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# Examining the Effect of Education Type on Common Misconceptions of Traumatic Brain Injury

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Examining the Effect of Education Type on Common Misconceptions of Traumatic Brain Injury  
by  
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Bachelor of Arts, Aurora University, 2013

A Thesis Submitted In Partial Fulfillment of the Requirements for the  
Master of Science in Experimental Psychology with a Concentration in Behavioral Neuroscience

In

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EXAMINING THE EFFECT OF EDUCATION TYPE ON COMMON MISCONCEPTIONS  
OF TRAUMATIC BRAIN INJURY

By

Monica De Iorio

Approved By:



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Susan A. Nolan, Faculty Mentor



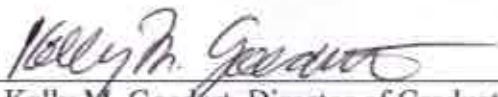
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## Table of Contents

Approval Page.....	iii
Acknowledgments.....	iv
Table of Contents.....	v
List of Figures.....	vi
List of Tables.....	vii
Abstract.....	viii
Introduction.....	1
Prevalence and Neurophysiology of Traumatic Brain Injury.....	2
Cognitive and Behavioral Sequelae.....	4
Stigma, Misconception, and Misattributions.....	7
Call for Education.....	11
The Current Study.....	16
Method.....	20
Participants.....	20
Demographics Form.....	24
Design and Procedure.....	24
Results and Discussion.....	26
TBI Misconceptions.....	27
Misattributions.....	30
General Discussion.....	36
Limitations.....	36
Future Directions.....	37

## List of Figures

Figure 1.....	28
Figure 2.....	32
Figure 3.....	33

## List of Tables

Table 1. ....	27
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## Abstract

It has been widely shown that misconceptions related to traumatic brain injury (TBI) are held among both family members of people with TBI and the general public. These misconceptions have the potential to increase the distress of people with TBI and negatively impact rehabilitation processes. Although increased education has often been suggested to reduce misconceptions, few studies have examined which methods are most effective in providing information to the public. In the current study, I investigated the effects of existing education materials – either a TBI factsheet or personal stories of people with TBI. These materials are currently easily accessible online, but the effect they have on those who read them has not been studied. I explored the influence of these tools on both misconceptions of TBI and misattributions of behavior resulting from injury to life stage (i.e., adolescence). Results suggest that, on average, factsheets may be more effective for increasing knowledge about TBI than personal stories or a control group. Personal stories may be more useful, on average, for decreasing misattributions, as compared to a control group.

**Keywords:** traumatic brain injury, education, misconception, attribution, factsheet, personal stories

## Introduction

In the United States there was an estimated average annual incidence of 1.7 million traumatic brain injuries (TBIs) for the years between 2002 and 2006 (Faul, Xu, Wald, Coronado, & Dellinger, 2010). Although improved diagnostic and treatment methods decreased mortality of patients with TBI between 1970 and 1990, since then mortality rates have remained relatively stagnant and incidence rates have risen (Roozenbeek, Maas, & Menon, 2013). These injuries can be caused by a wide variety of events, and the resulting injuries lead to sequelae that can differ according to severity and location of injury. Despite the variability, commonalities exist (Gennarelli, 1986; Lux, 2007). For example, people with TBI often have some similar experiences with respect to rehabilitation and adjustment to life after injury (Conneeley, 2012). Depending on the severity of the injury, this may include taking time away from work or school or staying in a rehabilitation facility for some time, along with an eventual reintegration into home-life, work, or school.

The rehabilitation process can be further complicated by interactions with other people. Among the general population, there is a lack of knowledge about what TBI is, the problems that result from TBI, and the rehabilitation process (Gouvier, Prestholdt, & Warner, 1988). Exacerbating the lack of knowledge, TBI is often an invisible injury, one which cannot be perceived by simply looking at the person (McClure, 2011). Consequently, when people with TBI experience difficulty in daily life, their challenges are often misattributed to a personality flaw rather than to the TBI (McClure, Devlin, McDowall, & Wade, 2006; McClure, Buchanan, McDowall, & Wade; 2008). Although the lack of knowledge related to TBI has been substantiated in a variety of studies, few have explored ways to ameliorate this problem. In the

current study, I propose to investigate two types of existing educational materials to determine effectiveness at decreasing misconceptions and misattributions.

### **Prevalence and Neurophysiology of Traumatic Brain Injury**

Traumatic brain injury is damage due to blunt force or acceleration/deceleration of the head resulting in at least one of a set of identified symptoms (Lux, 2007). These injuries may be either open or closed. An open TBI is one in which the skull has been opened, as would be seen with a gunshot wound, and the brain has been exposed to air, whereas a closed TBI does not expose the brain to air, as would be seen in a TBI from whiplash (Lux, 2007). The possible causes of TBI are wide-ranging and include car crashes, physical abuse, falls, and sports injuries or injuries from battle (Gennarelli, 1986).

In addition to variability in cause, TBIs are classified on a spectrum of severity. A TBI may be mild, moderate, or severe, and injuries within each category can also range in presentation and consequence. One of the major tools for classification is the Glasgow Coma Scale (GCS; Alexander, 1995; Gennarelli, 1986). The GCS measures reflexes and levels of responsiveness to various questions, as well as, to stimuli like pain and sound (Silver, McAllister, & Yudofsky, 2011). Scores may range from three to 18, with higher scores indicating higher functioning (Campbell, Greenberg, & Weil, 2012).

Mild traumatic brain injury is the most common type of TBI. It is also known as a concussion and is classified with a GCS score of 13-15 with less than a 30-minute period of loss of consciousness (Silver et al., 2011). Individuals who have experienced a mild TBI often have a faster recovery and fewer long-term problems than people with more severe injuries. However, mild TBI has been associated with some chronic memory problems (Riggio & Wong, 2009).

Moderate traumatic brain injury is classified with a GCS score of 9-12 with loss of consciousness lasting no more than one day (Silver et al., 2011). People with moderate TBI have reported a wide variety of challenges, including memory and concentration difficulty and headaches (Vitaz, Jenks, Raque, & Shields, 2003).

Over 24 hours without consciousness indicates a severe TBI and a GCS score of 3-8 (Silver et al., 2011). These injuries are less common, but can be extremely debilitating. For example, in Germany, people with severe TBI have been found to be more likely than those with mild or moderate TBI to be unemployed, suffer from mental illness, and experience social problems even 10 years post injury (Andruszkow et al., 2013).

Despite the differences between the three severity categories, the pathophysiology that underlies the injury is much the same. Traumatic axonal injury has been identified as a possible underlying mechanism of TBI (Povlishock, 1993; Silver et al., 2011). In other words, the challenges faced by people with TBI likely result from damaged neurons. Neurons are the communication system within the brain, and axons are the part of the cells that send outgoing messages to muscles and other neurons both within the brain and throughout the rest of the body (Krebs, Weinberg, & Akesson, 2012). Depending on the location and severity of the damaged axons, the damage can be extremely incapacitating.

Traumatic axonal injury is now known to be a process that occurs over time, and not only upon direct impact (Lux, 2007; Povlishock, 1993). The process involves the stretching of ion channels and allowing an influx of calcium molecules that, at the lowest level, results in a temporary inhibition of action potential (Gennarelli, 1996). If the abnormal ion influx is such that the cell can no longer return to homeostasis, the axon may swell and the excess calcium may initiate a sequence of events that will lead to disintegration of the cell or disconnection of white

matter tracts (Gennarelli, 1996; Polishock, 1993; Sharp et al., 2011; for review see Raghupathi, 2004).

Traumatic brain injury also results in differing effects depending on where the damage is localized; it is common that damage in TBI is diffuse (Polvishock, 1993). However, because of the way that the brain is situated within the skull and how it is typically impacted by various types of force, damage from TBI tends to follow a certain pattern (Lux, 2007). This is part of the reason why many types of TBI have common cognitive and behavioral sequelae. The frontal lobe, as well as the anterior temporal region tend to be most commonly damaged and may lead to various mood and memory symptoms (Lux; Riggio & Wong, 2009). Despite these patterns, Polvishock found evidence that axonal damage is typically widespread through the brain and this diffuse occurrence may contribute to difficulty of treatment.

### **Cognitive and Behavioral Sequelae**

For most people with TBI, the physiological damage to the brain results in cognitive and behavioral challenges in daily life. A few common issues involve difficulty with emotional control, memory, and attention (Riggio & Wong, 2009; for review see Lux, 2007). Each of these issues does not occur in every case, and it also can be hard to tell if problems with emotional control, memory or attention are related to the TBI. Comparing pre-injury behavior to post-injury behavior can be an important indicator of which cognitive and behavioral challenges are related to the injury and which were pre-existing (McClure & Abbott, 2009).

Immediately after a TBI, people often experience a period of amnesia (Silver et al., 2011). This is generally transient, but difficulties in sustained attention and working memory tasks are likely to be long-lasting. Working memory deficiencies tend to be larger when the task is more demanding (Vallat-Azouvi, Pradat-Diehl, & Azouvi, 2009). For instance, Vallat-Azouvi

and colleagues found that, on average, people with TBI were less successful at repeating an experimenter's actions when there was a longer time after the initial demonstration and with more behavior to mimic. People with TBI have been shown to have persisting working memory problems after 4 months of therapy and also 5 years post injury (Levin et al., 2002; Slovarp, Azuma, & Lapointe, 2012).

