



Published in final edited form as:

*West J Nurs Res.* 2016 September ; 38(9): 1114–1138. doi:10.1177/0193945916636629.

## NURSES' BELIEFS ABOUT CARE OF PATIENTS WITH TRAUMATIC BRAIN INJURY

**Tolu O. Oyesanya, MS, RN,**

University of Wisconsin-Madison, School of Nursing, 5130 Signe Skott Cooper Hall, 701 Highland Ave, Madison, WI 53705, toyesanya@wisc.edu, (414) 559-9923

**Mitchell A. Thomas, BS(c),**

University of Wisconsin-Madison, Department of Communication Sciences and Disorders, Scott H. Goodnight Hall, 1975 Willow Dr., Madison, WI 53706, mathomas6@wisc.edu, (262) 960-4923

**Roger L. Brown, PhD, and**

University of Wisconsin-Madison, School of Nursing, 4187 Signe Skott Cooper Hall, 701 Highland Ave, Madison, WI 53705, roger.brown@wisc.edu, (608) 263-5281

**Lyn S. Turkstra, PhD, CCC-SLP**

University of Wisconsin-Madison, Department of Communication Sciences and Disorders, 474 Scott H. Goodnight Hall, 1975 Willow Dr., Madison, WI 53706, lyn.turkstra@wisc.edu, (608) 262-7583

### Abstract

Patients with traumatic brain injury (TBI) and their families rely on healthcare providers, particularly nurses, to provide accurate information, yet inaccurate beliefs about TBI have been shown among nurses. Although prior studies have assessed nurses' beliefs about TBI recovery and rehabilitation, none have assessed specific beliefs about the nursing role to care for these patients. The purpose of this study was to investigate nurses' beliefs and learning preferences about caring for patients with moderate-to-severe TBI. A cross-sectional survey was administered to 513 nurses at a Midwestern hospital between October and December 2014 (20.3% response rate). Latent class analysis was used. Findings showed nurses had inaccurate beliefs about TBI relating to recovery and the nursing role and had significant differences in learning preferences. These findings have implications for development of educational and training interventions specific to nurses to ensure they have factual information about TBI and to clarify the nursing role.

### Keywords

Nursing; Attitude; Brain Injuries; Education; Nursing

---

**Corresponding Author:** Tolu Oyesanya, MS RN, 5130 Signe Skott Cooper Hall, 701 Highland Ave., Madison, WI 53705, toyesanya@wisc.edu, (414) 559-9923.

**Declaration of Conflicting Interests:** Authors declare no potential conflicts of interest with respect to the research, authorship, and/or publication of this article.

Nurses must hold accurate beliefs about care of patients with traumatic brain injury (TBI), as patients and families rely on nurses for accurate information (Browndyke, Santa Maria, Pinkston, & Gouvier, 1998). Yet, prior research has shown that nurses have misconceptions, or inaccurate beliefs, about recovery of patients with mild TBI, including about amnesia and recovery (Ernst, Trice, Gilbert, & Potts, 2009; Linden & McClure, 2012). However, no studies have assessed nurses' beliefs about caring for patients with moderate-to-severe TBI, including focus on specific beliefs about the nursing role to care for these patients. To this end, this study aimed to investigate nurses' beliefs and learning preferences about caring for patients with moderate-to-severe TBI.

## Traumatic Brain Injury

Each year, over 2.5 million people in the United States sustain a TBI (Centers for Disease Control and Prevention, 2014), including more than 511, 257 adolescents aged 0 to 14 years (Faul, Xu, Wald, & Coronado, 2010). More than 35,136 adolescents have injuries that are moderate-to-severe TBIs and require hospitalizations (Faul et al., 2010). Adolescents [and older adults age 75 years or older] are most likely to sustain a TBI (Centers for Disease Control and Prevention, 2014). The severity levels of TBI are characterized as mild, moderate, and severe (Rao et al., 2010). TBI causes significant impairments in psychomotor, verbal, and cognitive functioning (Green et al., 2006), with moderate-to-severe TBI causing chronic impairments that survivors of TBI will live with over their lifetime (Himanen et al., 2006).

