2</i>	<i>3</i>	<i>4</i>	59. I was shy.
<i>1</i>	<i>2</i>	<i>3</i>	<i>4</i>	60. I was in good physical shape.

Appendix C

Postconcussion Syndrome Checklist

Postconcussion Syndrome Checklist

Date: _____
 Your age: _____
 Sex: _____
 Ethnicity: _____

Please rate (using the numbers provided below) the frequency, intensity, and duration of each of the following symptoms based on how they have affected you today [first administration]/ in the past two weeks [phone follow-up] according to the following scale:

FREQUENCY	INTENSITY	DURATION
1=Not at all	1=Not at all	1=Not at all
2=Seldom	2=Vaguely present	2=A few seconds
3=Often	3=Clearly present	3=A few minutes
4=Very often	4=Interfering	4=A few hours
5=All the time	5=Crippling	5=Constant

	FREQUENCY	INTENSITY	DURATION
Headache	_____	_____	_____
Dizziness	_____	_____	_____
Irritability	_____	_____	_____
Memory problems	_____	_____	_____
Difficulty concentrating	_____	_____	_____
Fatigue	_____	_____	_____
Visual disturbances	_____	_____	_____
Aggravated by noise	_____	_____	_____
Judgment problems	_____	_____	_____
Anxiety	_____	_____	_____

Appendix D

Past History Variables Checklist

Past History Variables Checklist

PHONE ADMINISTRATION

	YES	NO
1. Did you lose consciousness when you were injured a few months ago? LOC		
2. Were you given any information at the hospital or told by your doctor or nurse or anyone about what symptoms to expect after your injury? INF		
3. Have ever you had a head injury or concussion before this one? PHI		
4. Are you involved in any litigation or any action surrounding disability benefits since the injury? LIT		
5. How would you rate your everyday stress level on a scale from 1-10?		

Appendix E

Phone Script for the Follow-up Telephone Call

Hello! This is Barbara Sparrow and I am a UT graduate student doing a research study in conjunction with Brackenridge Hospital. You took part in a mail-out survey having to do with your concussion or head injury about three months ago. Do you remember filling out the short questionnaires and mailing them to me a few months ago?

This is the final part of the study – it should take less than ten minutes. Is now a good time for you or can I set up a time to call back? Are you able to answer questions with privacy right now? (What is a better time to reach you?)

All that's going to happen today is that I'll ask you about some of the symptoms from the checklist you completed three months ago as well as ask you a few short questions about yourself. After we'll done you'll be entered into the drawing for one of two \$100 gift certificates. It looks like there will be about 40 participants in this study in all. I'll call you in mid-April if you are one of the winners.

You may refuse participation in this study at any time. Participation in this study will not help/harm any litigation in connection with your injury, as I will not give out any information you give to me or become involved in any other way. Any responses you give today will be kept as confidentially as those from the mail-out

packet – I am the only one who will see your answers and everything will be kept in a locked file cabinet. In addition, your name will not appear on any of your answers; a code number will be used instead.

Do you have any questions before we begin? Let me know if you have any questions during our call and I'll be happy to answer them!

(At the end of the interview) Do you have any questions? Thank you so much for your time and participation. I really appreciate it!

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