Understanding working memory impairments is complicated, even when using neurological, behavioral, and qualitative data. In one study, participants with mild TBI and a group of healthy controls completed an *n*-back test of working memory while receiving a brain scan. The participants listened to a string of letters and identified when a letter matched a previous letter either 1, 2, or 3 times back (McAllister et al., 2001). The results of this study showed no statistically significant difference between patient and control ability to correctly identify matched letters between groups, but there was a mean difference in brain activation (McAllister et al., 2001). On average, people with mild TBI had more brain activity than healthy individuals during the 2 *n*-back test and self-reported more problems with cognition and memory during a battery of neuropsychological tests and questionnaires (McAllister et al., 2001). The differences in brain activation and reported problems may indicate that even when performing at a similar success rate, on average, people with TBI may experience more difficulty than healthy individuals with completing working memory tasks.

Additionally, changes in working memory may be non-linear. Levin and colleagues (2004) found that people with severe TBI tend to show improvement in working memory over the first year post injury; however, two years later, the same people tend to regress, performing at levels similar to those at the time of injury. Such fluctuation in working memory function could

be confusing and frustrating to both people with TBI and to family members or the general public who are trying to understand TBI.

Although less evidence exists showing attentional impairments after TBI, attentional difficulties have potential to impede upon daily life (Slovarp et al., 2012). On average, people with TBI often perform more poorly than healthy individuals on sustained attention tasks and divided attention tasks (Slovarp et al., 2012; Silver et al., 2011). For example, Slovarp and colleagues found individual variability in the ability of people with TBI to spend 10 minutes identifying whether or not a target letter matched one of three letters listed below it. The results from the study also showed a positive correlation between success on the sustained attention task and success on a working memory task (Slovarp et al., 2012). The correlational results suggest that problems with working memory and attention may be connected.

Beyond cognitive challenges, changes in emotionality have been reported. People with TBI tend to be quick to anger and exhibit aggressive behavior, both verbally and physically (Baguley, Cooper, & Felmingham, 2006; James & Young, 2013; Tateno, Jorge, & Robinson, 2003). Even if a person with TBI does not present with aggression, he or she may lack some emotional control in general. This may manifest in a lack of empathy; for example, people with TBI have been found to be less likely than others to smile or frown in response to seeing pleasant or negative images (Sousa, McDonald, & Rushby, 2012).

Cognitive and behavioral difficulties, like those discussed above, are addressed in long rehabilitation processes that often do not eliminate symptoms entirely, but rather, help people to function in spite of challenges (Conneeley, 2012). Techniques to optimize memory, attention, and emotional control after TBI vary tremendously and there is much work to be done in regard to determining the best course of action. However, regardless of rehabilitation type, there is a

goal of smooth reintegration into the home environment (if removed for a period of time) and into a school or work setting (Zonfrillo, Durbin, Winston, Zhang, & Stineman, 2014). This adjustment process both for the injured person and his or her family and acquaintances is often challenging because of the cognitive and behavioral changes resulting from the injury. Both people with TBI and family members have indicated that even after reintegration has occurred, there is a desire for continued support from professionals and a need for further information (Turner, Fleming, Ownsworth, & Cornwell, 2011).

### **Stigma, Misconception, and Misattributions**

People with physical or mental disabilities that differentiate them from others are often stigmatized by the general public (Ionta & Scherman, 2007). For example, people often try to avoid social interaction with people who have disabilities (Martin, Pescosolido, & Tuch, 2000). As a consequence, it can be difficult for individuals with physical or mental disabilities to get hired or to be included at social events. In addition, they may lose friends that they had before the injury (Joachim & Acorn, 2000).

Contrary to the experience of most people with other physical disabilities, many people with TBI do not experience such stigmatizing behavior, likely because TBI is an invisible injury (for review, see McClure, 2011). One exception, however, is people with TBI who also struggle with motor problems; these people have reported losing friends and feeling devalued by society, a further indication that observable problems may be what prompt stigmatizing behaviors from others (Gelech & Desjardins, 2010). Morton and Wehman (1995) have reviewed the literature on severe TBI and found a pattern of social difficulties for people with severe TBI. This may be because the injury is more salient to observers of a person with severe TBI. Alternatively, people with severe TBI are more likely to live at home and have less of a desire to be in social situations



(Morton and Wehman, 1995). Decreased desire and opportunity for social interaction may then contribute to a decrease in meaningful relationships.

Stigma can be damaging to the individuals who experience it. For this reason, many programs exist with the purpose of eliminating beliefs that could lead to rejection of people with stigmatized conditions (Corrigan, Morris, Michaels, Rafacz, & Rusch, 2012). Even though the invisibility of TBI seems to lead to a lack of stigmatizing behavior, it also has the potential to create a different problem (Joachim & Acorn, 2000). The abilities of people with visible injuries are generally underestimated, but the abilities of people with invisible injuries tend to be exaggerated (Swift & Wilson, 2001). Swift and Wilson interviewed 19 people with TBI and found agreement among all participants that people in the general public have misconceptions regarding what is to be expected in TBI recovery. One theme repeated by participants was that people without TBI expected that any issues from the injury would improve once physical symptoms improved (Swift & Wilson, 2001). In this way, the challenges faced by people with TBI may be downplayed or ignored. Hence, when a person with TBI struggles in a task that they would otherwise be expected to accomplish, he or she can elicit negative treatment from those around him or her (McClure, 2011). Alternatively, people with TBI may believe that memory or attentional issues are normal and may not seek rehabilitation as a result (McClure, 2011).

Because people with TBI can be negatively affected by misconceptions held by the general public, the need for information extends beyond the immediate family of people with TBI (Farmer & Johnson-Gerard, 1997; Gouvier et al., 1988; Guilmette & Paglia, 2004; Willer, Johnson, Rempel, & Linn, 1993). Gouvier and colleagues surveyed people at an American shopping mall to determine the extent of TBI knowledge in the public. Results showed misconceptions about unconsciousness, amnesia, and recovery, with 70% of participants

endorsing the idea that effort is the main factor determining the extent of recovery for people with TBI (Gouvier et al., 1988). Farmer and Johnson-Gerard found that such misconceptions also existed in a population of educational professionals who came in contact with TBI, and to a lesser degree, these misconceptions were held by rehabilitation staff. Not only do various groups of people hold misconceptions, but research by Guilmette and Paglia (2004) revealed no significant differences in mean levels of misconceptions related to TBI over time – between samples from Louisiana, Canada, and New York in 1988 and 1993 and a sample of people in the Northeast United States in 2002. These findings indicate that the misconceptions seem to have persisted across time.

People experiencing TBI seem to notice others' misconceptions. People with TBI have reported feeling misunderstood by others when they find certain tasks to be challenging or when they are unable to perform as expected (Swift & Wilson, 2001). What they are describing is likely a misattribution problem. Partially due to the lack of visibility and lack of information, people without TBI tend to attribute any problems observed to personal flaws (e.g., laziness or impatience) or a person's age (e.g., adolescence), rather than to the person's injury (McClure et al., 2006; McClure et al., 2008; for review see McClure, 2011). People have a tendency to ignore whether the injured person exhibited such kinds of problematic behavior before the injury occurred.

Misattributions have been found to occur even when people have been directly told that someone has experienced a TBI (McClure et al., 2006; McClure et al., 2008). McClure and colleagues (2006) had participants read a vignette that explained four behavioral changes that occurred after an adolescent boy experienced a TBI. The behaviors discussed in the vignette were used because they are equally likely to result from a TBI as they are from entry into

adolescence. Participants read the vignette and viewed a picture of an adolescent boy with or without a head bandage. They then rated the likelihood that behavioral changes resulted from adolescence or TBI (McClure et al., 2006). The results showed that people were more likely to attribute behavioral change to adolescence when the picture showed no bandage, whereas the visible injury led to no significant difference in ratings for adolescence and TBI (McClure et al., 2006). The misattribution pattern was replicated in a later study using the same paradigm, but with a photo of a person with a head scar instead of a bandage (McClure et al., 2008). People who read the vignette and saw a photo of a boy with a scar, as opposed to those who saw the boy without a scar gave higher average ratings of the severity of injury (McClure et al., 2008). The results that people tend to misattribute more when injuries are invisible, and are more likely to rate an invisible injury as less severe, are in line with the idea that people expect behavioral sequelae to decrease along with physical signs of injury.

In contrast to this result, Linden and McClure (2012) found that computer science students, compared with nursing students, did not show mean differences in attributions of behavioral changes according to whether they saw a photo of a person with a scar, head bandage, or no marker of injury. The researchers speculated that several factors may have led to this pattern of results. The photo used in this study was black and white instead of color. The degradation of the black and white photo may have made the differences between pictures less prominent and lessened the effect (Linden & McClure, 2012). Also, the sample of computer science students had more men than women, while the sample of nursing students had more women than men (Linden & McClure, 2012). The gender imbalance was also an issue because women have been found to have more positive opinions toward disadvantaged groups (Chambers et al., 2009). The influence of visibility in this study may have been moderated by gender-related

attitude trends. On the other hand, the salience of visual markers for medical professionals might lead to reduced attention to the needs of people without physical signs of injury (Linden & McClure, 2012). This would explain why there was an attribution difference found in the nursing student sample, but not among the computer science students.

Incidences of misconceptions and misattributions can have numerous negative effects on people with TBI and their course of rehabilitation. As noted previously, people with TBI and those closest to them have noticed such misattributions and misunderstandings. Pappadis, Sander, Struchen, Leung, and Smith (2011) noted that experiencing such misunderstandings can lead to feelings of inadequacy and frustration for people with TBI. Considering that one goal of rehabilitation is community reintegration, such frustration related to interacting in public settings may slow, or even set back, progress (Wood, Novack, & Long, 1984). Rehabilitation may also not be sought at all, because of acceptance of the notion that troubles are experienced by everyone or that any difficulties experienced will go away on their own in a short time (Gouvier et al., 1988; Pappadis et al., 2011). Despite the possible effects that attributions may have on the actions of people with TBI, it is important to note that behavior does not always align with attribution beliefs (Adekeye & Adeusi, 2011).