## Impairments Caused by TBI

Characteristics of patients with TBI vary as a function of injury severity (Rao et al., 2010). The consequences of mild TBI typically include physical and mental fatigue, emotional distress, impairments in attention and concentration, and somatic symptoms such as headaches and sensitivity to light and sound, all of which typically resolve within a few weeks (Brain Injury Association of America, 2015b). In comparison, moderate-to-severe TBI is associated with significant impairments in sensorimotor, cognitive, and psychosocial functioning. Cognitive impairments include problems with executive functioning, memory, and attention (Dikmen, Machamer, Winn, & Temkin, 1995), which reduce capacity for new learning and decrease speed of information processing (Millis et al., 2001). While deficits typically improve spontaneously in the early months after injury, most patients with moderate-to-severe injury have lifelong challenges that have a tremendous impact on everyday independence, work, and social life (Faul et al., 2010).

## Nursing Roles and Responsibilities in Care of Patients with TBI

Nurses have an important and large role in care of patients with moderate-to-severe TBI during acute and non-acute care. As an essential member of the interdisciplinary teams, nurses hold numerous roles and responsibilities to assist with the patient's treatment and recovery, including: 1) assessing the patient; 2) coordinating and communicating care; 3) conducting technical and physical care; 4) integrating prescribed therapies; 5) providing emotional support to the patient and their family; 6) advocating for the patient; 7) involving

the patient and family in care; and 8) educating the patient and family (Long, Kneafsey, Ryan, & Berry, 2002b; Ryan, 2009). These roles and responsibilities depend on the severity of the patient's injuries and their time since injury; as the patient's condition changes, nurses modify their plan of care. These modifications will likely occur more when caring for patients with acute, new-onset moderate-to-severe TBI compared to patients in the chronic stage.

## Healthcare Providers' Beliefs about TBI

Although TBI is quite common across the disease/injury spectrum, occurring 10 times more often than breast cancer (American Cancer Society, 2015; Centers for Disease Control and Prevention, 2013), misconceptions, also known as inaccurate beliefs, among healthcare providers still exist. Research has shown that healthcare providers have misconceptions about consequences of TBI, injury mechanisms, and recovery. More specifically, research shows that healthcare providers have inaccurate beliefs about patients with TBI pertaining to unconsciousness, coma, amnesia, and length and expectations for recovery (Duff & Stuck, 2014; Evans, Hux, Chleboun, Goeken, & Deuel-Schram, 2009; Hooper, 2006; Hux, Walker, & Sanger, 1996; Redpath et al., 2010; Yuhasz, 2013). These misconceptions occur particularly often in healthcare providers who do not provide care to patients with TBI on a regular basis (Swift & Wilson, 2001).

## Research on Nurses' Beliefs about TBI

Nurses' beliefs about patients with moderate-to-severe TBI are important as it is likely that all nurses will provide care to these patients with these injuries at some point in their practice. This is because patients with acute or chronic moderate-to-severe TBI can be found on any hospital unit, depending on severity of injury, time since injury, and comorbidities (McQuillan & Mitchell, 2002). However, much of the research on nurses' beliefs has focused on beliefs about patients with mild TBI, which limits application to nursing care of patients with moderate-to-severe TBI in the United States and globally.

However, the existing research has shown that nurses and nursing students have several inaccurate beliefs about recovery after mild TBI (Ernst et al., 2009). Items in the Ernst (2009) study focused on misconceptions about use of seatbelts, unconsciousness, impairments caused by TBI, and recovery after TBI, but did not focus on specific nursing care responsibilities or learning preferences. In other studies, both nursing students and nurses have also been shown to have negative attitudes towards patients with TBI, including use of visibility of injury as an indicator of how much care a patient should receive (Linden & McClure, 2012; Linden & Redpath, 2011). Although nursing beliefs were assessed in these studies, specific beliefs about the nursing role to care for patients with moderate-to-severe TBI were not included. Overall, these findings are concerning because provider perceptions can influence behavior in practice (Ernst et al., 2009; Grol, 1997). Furthermore, nurses with misconceptions about TBI may share inaccurate information with patients and families (Ernst, 2009), which has major implications for patient and family education.

Research has also shown that nurses report feeling ill-prepared to care for patients with various types of brain injuries (Long, Kneafsey, Ryan, & Berry, 2002a; Pryor & Smith, 2002). For instance, in a survey of 137 nurses conducted by Long et al (2002), two-thirds of nurses felt their prior training and education had not adequately prepared them with knowledge and skills necessary to care for patients undergoing rehabilitation after a stroke (Long et al., 2002a). Nurses have also reported the belief that specialized education and training is needed to care for patients with neurological conditions (Baker, 2012). According to Baker (2012), in a study of nurses' perceptions of educational requirements to care for patients with neurological conditions, 91% of registered nurses reported that nurses should be required to have access to specialist education and training when caring for patients with neurological conditions. Nurses also reported wanting more education in multiple areas, including management of patients' behaviors and families' concerns (Baker, 2012). Studies on this topic recommended additional educational and training interventions for nurses (Baker, 2012; Edwards, 2006; Pryor & Smith, 2002). Examples of educational and training interventions could include continuing education meetings and workshops (Forsetlund et al., 2009), coursework (Keane, 1991), and online training (Ruiz, Mintzer, & Leipzig, 2006). However, research in this area has broadly focused on brain injury, without specifically measuring nurses' beliefs about caring for patients with moderate-to-severe TBI.

## **Clinical Guidelines on Nursing Care of Patients with Moderate-to-Severe TBI**

In addition to lack of research measuring nurses' beliefs about caring for patients with moderate-to-severe TBI, there are gaps in clinical guidelines focusing on evidence-based nursing care of patients with these injuries. For instance, although clinical guidelines exist for acute care nursing management of patients with moderate-to-severe TBI (American Association of Neuroscience Nurses, 2008), these guidelines are limited to medical management in the acute stage (e.g., seizure prevention, maintaining nutrition); there are no clinical guidelines published that address major influences on nursing care for patients with moderate-to-severe TBI, like patients' cognitive impairments or sex-based differences in outcomes. The available guidelines also do not provide information about care of patients in the sub-acute and chronic stage post-injury. This is concerning as lack of clinical guidelines on these topics suggests nurses will not have necessary information when providing care to patients with TBI who have severe cognitive impairments or those who are in the chronic stage post-injury. Finally, although there are existing guidelines for management of patients with severe TBI (American Association of Neuroscience Nurses, 2008), it is not clear that nurses know about them or follow them.

The limited research on nurses' beliefs about caring for patients with moderate-to-severe TBI and lack of sufficient clinical guidelines to manage care of patients with moderate-to-severe TBI emphasizes the need for more research to direct education and training of nurses who care for these patients. To develop relevant and useful educational materials to be delivered to nurses in their preferred methods, we investigated nurses' beliefs and learning preferences about caring for patients with moderate-to-severe TBI. The authors hypothesized that: 1) nurses would have significant differences in beliefs about care of patients with

moderate-to-severe TBI related to recovery/rehabilitation; and 2) more nurses would select the learning preference “searching on the Internet” when wanting to learning about care of these patients.

## Methods

### Study Design & Participants

This cross-sectional, exploratory study was conducted by having nurses employed by Level I trauma center in the Midwest complete an electronic survey. All nurses at the participating hospital were surveyed because patients with TBI can be found on an hospital unit depending on severity of injury, time since injury, and comorbidities (McQuillan & Mitchell, 2002). Thus, the target population was all nurses, including those who may or may not care for patients with TBI on a frequent basis. Data were collected between October and December 2014. All registered nurses employed by the hospital (N=2,523) were invited to participate via email, with two email reminders. All survey responses were anonymous. Participants had the option to enter a raffle to win one of 6 VISA gift cards, valued at \$25 each. Participants’ survey responses were kept separately from all contact information that was collected to enter the raffle. Our response rate was 20.3% (513 nurses), defined as the number of completed surveys divided by the number of nurses that received the email (Couper & Miller, 2008). Our response rate was acceptable because response rates in electronic surveys are typically 20% or lower (Shih & Fan, 2009). All procedures were approved by the participating institutional review board.

Most respondents were female (90.65%) with a mean age of 38.19 years. All of the respondents self-identified as registered nurses and reported the following educational degrees: nursing diploma (2.14%); associate’s (13.45%); bachelor’s (72.12%); and master’s or doctorate (12.29%). Primary place of employment included: primary care clinic (2.72%), emergency room (4.87%), ambulatory clinic or doctor’s office (18.12%), inpatient unit (56.14%), and other [e.g., operating room, outpatient surgery, organ procurement, radiology, etc.] (21.24%). Nurses reported an average of 12.69 years of active nursing practice (range: 0-50; SD: 10.99), and 5.91 years of being employed by the participating hospital (range: 0-42; SD: 6.51).