### **Call for Education**

Much research indicates a lack of knowledge among the general public about TBI. At the end of most reports of research on this topic, authors suggest that these problems need to be addressed through increased educational efforts (e.g., Gouvier et al., 1988; Guilmette & Paglia, 2004; Pappadis et al., 2011). Nevertheless, there seems to be a gap in the literature that examines how this education should occur and what might be most effective. Although there are few studies examining education about TBI, it is clear that it is important to test educational tools.

Research of educational methods in other areas of health have shown that not every effort leads to desirable results (e.g., Tolomiczenko, Goering, & Durbin, 2001).

One study addressed the question of what kind of education might be useful for TBI through examining the effect of oral histories as a way of conveying information about TBI (Fraas & Calvert, 2006). The researchers videotaped interviews that allowed the people with TBI to discuss their lives before and after their injury (Fraas & Calvert, 2006). Undergraduate and graduate students studying communication sciences, as well as practicing speech language pathologists, completed a 10-item questionnaire regarding beliefs about TBI before and after listening to a 30-minute audio of oral histories given by people with TBI (Fraas & Calvert, 2006). It was found that, on average, the oral histories increased positive attitudes about recovery from TBI compared with attitudes held before listening to the oral histories. However, the questionnaire focused specifically on speech and language difficulties and attitudes surrounding how helpful therapy can be; general knowledge about TBI sequelae was not addressed (Fraas & Calvert, 2006).

The researchers in the study examining the effect of oral histories on TBI knowledge created a new educational tool based on interviews with people with TBI (Fraas & Calvert, 2006). The answers from the interviews became the oral histories used for education in the study (Fraas & Calvert, 2006). There are also pre-existing educational tools that need to be assessed for efficiency and effectiveness. Research on the effectiveness of educational materials can ensure that efforts and resources are working, and can prevent unexpected and unwanted effects of education. For instance, Corrigan, Watson, Warpinski, and Garcia (2004) found that, on average, education materials highlighting an association between violence and mental health problems led participants to be more likely to avoid people with mental illness and to support services that

coerced people into treatments. In another study, Tolomiczenko and colleagues (2001) observed unintended negative effects of a video meant to educate about mental illness and homelessness, while controlling for previous exposure to a homeless population. On Average, participants who viewed a video about mental illness in homeless populations associated more danger with homeless people and reported more negative attitudes after exposure to the video than they had before (Tolomiczenko et al., 2001).

There are many types of educational methods, including factsheets and blogs. Methods such as these may be desirable because they could be easily disseminated from hospitals and schools (Guidry, Fagan, & Walker, 1998). Research has examined the effectiveness of printed materials in increasing knowledge, promoting more positive attitudes, or increasing desired behavior (e.g., Bhugra & Hsiao-Rei Hicks, 2004; McAvoy & Raza, 1991). Although videos, discussions, and presentations are less convenient than printed materials, they are also viable options as educational tools (Greenhalgh, Collard, & Begum, 2005; Spagnolo, Murphy, & Libera, 2008).

Outside of TBI, several types of educational materials have been evaluated for their ability to influence behavior, with variable results. For instance, factsheets designed to encourage women to receive cervical smears have been tested for use with a population of women identified to be at risk of cervical cancer (McAvoy & Raza, 1991). The results showed that mailed factsheets did not lead to more women going in for examinations, but receiving a factsheet from a research assistant and participating in a subsequent interview about the experience did lead to an increase in examinations (McAvoy & Raza, 1991). However, video presentations reviewed in the presence of a research assistant, not factsheets, resulted in the highest incidence of women receiving cervical smears (McAvoy & Raza, 1991).

For the most part, other studies on education materials have found results similar to those found in the McAvoy and Raza (1991) study. Bhugra and Hsiao-Rei Hicks (2004) found that factsheets mailed to participants were effective for influencing attitudes about treatment of depression even four weeks after the pamphlet was read, but influence on behavior was not addressed. Additionally, Evans, Macpherson, Thompson, and Babiker (1996) found that using factsheets to educate about psychiatric treatment had no significant effect on the average patient knowledge of medications unless the factsheet was discussed with a health care provider. This does not mean that factsheets should be abandoned as a possible educational tool. Rather, it emphasizes the need for further research to understand the contexts in which they are effective. One variable that may explain some of the mixed results of factsheet use could be cultural sensitivity and reading level (Guidry et al., 1998). Perhaps factsheets that are easier to read would be less dependent on discussion with professionals.

Factsheets are appealing educational tools because they are relatively easy to distribute and can provide quick information. Another educational tool that could provide quick information and still be easy to distribute is the personal story. Personal stories are typically less dense with factual information, but the information that is included is generally more person-centered. Less research has examined how personal stories, especially those in written blog form, might be used as an educational tool. In a qualitative study, researchers found that sharing personal experiences aloud in a group setting seemed to be beneficial for educating people about how to control diabetes (Greenhalgh et al., 2005). A year after these meetings began, those who attended regular meetings were more likely to have blood glucose levels that were trending downward and to express positive feelings about the meetings a year after they began than were those who recently began attending meetings (Greenhalgh et al., 2005). However, the mechanism

proposed behind the success was the ability to learn from other people with similar experiences, along with an atmosphere of support (Greenhalgh et al., 2005). It is unclear whether personal stories in written form would have a similar effect.

Another study examined educational tools for reducing stigma, not of TBI, but of mental illness. This study used a one-hour educational presentation in which people with mental illness shared their stories with high school students (Spagnolo et al., 2008). The stories emphasized similarities between mentally ill and healthy individuals (Spagnolo et al., 2008). On average, after experiencing the program, participants reported fewer stigmatizing views than they did before the presentation. However, this participants also participated in discussions and received a factsheet at the end of the program, so it is unclear which of the individual components of the presentation led to changes in attitudes. Relatedly, Pinfold, Toulmin, Thornicroft, Huxley, Farmer, and Graham (2003) evaluated a mental health educational program in a school setting. The program included a video about mental health, discussion of how to reduce stereotypes, informational leaflets, and a question-and-answer session with a person who had a mental illness (Pinfold et al., 2003). Pinfold and colleagues found that students' had more positive attitudes toward mental illness, on average, after participating in the program than before. Students who had previously known someone with a mental illness showed more of an increase in positive views. Again, no personal stories were shared in a written format. This study also measured social distancing and found that people tended to report feeling less afraid to talk to a person with mental illness one week after the intervention (Pinfold et al., 2003). There was no significant change in other social distancing items.

There is little research on the effect of education on attitudes toward people with TBI. Increased research specific to TBI could help to identify the most useful tools to reduce



misconceptions and misattributions. If these educational efforts are successful, some of the challenges experienced by people with TBI could be reduced. It is also possible that rehabilitation efforts could be improved as a result of decreased distress during reintegration.

### **The Current Study**

The aim of the present study was to assess the effectiveness of existing factsheets and personal stories as tools to educate the public about TBI. Participants were randomly assigned to read one of three sets of written material. Depending on the condition, participants read a factsheet about TBI, personal stories by people with TBI, or an unrelated factsheet about forest pest management. Effectiveness of the two TBI-related educational tools – the TBI factsheet and the personal stories – was assessed by examining the number of misconceptions held about TBI, the tendency to misattribute behavioral changes in a person with TBI, and the desire for social interaction with a person with TBI.

This study differed from existing research on effective educational methods by focusing on TBI specifically. Previous research has examined education related to reducing the stigma of mental illnesses and other physical disorders, but such stigma is not typically experienced by people with TBI (McClure, 2011). The invisibility of TBI seems to prompt an overestimation of the abilities of people with the injury (Swift & Wilson, 2001). The differential experience of people with TBI creates different goals of education than would be needed in other physically injured populations or in a mentally ill population.

In an effort to tailor the study to issues specific to TBI, the present study addressed both knowledge levels about TBI and attitudes toward people with TBI. Research identifying the challenges faced by people with TBI has examined the public's general lack of knowledge about TBI and, also, misattributions of the behavior of people with TBI. However, these two issues

have mostly been studied independently. An effective educational tool should address both problems of misconception and misattribution, so this study brought the two issues together. The examination of levels of desire to interact with people with TBI was also included in this study as an indication of whether or not increased knowledge tends to lead to a change in stigmatizing behavior.

Additionally, this study furthered the information known about how personal stories can be used as an educational tool. Although research on education about TBI is limited, the results of one study suggested that hearing about the experiences of a person with TBI can have an impact on beliefs related to TBI (Fraas & Calvert, 2006). The inclusion of personal stories as a possible educational tool in this study helped to clarify the contexts in which personal stories may have an effect.

The main questions of interest in this study center around the impact of the type of education on misconceptions, misattributions, and social distancing. However, previous research has indicated that there are gender differences in relation to attitudes toward disadvantaged groups (Chambers et al., 2009). On average, women report more positive attitudes toward disadvantaged populations than men do. For this reason, gender was included as an independent variable in this study.

Considering the trends in previous research, as well as the unique aspects of the current study, I had two main hypotheses. The first hypothesis was that, on average, participants who received either of the educational materials about TBI would have fewer misconceptions than would those who read the unrelated factsheet. Personal stories were expected to lead to similar levels of knowledge transfer when compared to factsheets.