### Perceptions of Brain Injury Survey (PBIS)

The findings described in this manuscript are part of a larger survey that was completed by the nurse respondents, the Perceptions of Brain Injury Survey (PBIS) (Authors [A], under review; Authors [B], under review). The authors designed the PBIS, which was adapted from two surveys: 1) a survey about school speech-language pathologists’ perceived knowledge of and perceived confidence to provide services to students with TBI (Hux et al., 1996); and 2) a survey on nurses’ perceived knowledge and learning preferences regarding care of patients with mild TBI (Watts, Gibbons, & Kurzweil, 2011). Information about the structure and psychometrics of the final survey are reported elsewhere (Authors [B], under review). In this article, we report findings on items focusing on nurses’ beliefs and learning preferences based on level of perceived knowledge. As Cronbach’s alpha is known to

underestimate reliabilities (Novick & Lewis, 1967), McDonald's omega coefficients ( $\omega$ ) are reported for each subscale (McDonald, 1970).

**Survey Development**—Survey items are based in part on evidence-based clinical guidelines published by the American Association of Neuroscience Nurses (American Association of Neuroscience Nurses, 2008) and in part on the broader TBI outcomes literature (Corrigan et al., 2007; Dams-O'Connor, Pretz, Billah, Hammond, & Harrison-Felix, 2015; Lunney, McGuire, Endozo, & McIntosh-Waddy, 2010; Saban, Smith, Collins, & Pape, 2011). The first draft of survey items generated for the PBIS was distributed to five registered nurses, a PhD-prepared nurse, a physician, and a statistician. The five nurses were asked to provide the authors with feedback on nursing care roles and responsibilities, the survey format, and item syntax. The physician provided feedback about care of patients with moderate-to-severe TBI from an interdisciplinary perspective. The statistician gave information on item response formats suitable for statistical analysis. The first author then revised the PBIS based on feedback from these professionals to create the second draft. Next, two TBI-content experts who are experts in TBI practice and research provided feedback on the second draft of the survey: a PhD-prepared speech-language pathologist and a DNP-prepared nurse. These experts made suggestions for revising or adding additional items. Their feedback was used to develop the third draft of the survey. After, the third draft was presented at a hospital nursing practice council meeting and reviewed in detail by 30 registered nurses, 8 of which worked on hospital units where nurses frequently provide care to patients with moderate-to-severe TBI. Feedback from the nursing practice council was used to develop the fourth draft of the survey, which was used to develop the electronic version. The electronic version was then pilot tested by four registered nurses and one physician for formatting before being finalized.

**Perceived Knowledge Items**—The 20 items focusing on perceived knowledge asked nurses about their knowledge of various nursing topics specific to TBI, including nursing care plans, stage of recovery, treatment and therapy options, and clinical guidelines. These items were in a check-all-that-apply and Likert-type scale format ranging from 1 to 4 (1= none, 2= some, 3= moderate and 4= expert). Those with higher scores on this subscale had higher perceived knowledge ( $\omega=0.99$ ).

**Beliefs Items**—Seventeen beliefs items asked nurses to rate their level of agreement or disagreement with a series of statements specific to TBI care, prognosis, and recovery. These items were in a 4-point Likert-type scale format: strongly agree (1), agree (2), disagree (3), and strongly disagree (4). Items focused on the following TBI-specific topics: care provision; sex-based differences after TBI; consequences of TBI and prognosis; nursing role and specific TBI related training; and importance of knowledge of TBI to the nurse's practice. Nurses with higher scores on this subscale endorsed more disagreement with the listed statements ( $\omega=0.92$ )

**Learning Preferences Items**—Respondents were asked to select where they would obtain information if they needed to learn about care of patients with TBI. Learning preferences items were in a select-all-that-apply format. Response option examples include:

1) ask a more experienced colleague; 2) search on the Internet; and 3) attend a face-to-face continuing education class in-service. Psychometric testing was not conducted on these items.

**Demographic Items**—Finally, nurses were asked demographic questions about total number of years in active nursing practice, total number of years in current nursing position, and frequency of caring for patients with moderate-to-severe TBI. Psychometric testing was not conducted on these items.