The second hypothesis was that the personal stories would lead to the greatest reduction of misattributions, on average, among the three conditions. Specifically, it was expected that people who read the personal stories would express fewer misattributions of behavior, on average, when compared to people in the factsheet condition and people in the control group. I expected that, on average, those who read the factsheets would support fewer misattributions compared to the control group, but that the factsheets would be less effective at misattribution reduction than the personal stories. Reduction of misattributions of behavior require that information about TBI is not only learned, but applied. Previous research has suggested that factsheets tend to be more successful for behavioral change if participants also interact with a professional (McAvoy & Raza, 1991). Alternatively, the sharing of personal stories has been associated with more successful impact on attitudes and behavior (e.g., Fraas & Calvert, 2006; Greenhalgh et al., 2005). The current study assessed written personal stories as opposed to stories shared directly by someone with the condition of interest. However, it was predicted that the personal nature of the stories might serve as a proxy for personal contact and lead to a decreased likelihood of misattributing behaviors related to TBI.

In addition, this study examined whether the factsheets on TBI or personal stories from people with TBI led to a change in willingness to interact with a person with the condition. I assessed whether increased education led to stigmatizing behaviors similar to those experienced by people with physical injuries or to increased willingness to interact. This was an exploratory analysis to determine if there was an increase or decrease in desire for social interaction after receiving the educational readings. Either result was considered plausible because the focus on differences between people with TBI and healthy individuals might have led participants to have

an explanation for the different behavior, or it might have created a desire to dissociate from people with tendencies for different behavior.

## Method

### Participants

To detect a medium effect size at a power level of 0.80 with an alpha of .05, 158 participants were needed. This was determined by an a priori power analysis using G\*Power (Faul, Erdfelder, Lang, & Buchner, 2007). The 164 participants included in the study were recruited using the psychology participant pool. Students received class credit for their participation. Participants had to be fluent in English to participate in this study to ensure the ability to read the educational materials. All participants received informed consent in accordance with the Institutional Review Board Approval.

### Materials

**TBI Factsheet.** The factsheet used in the present study was a compilation of parts of existing factsheets that can be easily accessed online. The original factsheets were created in collaboration with the Model Systems Knowledge Translation Centers and TBI Model Systems (Novack, T., & Bushnik, T., 2002; “Traumatic Brain Injury Factsheets,” n.d.). Model System Knowledge Translation Centers strive to summarize research and make the research meaningful for people with TBI, spinal cord injuries, and burn injuries (“About the Model System Knowledge Translation Center,” n.d.). A Traumatic Brain Injury Model System is a specialized care program for TBI that utilizes research to improve quality of life for people with TBI (“About the Model Systems,” n.d.). Both Model System Knowledge Translation Centers and Model Systems are funded by the National Institute on Disability and Rehabilitation Research. In their original form, the factsheets were in four separate files each with a different emphasis: what constitutes a TBI, how the injury might impact functioning, the recovery stages, and how families are affected. The factsheet created for the current study combined information from

three of the four existing forms, excluding information from the factsheet on how family members are affected (<http://www.msktc.org/tbi/factsheets>). The information included in the TBI factsheet created for this study was chosen based on the information assessed in the Common Misconceptions of Traumatic Brain Injury Questionnaire.

**Personal Stories.** The personal stories examined in this study were taken from the Brain Injury Association of America website (<http://www.biausa.org/BlogRetrieve.aspx?BlogID=9665>). The Brain Injury Association of America allows people who have experienced TBI to share their unedited stories online in an effort to educate others. Three stories were selected for use in this study based on length and content. Stories that included information about coexisting conditions were excluded. Any posting that included information about life before and after the condition were desirable for inclusion. The stories were slightly modified to ensure that issues discussed in the Common Misconceptions of Traumatic Brain Injury Questionnaire were discussed and that the information matched the content in the TBI factsheet.

**Control Factsheet.** The control group read the first two pages of a factsheet about forest pest management in New Jersey (“New Jersey fact sheet: Forest pest management,” 2013). This factsheet was formatted in the same way as the TBI educational material and was approximately the same length. The forest and pest management factsheet was associated with the United States Department of Agriculture Natural Resource Conservation Service and the New Jersey Audubon Society (“New Jersey fact sheet: Forest pest management,” 2013).

**Common Misconceptions of Traumatic Brain Injury Questionnaire.** The Common Misconceptions of Traumatic Brain Injury Questionnaire was used as a direct measure of misconception. This questionnaire was adapted by Springer, Farmer and Bouman (1997) from a

previous questionnaire used in a number of studies (e.g., Gouvier et al., 1988). It has been found to have good internal consistency ( $\alpha = 0.84$ ) (Pappadis et al., 2011). This internal consistency was confirmed from the data in this study which yielded a similar Cronbach's Alpha ( $\alpha = .85$ ). This questionnaire requires participants to read statements and rate whether they are true, probably true, probably false, or false. Conservative coding was used, such that any rating of probably true or probably false was coded as incorrect. This method of coding is consistent with previous research, including the study in which the internal consistency was initially assessed (Pappadis et al., 2011). The Common Misconception of Traumatic Brain Injury score was determined by summing correct responses. Greater numbers of correct answers indicates a higher level of knowledge about TBI.

**TBI Vignette.** This study included a vignette along with a color photo of a male adolescent. The vignette and picture were extracted from a study conducted by McClure and colleagues (2006). The boy pictured showed no physical signs of the brain damage outlined in the vignette. According to McClure and colleagues (2006), the vignette was developed with the purpose of having ambiguous post-injury changes to be used for examination of attribution bias. The vignette explained that the person in the photograph experienced a TBI that led to four behavioral changes: sleeping patterns, anger levels, motivation, and self-confidence. Because the TBI was said to have occurred as the person entered adolescence, an argument could be made that the changes were either due to adolescence or due to the brain injury (McClure et al., 2006). For the purposes of this study, the location information included in the vignette was changed from Australia to the United States, including changing the city in the vignette to a city near the research center.

**Attribution Questionnaire.** The participants completed an attribution questionnaire that required them to make judgments on ambiguous changes to assess whether exposure to information changed how the participants interpreted the behavior of brain-injured people (McClure et al., 2006). Each change that participants read about in the vignette was presented. Participants were then asked to rate the believability of both brain injury and adolescence as possible explanations for the behavioral shifts. Ratings were made on a scale from one to seven with one being a 'very poor explanation' and seven being a 'very good explanation.' An attribution score was calculated by subtracting the brain injury rating from the adolescent rating for each behavioral change and averaging the four resulting numbers. Thus, any score above zero indicated a tendency to rate the adolescent explanation as a better explanation than the head injury. Any score below zero indicated a tendency to rate the head injury as a better explanation than adolescence. Attribution scores of zero indicated that each explanation was given the same rating. The internal consistency of this measure as found in this study was  $\alpha = .80$ .

**Social Interaction Questionnaire.** Participants also completed a Social Interaction Scale (SIS) to assess whether or not reading the educational materials had an impact on the desire to interact with people who had experienced TBI (Redpath, Williams, Hanna, Linden, Yates, & Harris, 2010). Again, this measure referred to the photo and vignette. Participants were asked to select a number from 1 (not at all) to 7 (very much) representing how likely they would be to take part in various social interactions with the person that they read about in the vignette. This has been found to be a reliable measure as indicated by its Cronbach's *alpha* of 0.90 (Redpath et al., 2010). The reliability of this measure was confirmed by the data in the present study ( $\alpha = .91$ ). Social Interaction Scale scores were calculated so that higher scores indicated more willingness to interact.



**Level of Contact Report.** Previous studies have found that familiarity with TBI is related to holding fewer misconceptions and expressing a more positive opinion toward people with TBI (Farmer & Johnson-Gerard, 1997; Guilmette & Pagalia, 2004; McLellan, Bishop, & McKinlay, 2010). Foster, McClure, McDowall, and Crawford (2013) found that unfamiliarity with TBI is also associated with tendencies to misattribute behavior to factors besides brain injury. The Level of Contact Report allowed participants to convey their familiarity with TBI (Holmes, Corrigan, Williams, Canar, & Kubiak, 1999). Participants were presented with 12 situations that could put someone in contact with information about TBI. Participants were able to select all situations that apply to them. This measure has a mean rank-order correlation of 0.83 and can be considered reliable (Holmes et al., 1999). In this study, familiarity was used as a covariate to allow for a clearer depiction of effects of education. High scores on this measure indicated familiarity with TBI.

**Demographics Form.** Participants completed a demographics and information form. This form provided gender and ethnicity information about participants. It also provided information about year in school. These data allowed for a better understanding of the sample population. There was also a section to allow participants to write additional comments.

### **Design and Procedure**

Participants spent approximately one half hour testing individually in the laboratory. Participants were randomly assigned into one of three conditions. They received approximately two pages of educational reading material in the form of a factsheet about TBI, or personal stories from people with TBI, or a factsheet about forest pest management. The students had as long as they needed to complete the reading.

After finishing the reading, participants completed the four measures. To control for any order effects, half of the sample filled out the Common Misconceptions of Traumatic Brain Injury Questionnaire first, while the other half was presented with the vignette and picture first. After viewing the photo and reading the vignette, participants filled out the Attribution Questionnaire and the Social Interaction Scale (these two scales were also counterbalanced for order effects). The Level of Contact Report and a demographics form were completed last. All of the measures were administered on a computer screen using Survey Monkey, and each measure was presented on a different screen. Once the participant completed the questionnaires, he or she was debriefed verbally and given a written hand out about the study.

## Results and Discussion

In data cleaning, before all analyses, the data of three participants was excluded, leaving  $N = 161$  for the analyses. One was removed because of a computer malfunction. The remaining two were removed because they underlined or highlighted portions of their readings.

A 3 x 2 multivariate analysis of covariance was conducted examining the effect of reading type (factsheet, personal stories, or control) and participant gender (male or female) on misconception scores, misattribution scores, and social interaction scale scores. The covariate was familiarity with TBI as indicated by Level of Contact Report score ( $M = 5.96$ ,  $SD = 3.14$ , range = 1-12). The covariate in this analysis was not significant and had a small effect size ( $\Lambda = .97$ ,  $F(3,149) = 1.34$ ,  $p = .264$ ,  $\eta_p^2 = .03$ ). Therefore, I will report the results of the MANOVA without the covariate. An overall effect of reading type was found ( $\Lambda = .87$ ,  $F(6,300) = 3.67$ ,  $p = .002$ ,  $\eta_p^2 = .07$ ), a medium effect. There was no significant effect found for either gender ( $\Lambda = .97$ ,  $F(3,150) = 1.60$ ,  $p = .193$ ,  $\eta_p^2 = .03$ ), or the reading and gender interaction ( $\Lambda = .97$ ,  $F(6,300) = .83$ ,  $p = .544$ ,  $\eta_p^2 = .02$ ). Thus, these effects will not be discussed further in the follow-up analyses below. All dependent variables were included in this single multivariate of analysis because each of the variables correlated with at least one of the other variables (See Table 1). To examine the specific hypotheses of the current study, I conducted a Roy-Bargmann step-down analysis as suggested by Tabachnik and Fidell (1996) (pp. 402-404).

Table 1.

Summary of Correlations for Scores on the CMTBI-Q, Attribution Questionnaire, and SIS

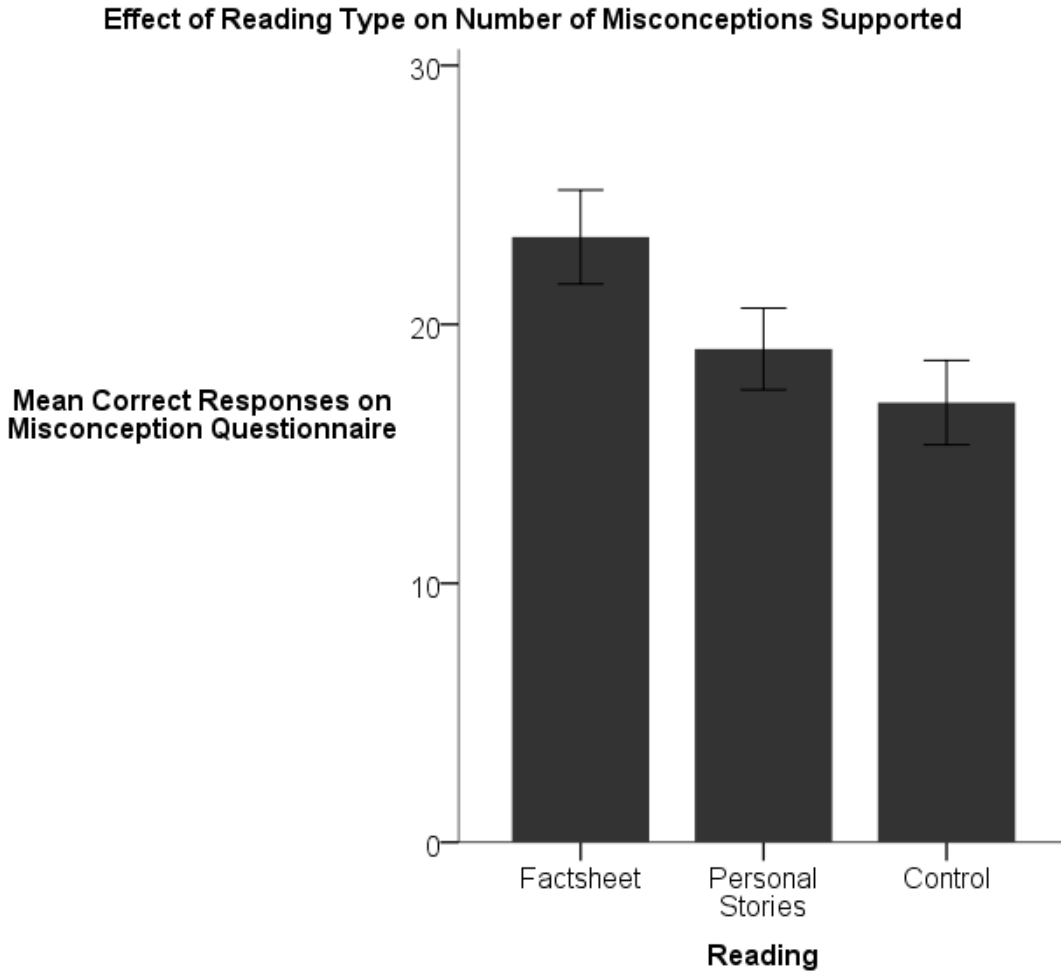
Measure	2	3
1. CMTBI-Q	-.252**	-.083
2. Attribution Questionnaire	-	.185**
3. SIS	-	-

Note. \* $p < .05$ , \*\* $p < .01$

**TBI Misconceptions.** The first hypothesis was that, on average, participants who read the factsheet or personal stories would have fewer misconceptions than those who read the unrelated factsheet. The average number of correct responses for the groups on the misconception questionnaire is depicted in Figure 1. As can be seen in the figure, the hypothesis was partially confirmed, with the factsheet group scoring higher on the misconceptions questionnaire than the control group. However, the average score of the personal stories group was significantly lower than the factsheet group and not different from the control group. These impressions from the figure were confirmed by the analyses.

A follow up between-groups analysis of variance was conducted to examine the effects of the reading type (factsheet, personal stories, or control) on misconception scores. The type of reading significantly affected misconception scores ( $F(2,158) = 14.85, p < .001, \eta_p^2 = .16$ ), a large effect. Tukey *HSD* post-hoc tests revealed that, on average, those who read the factsheet had higher accuracy scores ( $M = 23.37, SD = 6.45$ ) than those who read personal stories ( $M = 19.05, SD = 5.92, p < .001, d = .70$ ) and those who read the control reading ( $M = 16.98, SD = 5.92, p < .001, d = 1.03$ ). The average accuracy scores of those who read the personal stories and

those who read the control reading did not differ ( $p = .179$ ,  $d = .35$ ).



*Figure 1.* Error bars show 95% confidence intervals.

These results suggest that, despite conveying the same information, factsheets significantly reduced the number of misconceptions supported, while personal stories did not. The finding of an increased average level of knowledge of TBI after reading the factsheet (as compared with the other conditions) is similar to the results of Bhugra and Hsiao-Rei Hicks (2004) who found that, on average, factsheets improved attitudes toward mental illness as compared with baseline beliefs. Other studies that showed improvement in knowledge after using a factsheet suggested that an important aspect of knowledge transfer from factsheets was

discussion of the facts with an expert (Evans et al., 1996; McAvoy & Raza, 1991). Our study did not include any discussion of the facts and still showed an increase in fact recognition. The factsheets that have been found to require discussion with a professional were on the topic of psychiatric treatment, namely the effects of medications and the benefits of cervical smears for women at risk for cervical cancer (Evans et al., 1996; McAvoy & Raza, 1991). The outcome of interest in these studies focused on behavioral change, while the current study focused on attitude change. It is also possible that the factsheets in previous studies included information that was more complex than the factsheets used in the current study which focused on the basics of what a TBI is – specifically, the emotional and cognitive outcome possibilities and the complexities of the recovery process; however the reading level of these respective educational material is not clear.

Personal stories, on the other hand, did not result in a significant increase in average levels of knowledge of TBI, contrary to the hypothesis. Previous studies suggest that personal connections with people seem to be effective at addressing negative views and decreasing stigma (Pinfold et al, 2003; Spagnolo et al., 2008). However, such studies did not include a measure of direct knowledge transfer. Rather, they focused on measures of attitude change (Pinfold et al., 2003; Spagnolo et al., 2008). These studies were also performed with the purpose of education about conditions other than TBI. The different subject matter may have influenced results. Another important difference is that the current study used written personal stories as a proxy for personal contact. It is possible that written personal stories do not create the personal connection that a face-to-face interaction facilitates. The personal connection could be the ‘active ingredient’ in knowledge transfer for personal stories.

A strength of the current study is that the same factual information was included in the personal stories and the factsheets. Despite this, the factsheet, and not the personal stories, led to a significant increase in mean knowledge, which suggests that there may be an important difference between factsheets and personal stories. Previous studies have not compared the difference between these two tools with respect to TBI and it seems that there may be something important in the presentation of the facts that differentially influences knowledge transfer, or the ability to correctly recognize facts to which one has been previously exposed.

One possibility is that the ability to recognize facts depends upon the similarity of presentation. The factsheet in this study listed facts in a straightforward manner that often matched more closely with the facts presented in the questionnaire. For example, “Injured individuals may be unaware that they have changed or have problems. This can be due to the brain damage itself or to a denial of what’s really going on in order to avoid fully facing the seriousness of their condition,” was information presented in the factsheet. This section of the factsheet addressed the knowledge scale item, “Brain injury patients usually show a good understanding of their problems because they experience them every day.” On the other hand, the part of the personal stories that addressed this item was, “Sometimes it is frustrating, because with my difficulties thinking and planning, I can’t always understand everything I am going through.” The need to extract or interpret the facts in the personal stories might have made it more difficult for participants to apply the information to the facts in the questionnaire, or the personal stories may have drawn attention toward the emotions of the situation and away from the facts included.

**Misattributions.** The second hypothesis was that, on average, personal stories would lead to the least amount of misattribution of the three conditions and that factsheets would lead to

an average attribution score that fell between that of the control group and the personal stories. As shown in Figure 2, the hypothesis was partially supported. The personal story group had lower average scores than the control group, as expected. However, there was no significant difference found between the attribution scores for the factsheet group and the personal stories group, or the control group. This suggests that only personal stories have an effect on misattributions. It is important to note that any attribution scale score above zero indicates a larger endorsement of the adolescent explanation and any score below zero indicates a larger endorsement of the TBI explanation. Attribution scores of zero indicate equal ratings for each explanation and a lack of misattribution. Figure 2 shows that participants in the control group in this study were not showing signs of misattribution, so the lower mean scores found for the personal stories group represent a disproportionate endorsement of the TBI explanation. These findings were confirmed by the analyses.

An analysis of covariance was conducted examining the effect of reading type (factsheet, personal stories, or control) on misattribution scores. The overall effect indicated that average misattribution scores differed according to reading type ( $F(2,154) = 5.56, p = .005, \eta_p^2 = .07$ ), a medium effect. Additionally, misconception score was found to be a significant covariate ( $F(1,154) = 7.90, p = .006, \eta_p^2 = .05$ ), a medium effect. A Tukey *LSD* post-hoc analysis of attribution scores showed that, on average, those who read the personal stories had significantly lower attribution scores ( $M = -1.43, SD = 1.74$ ) than those who read the control reading ( $M = -.369, SD = 1.71, p = .001, d = .62$ ), controlling for misconception score. There was no significant difference found between average attribution scores of the factsheet group ( $M = -.835, SD = 1.65$ ) and those who read the personal stories ( $p = .074, d = .27$ ), or between average attribution



scores of the factsheet group and the control group ( $p = .191$ ,  $d = .34$ ), again controlling for misconception score.

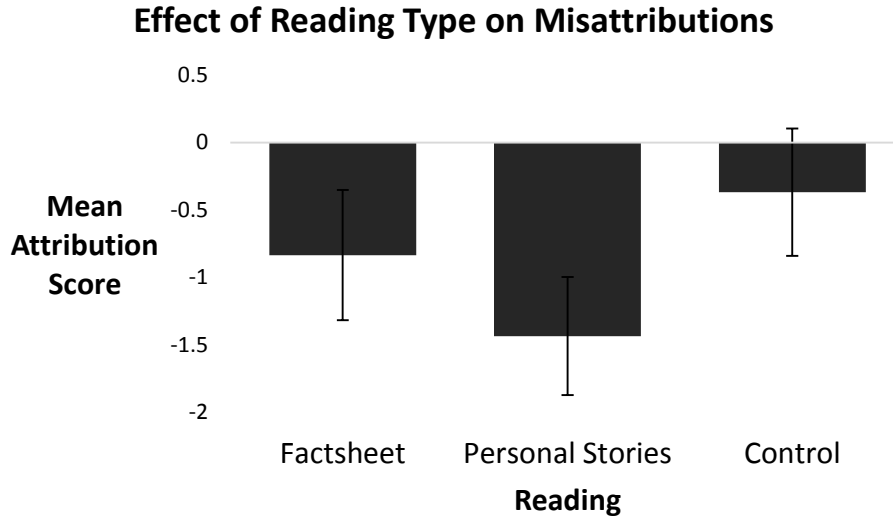


Figure 2. Mean Attribution Scores have been adjusted to control for the effect of misconceptions. Error bars show 95% confidence intervals.

The misattribution score reflects the difference in participants' endorsement of adolescence and TBI as explanations of behaviors. The pattern of difference scores I observed could result because participants' increased endorsement of the TBI explanation, or because of decreased endorsement of the adolescent explanation. To further elucidate the mechanism underlying the average difference in attribution score between the personal stories group and the control condition, an additional MANOVA was conducted to examine the effects of reading type on the strength of endorsement for the average TBI and average adolescence explanations. The overall model was significant ( $\Lambda = .02$ ,  $F(4,306) = 4.0$ ,  $p = .004$ ,  $\eta_p^2 = .05$ ), a medium effect. The dependent variables were not correlated, so the Roy-Bargmann step-down procedure was not used for follow-up analyses ( $r = -.16$ ,  $p = .051$ ). Follow-up univariate ANOVAs showed a significant main effect of reading type on average strength of the adolescence explanation

( $F(2,154) = 7.41, p = .001, \eta_p^2 = .09$ ), a medium to large effect. A Tukey *HSD* post-hoc analysis revealed that, on average, those who read the personal stories reported lower endorsement of the adolescent explanation ( $M = 4.11, SD = 1.29$ ) than those who read the control reading ( $M = 5.0, SD = 1.16, p < .001, d = .74$ ). No other significant differences emerged. This effect, illustrated in Figure 3, suggests that the personal stories lowered misattribution scores and led to a disproportionate endorsement of the TBI explanation by reducing endorsement for the adolescent explanation.

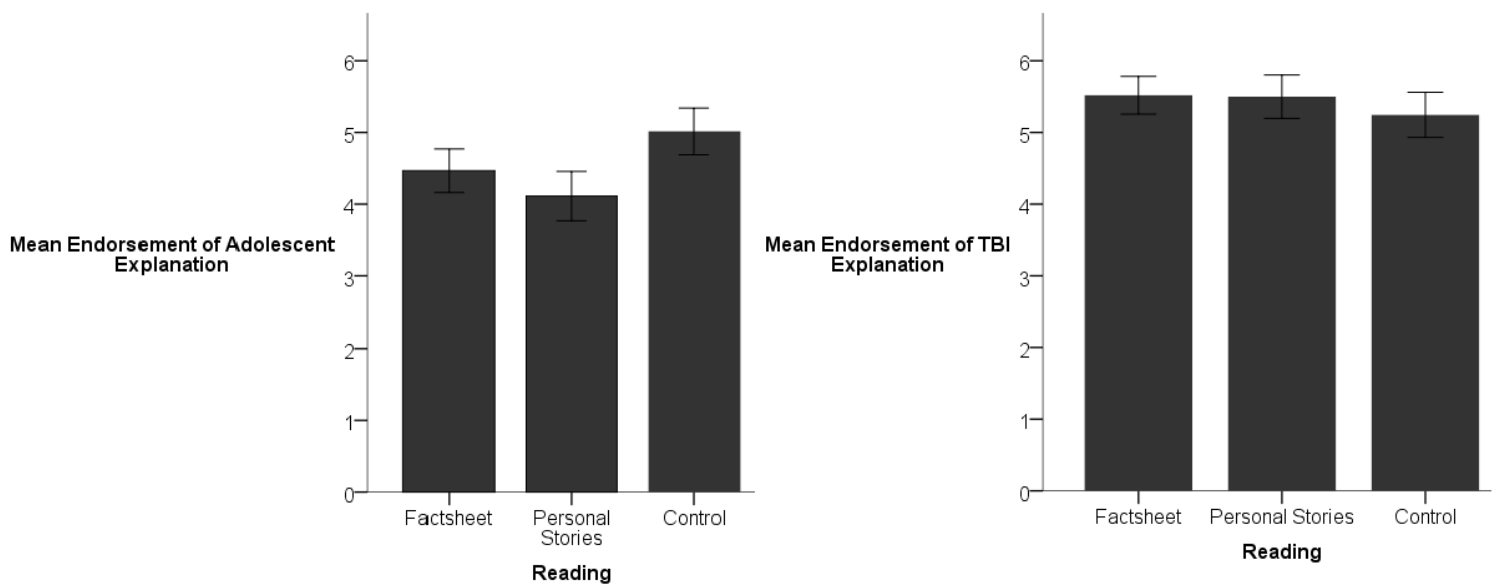


Figure 3. Error bars show 95% confidence intervals.

Previous studies using the same paradigm have found that people tend to give higher average ratings to adolescence while discounting TBI as an explanation (McClure et al., 2006; McClure et al., 2008). There are at least two possible explanations for why this study had different results. First, it is possible that there has been increased public awareness of TBI in recent years that has contributed to an overall change in how people think about behavioral changes post TBI. According to the New York Times Chronicle (2014), the term “Traumatic

Brain Injury” was mentioned in no more than 11 New York Times articles each year until 2007. In 2007, 41 articles included that phrase and this high rate of use has been sustained in recent years. The increased incidence of TBI in the news is one possible contributor to the possible shift in public response to behavioral change.

Another possible explanation is that the population involved in this study was less inclined to misattribution as compared to the general population. The participants in this study were all enrolled in a Roman-Catholic-affiliated, private, liberal arts college in the Northeast United States, and although I did not ask about major areas of study, the participant pool drew largely from psychology courses. Certain factors that may influence a person to choose a Catholic university or attend psychology classes, or the average age of undergraduate students, might also be related to a reduced tendency to misattribute behaviors. The previous studies that showed a difference in attributions sampled students from different locations on a New Zealand college campus (McClure et al., 2006; McClure et al., 2008). The Linden and McClure (2012) study utilized a sample of participants who were college students from Belfast, Northern Ireland.

**Social Distancing.** The third hypothesis was that the educational materials would have an effect on willingness to interact with someone with TBI, as measured by the social interaction scale. There were no specific predictions of directionality for this outcome measure. A follow-up univariate analysis of covariance was conducted to examine the effect of reading (factsheets, personal stories, or control) on social interaction scores. Misconceptions and attribution scores were used as covariates. There was not a significant main effect of reading type on social interaction score ( $F(2,153) = 1.20, p = .305, \text{partial } \eta^2 = .02$ ), a small effect. Scores on the social interaction scale indicated high levels of willingness to interact with people who have

experienced a TBI ( $M = 33.70$ ,  $SD = 8.73$ ), regardless of experimental condition and controlling for misattribution and misconception scores.

This lack of a statistically significant difference is slightly positive only because it does not show evidence of unintended negative effects of the educational materials. However, this result should be interpreted with caution, and more research should be done to clarify how learning more about TBI influences reactions to interactions with people with TBI.

## General Discussion

A lack of knowledge of TBI within the general population coupled with the differential treatment of people with TBI has sparked a call for improved education. The current study aimed to address the question of how increased education might be best accomplished. The results suggest that the way information is presented plays a role in how that information is used. Factsheets seem to be useful for decreasing misconceptions, while personal stories seem to impact misattributions. Thus in developing educational materials for TBI, it is important to consider whether the aim of the education is reducing misconceptions or misattributions.

**Limitations.** The limitations of this study, some of which have already been mentioned, should be taken into account when considering the implications of these results. One issue that has already been mentioned is the sample of students. Such a restricted sample may limit the external validity of these results.

This study is also limited in generalizability because self-report and proxies of behavior were used. The attribution questionnaire and social interaction scale were used to give information about how people would interact with others who have experienced TBI. These scales give a limited range of understanding of attitudes and behavior. The attribution questionnaire examines ratings of four behavioral changes. The small number of ambiguous behaviors could restrict the applicability of any conclusions drawn from the scale. Also, response to education may differ according to the type of explanation suggested. For instance, personal stories and factsheets in this study led to decreased mean ratings of adolescence as an explanation, but other life stage or personality trait explanations may be affected differently. There is also concern as to whether or not the ratings that people give in response to a vignette truly reflect the responses they would have to seeing a certain behavior in person.

Similarly, the social attribution scale is self-report and might be affected by situational demand characteristics. The social attribution scale asks about a limited number of distinct situations and attempts to generalize the ratings to all social interaction and assumes that the ratings reflect what their feelings would be in a real-life situation.

**Future Directions.** As a preliminary work, the current study focused on the direct effects of these educational materials. Future research should examine the extent to which these educational methods could aid in reducing the costs and increasing the effectiveness of clinical education efforts. This would involve researching the length of time the effects last. It might also be beneficial to examine whether people with TBI notice a difference in how people interact with them after such education has been dispersed, or if functional outcomes of people with TBI are affected. Research may also be directed at factors contributing to whether or not a member of the general public will engage in reading such short-term educational materials outside the context of the lab. Examining the combined effects of these materials could also help optimize education efforts. A two-pronged approach using both types of reading might be more successful than either the factsheet or personal stories alone.

In addition to examining issues of clinical impact, future research should be directed at the difference among various education modalities, including factsheets and personal stories. Understanding why factsheets led to fewer misconceptions than the control reading, but personal stories did not might help in the creation of more effective educational materials. Similarly, research may be directed at understanding why decreased misconceptions did not consistently lead to decreased misattribution. Studies aimed at revealing the underlying mechanisms of educational materials can then be used to assist in better addressing the concerns of the population, whether that be increasing knowledge or decreasing misattributions, or both.

## References

About the model systems. (n.d.). Retrieved from <http://www.msktc.org/about-model-systems>

About the model system knowledge translation center. (n.d.). Retrieved from

<http://www.msktc.org/about>

Adekeye, O.A., & Adeusi, S.O. (2011). Attribution patterns, attitude and knowledge of hiv/aids on sexual behavioral change among students of covenant university, Ota, Nigeria. *Ife Psychologia*, 19(12), 255-269.

Alexander, M.P. (1995). Mild traumatic brain injury: Pathophysiology, natural history, and clinical management. *Neurology*, 45, 1253-1260.

Andruszkow, H., Urner, J., Deniz, E., Porbst, C., Grun, O., Lohse, R., ... Zeckey, C. (2013).

Subjective impact of traumatic brain injury on long-term outcome at a minimum of 10 years after trauma—first results of a survey on 368 patients from a single academic trauma center in Germany. *Patient Safety in Surgery*, 7(32). doi: 10.1186/1754-9493-7-32

Baguley, I.J., Cooper, J., & Felmingham, K. (2006). Aggressive behavior following traumatic brain injury: How common is common? *Journal of Head Trauma Rehabilitation*, 21(1), 45-56.

Bhugra, D., & Hsiao-Rei Hicks, M. (2004). Effect of an educational pamphlet on help-seeking attitudes for depression among British South Asian women. *Psychiatric Services*, 55(7), 827-829.

Campbell, J.S., Greenberg, J.H., & Weil, J.M. (2012). Confronting mild TBI and co-occurring post-traumatic stress disorder symptoms in combat deployed service members. In J.W. Tsao (Ed.), *Traumatic Brain Injury: A Clinician's Guide to Diagnosis, Management, and Rehabilitation*, (205-222). New York: Springer.

- Chambers, M., Guise, V., Valimaki, M., Botelho, M.A., Scott, A., Staniuliene, V., & Zanotti, R. (2010). Nurses' attitudes to mental illness: A comparison of a sample of nurses from five European countries. *International Journal of Nursing Studies*, 47(3), 350-362. doi: 10.1016/j.ijnurstu.2009.08.008
- Chronicle: Visualizing language usage in New York Times news coverage throughout its history (2014). Retrieved from [http://chronicle.nytlabs.com/?keyword=civil rights](http://chronicle.nytlabs.com/?keyword=civil%20rights)
- Conneeley, A.L. (2012). Transitions and brain injury: A qualitative study exploring the journey of people with traumatic brain injury. *Brain Impairment*, 13(1), 72-84. doi:10.1017/Brimp.2012.3
- Corrigan, P.W., Morris, S.B., Michaels, P.J., Rafacz, J.D., Rusch, N. (2012). Challenging the public stigma of mental illness: A meta-analysis of outcome studies. *Psychiatric Services*, 63(10), 963-973. doi: 10.1176/appi.ps.005292011
- Corrigan, P.W., Watson, A.C., Warpinski, A.C., & Gracia, G. (2004). Implications of educating the public on mental illness, violence, & stigma. *Psychiatric Services*, 55(5), 577-580.
- Evans, M., Macpherson, R., Thompson, E., & Babiker, I. (1996) Educating psychiatric patients about their treatment: Do fact sheets work? *Journal of the Royal Society of Medicine*, 89,690-693.
- Farmer, J.E., & Johnson-Gerard, M. (1997). Misconceptions about traumatic brain injury among educators and rehabilitation staff: A comparative study. *Rehabilitation Psychology*, 42(4), 273-286
- Faul, F., Erdfelder, E., Lang, A.-G., & Buchner, A. (2007). G\*Power 3: A flexible statistical power analysis program for the social, behavioral, and biomedical sciences. *Behavior Research Methods*, 39, 175-191



- Faul, M. , Xu, L., Wald, M.M., Coronado, V. & Dellinger, A.M. (2010). Traumatic brain injury in the United States: National estimates of prevalence and incidence, 2002-2006. *Injury Prevention, 16*. doi: 10.1136/ip.2010.029215.951
- Foster, L., McClure, J., McDowall, J., & Crawford, M.T. (2013). Attributions about persons with brain injury: The effects of knowledge and familiarity about brain injury. *Brain Injury, 27*(4). 485-491. doi:10.3109/02699052.2012.750747
- Fraas, M.R., & Calvert, M. (2006). Oral histories: Bridging misconceptions and reality in brain injury recovery. *Disability and Rehabilitation, 29*(18), 1449-1455.  
doi:10.1080/09638280601102311
- Gelech, J.M., & Desjardins, M. (2010). I am many: The reconstruction of self following acquired brain injury. *Qualitative Health Research, 21*(1), 62-74. doi:10.1177/1049732310377454
- Gennarelli, T.A. (1986). Mechanisms and pathophysiology of cerebral concussion. *Journal of Head Trauma Rehabilitation, 1*(2), 23-29.
- Gennarelli, T.A. (1996). The spectrum of traumatic axonal injury. *Neuropathology and Applied Neurobiology, 22*, 509-513.
- Gouvier, W.D., Prestholdt, P.H., & Warner, M.S. (1988). A survey of common misconceptions about head injury and recovery. *Archives of Clinical Neuropsychology, 3*, 331-343.
- Greenhalgh, T., Collard, A., & Begum, N. (2005). Sharing stories: Complex intervention for diabetes education in minority groups who do not speak English. *British Medical Journal, 330*, 1-6.
- Guidry, J.J., Fagan, P., & Walker, V. (1998). Cultural sensitivity and readability of breast and prostate printed cancer education materials targeting African Americans. *Journal of the National Medical Association, 90*(3), 165-169.

- Guilmette, T.J., & Paglia, M.F. (2004). The public's misconceptions about traumatic brain injury: a follow up survey. *Archives of Clinical Neuropsychology*, *19*, 183-189. doi: 10.1016/S0887-6177(03)00025-8
- Holmes, E.P., Corrigan, P.W., Williams, P., Canar, J., & Kubiak, M.A. (1999). Changing attitudes about schizophrenia. *Schizophrenia Bulletin*, *25*(3), 447-456.
- Ionta, J.R., & Scherman, C.D. (2007). An examination of college students' perceptions of people diagnosed with mental illness. *College of Saint Elizabeth Journal of the Behavioral Sciences*, *1*, 1-10.
- James, A.I., Young, A.W. (2013). Clinical correlates of verbal aggression, physical aggression and inappropriate sexual behavior after brain injury. *Brain Injury*, *27*(10), 1162-1172. doi:10.3109/0299052.2013.804200
- Joachim, G., & Acorn, S. (2000). Stigma of visible and invisible chronic conditions. *Journal of Advanced Nursing*, *32*(1), 243-248.
- Krebs, C., Weinberg, J., Akesson, E. (2012). *Lippincott's illustrated review of neuroscience*. R.A. Harvey (Eds). Baltimore, MD: Lippincott Williams & Wilkins.
- Levin, H.S., Hanten, G., Chang, C., Zhang, L., Schachar, R., Ewing-Cobbs, L., Max, J. (2002). Working memory after traumatic brain injury in children. *Annals of Neurology*, *52*, 82-88. doi: 10.1002/ana.10252
- Levin, H.S., Hanten, G., Zhang, L., Swank, P.R., Ewing-Cobbs, L., Maureen, D., ... Hunter, J.V. (2004). Changes in working memory after traumatic brain injury in children. *Neuropsychology*, *18*(2), 240-247. doi: 10.1037/0894-4105.18.2.240

- Linden, M.A., & McClure, J. (2012). The causal attributions of nursing students toward adolescent survivors of brain injury. *Nursing Research, 61*(1), 58-65.  
doi:10.1097/NNR.0b13e31823ca253
- Lux, W.E. (2007). A neuropsychiatric perspective on traumatic brain injury. *Journal of Rehabilitation Research and Development, 44*(7), 951-962.  
doi:10.1682/JRRD.2007.01.0009
- Martin, J.K., Pescosolido, B.A., & Tuch, S.A. (2000). Of fear and loathing: The role of 'disturbing behavior,' labels, and causal attributions in shaping public attitudes toward people with mental illness. *Journal of Health and Social Behavior, 41*, 208-223.
- McAllister, T.W., Sparling, M.B., Flashman, L.A., Guerin, S.J., Mamourian, A.C., Saykin, A.J. (2001). Differential working memory load effects after mild traumatic brain injury. *NeuroImage, 14*(5), 1004-1012, doi: 10.1006/nimg.2001.0899
- McAvoy, B.R., & Raza, R. (1991). Can health education increase uptake of cervical smear testing among Asian women? *British Medical Journal, 302*, 833-836.
- McClure, J. (2011). The role of causal attributions in public misconceptions about brain injury. *Rehabilitation Psychology, 56*(2), 85-93. doi:10.1037/a0023354
- McClure, J., & Abbott, J. (2009). How normative information shapes attributions for the actions of persons with traumatic brain injury. *Brain Impairment, 10*(2), 180-187.
- McClure, J., Buchanan, S., McDowall, J., & Wade, K. (2008). Attributions for behaviours of persons with brain injury: The role of perceived severity and time since injury. *Brain Injury, 22*(9), 639-648. doi:10.1080/02699050802255525

- McClure, J., Devlin, M.E., McDowall, J., & Wade, K. (2006). Visible markers of brain injury influence attributions for adolescents' behavior. *Brain Injury*, 20(10), 1029-1035.  
doi:10.1080/02699050600909870
- McKinlay, A., Bishop, A., & McLellan, T. (2011). Public knowledge of 'concussion' and the different terminology used to communicate about mild traumatic brain injury. *Brain Injury*, 25(7-8), 761-766. doi:10.3109/02699052.2011.579935
- McLellan, T., Bishop, A., & McKinlay, A. (2010). Community attitudes toward individuals with traumatic brain injury. *Journal of the International Neuropsychological Society*, 16, 705-710. doi:10.1017/S1355617710000524
- Morton, M.V., Wehman, P. (1995). Psychosocial and emotional sequelae of individuals with traumatic brain injury: A literature review and recommendations. *Brain Injury*, 9(1), 81-92. doi: 10.3109/02699059509004574
- New Jersey fact sheet: Forest pest management. (2013). Retrieved from [http://www.njaudubon.org/portals/10/Conservation/PDF/publications\\_resources/Forest\\_Pest\\_Management-Fact\\_Sheet\\_NJAS.pdf](http://www.njaudubon.org/portals/10/Conservation/PDF/publications_resources/Forest_Pest_Management-Fact_Sheet_NJAS.pdf)
- Novack, T., & Bushnik, T. (2002). Understanding TBI. Retrieved from <http://www.msctc.org/tbi/factsheets/Understanding-TBI>
- Pappadis, M.R., Sander, A.M., Struchen, M.A., Leung, P., & Smith, D.W. (2011). Common misconceptions about traumatic brain injury among ethnic minorities with TBI. *Journal of Head Trauma Rehabilitation*, 26(4), 301-311.
- Pinfold, V., Toulmin, H., Thornicroft, G., Huxley, P., Farmer, P., & Graham, T. (2003). Reducing psychiatric stigma and discrimination: Evaluation of educational interventions

- in UK secondary schools. *The British Journal of Psychiatry*, 182, 342-346.  
doi:10.1192/bjp.02.375
- Povlishock, J.T. (1993). Pathobiology of traumatically induced axonal injury in animals and man. *Annals of Emergency Medicine*, 22(6), 980-986.
- Raghupathi, R. (2004). Cell death mechanisms following traumatic brain injury. *Brain Pathology*, 14, 215-222.
- Redpath, S.J., Williams, W.H., Hanna, D., Linden, M.A., Yates, P., & Harris, A. (2010). Healthcare professionals' attitudes towards traumatic brain injury (TBI): The influence of profession, experience, aetiology and blame on prejudice towards survivors of brain injury. *Brain Injury*, 24(6), 802-811. doi:10.3109/02699051003709623
- Riggio, S., & Wong, M. (2009). Neurobehavioral sequelae of traumatic brain injury. *Mount Sinai Journal of Medicine*, 76, 163-172. doi:10.1002/msj.20097
- Roozenbeek, B., Maas, A.I., Menon, D.K. (2013). Changing patterns in the epidemiology of traumatic brain injury. *Nature reviews: Neurology*, 9, 231-236. doi: 10.1038/nrneurol.2013.22
- Sharp, D.J., Beckmann, C.F., Greenword, R., Kinnunen, K.M., Bonnelle, V., De Boissezon, X., ... Leech, R. (2011). Default mode network functional and structural connectivity after traumatic brain injury. *Brain: A Journal of Neurology*, 134, 2233-2247. doi: 10.1093/brain/awr175
- Silver, J.M., McAllister, T.W., & Yudofsky, S.C. (2011). *Textbook of traumatic brain injury* (2<sup>nd</sup> ed.). Arlington, VA: American psychiatric publishing.

- Slovarp, L., Azuma, T., & Lapointe, L. (2012). The effect of traumatic brain injury on sustained attention and working memory. *Brain Injury, 26*(1), 48-57.  
doi:10.3109/02699052.2011.635355
- Sousa, A.D., McDonald, S., & Rushby, J. (2012). Changes in emotional empathy, affective responsivity, and behavior following severe traumatic brain injury. *Journal of Clinical and Experimental Neuropsychology, 34*(6), 606-623. doi:10.1080/13803395.2012.667067
- Spagnolo, A.B., Murphy, A.A., & Librera, L.A. (2008). Reducing stigma by meeting and learning from people with mental illness. *Psychiatric Rehabilitation Journal, 31*(3), 186-193. doi:10.2975/31.3.2008.186.193
- Springer, J.A., Farmer, J.E., & Bouman, D.E. (1997). Common misconceptions about traumatic brain injury among family members of rehabilitation patients. *Journal of Head Trauma Rehabilitation, 12*(3), 41-50.
- Swift, T.L., & Wilson, S.L. (2001). Misconceptions about brain injury among the general public and non-expert health professionals: An exploratory study. *Brain Injury, 15*(2), 149-165.
- Tabachnik, B.G., & Fidell, L.S. (1996). *Using Multivariate Statistics*. New York, NY: Harper Collins Publishers Inc.
- Tateno, A., Jorge, R.E., & Robinson, R.G. (2003). Clinical correlates of aggressive behavior after traumatic brain injury. *The Journal of Neuropsychiatry and Clinical Neurosciences, 15*(2), 155-160.
- Tolomiczenko, G.S., Goering, P.N., Durbin, J.F. (2001). Educating the public about mental illness and homelessness: A cautionary note. *Canadian Journal of Psychiatry, 46*, 253-257.
- Traumatic brain injury factsheets. n.d. Retrieved from <http://www.msktc.org/tbi/factsheets>

- Turner, B.J., Fleming, J., Ownsworth, T., & Cornwell, P. (2011). Perceived service and support needs during transition from hospital to home following acquired brain injury. *Disability and Rehabilitation*, 33(10), 818-829. doi:10.3109/09638288.2010.513422
- Vallat-Azouvi, C., Pradat-Diehl, P., Azouvi, P. (2009). Rehabilitation of the central executive of working memory after severe traumatic brain injury: Two single-case studies. *Brain Injury*, 23(6), 585-594. doi: 10.1080/02699050902970711
- Vitaz, T.D., Jenks, J., Raque, G.H., & Shields, C.B. (2003). Outcome following moderate traumatic brain injury. *Surgical Neurology*, 60, 285-291. doi: 10.1016/S0090-3019(03)00378-1
- Willer, B., Johnson, W.E., Rempel, R.G., & Linn, R. (1993). A note concerning misconceptions of the general public about brain injury. *Archives of Clinical Neuropsychology*, 8, 461-465.
- Wood, F., Novack, T.A., & Long, C.J. (1984). Post-concussion symptoms: Cognitive, emotional, and environmental aspects. *International Journal of Psychiatry in Medicine*, 14(4), 277-283.
- Zonfrillo, M.R., Durbin, D.R., Winston, F.K., Zhang, X., & Stineman, M.G. (2014). Residual cognitive disability after completion of inpatient rehabilitation among injured children. *The Journal of Pediatrics*, 164,130-135.