## Data Analysis

Authors used latent class analysis (LCA), a subset of structural equation modeling, to determine homogenous subgroups in our sample (Clogg, 1995). LCA is used to assess the associations between responses on a set of indicators (Clogg, 1995). Prior to using LCA, one must assume that participants will differ in given responses based on an observable latent trait (Clogg, 1995), which, in this case, were the perceived knowledge items. Authors used LCA to develop homogenous subgroups (classes) of nurses based on level of perceived knowledge (Authors [A], under review). As limited research is available on this topic, no published information was available to refer to on the theorized structure of perceived knowledge items which authors used in developing the class structure.

The LCA was conducted using Mplus (Muthén & Muthén, 2010). No missing data were present as only completed survey responses were assessed. Multiple indices were used to determine the appropriate class structure for the perceived knowledge items. Authors assessed: 1) interpretability; 2) theoretical justification; 3) parsimony; 4) entropy variable  $> 0.7$  (Celeux & Soromenho, 1996); 5) the lowest Akaike's information criterion (AIC), Bayesian information criterion (BIC), and adjusted BIC (Fraley & Raftery, 1998); 6) average posterior probability for each class (must be  $> 0.75$  with no more than 10% overlap between non-contiguous clusters); 7) at least 2.5% of total sample size in each group; and 8) no significant improvement over neighboring class structures as assessed by Lo-Mendell Rubin and Vuong-Lo-Mendell-Rubin likelihood ratio tests. Finally, once we determined the appropriate class structure, each participant was given a maximal posterior probability, which assigned him/her to a specific latent class. Details about model fit indices for perceived knowledge items are elsewhere (Authors [A], under review).

The LCA yielded three subgroups: low ( $n=133$ ), moderate ( $n=242$ ), and high ( $n=138$ ) perceived knowledge. We used the three perceived knowledge subgroups to analyze nurses' beliefs about TBI and care of patients with TBI, nurses' learning preferences, and demographic indicators. Authors conducted pairwise comparisons for auxiliary variables (i.e., beliefs and learning preferences and demographic items) using two-sample t-tests (Table 1, 3, and 5) using NCSS (Hintze, 1987). For beliefs items, we collapsed the four-point Likert-type scale to a dichotomous scale (agree or disagree). Differences in agreement for beliefs and differences in learning preferences based on the perceived knowledge class structure are listed in Table 2 and 4, while pairwise comparisons of demographic indicators are listed in Table 6. Finally, we used False Discovery Rate to correct for multiple pairwise comparisons (Verhoeven, Simonsen, & McIntyre, 2005). Adjusted p-values were assessed

for significance at  $p < .05$ . The first author can be contacted directly for any underlying research materials.

## Results

### Nurses' Beliefs Based on Perceived Knowledge Groups

Nurses' beliefs differed significantly across perceived knowledge groups on several items. Regarding sex-based differences in TBI incidence and recovery, nurses in all groups agreed that TBI is equally common in males and females, which is a misconception (Table 1 and 2). However, more nurses in the high perceived knowledge group held this misconception. Although most nurses, regardless of perceived knowledge group, disagreed with the statement that men and women recover in the same way, some nurses also disagreed with the statement that men and women require different types of care after TBI, a contradictory finding.

Regarding care provision, there were significant misconceptions and differences in beliefs across groups. There were significant misconceptions about the statement "Medical labels that specify TBI as mild, moderate, or severe are useful for development of nursing care plans," with the majority of low perceived knowledge nurses disagreeing with this statement compared to most moderate and high perceived knowledge nurses agreeing with the statement (Table 3 and 4). Specific to nursing role and training, there were significant differences in beliefs on the statement, "the role of registered nurses in regard to care of patients with TBI is clearly understood in my workplace." The majority of low perceived knowledge nurses agreed with this statement, while varying percentages of moderate and high perceived knowledge nurses disagreed. There were also significant differences in beliefs about the statement, "Nurses on my unit do a good job when providing care to patients with moderate-to-severe TBI," with agreement from almost all low and moderate perceived knowledge nurses compared to only some of high perceived knowledge nurses. Finally, the majority of nurses from all perceived knowledge groups agreed that nurses need specialized training to provide care to patients with moderate-to-severe TBI. Regardless of perceived knowledge group, most nurses disagreed that knowledge of moderate-to-severe traumatic brain injury was important to their current nursing practice.

### Nurses' Learning Preferences Based on Perceived Knowledge Groups

Participants were asked to select learning preferences related to obtaining knowledge about care of patients with moderate-to-severe TBI. The majority of nurses, regardless of perceived knowledge group, endorsed "asking a colleague" as the most favored learning preference. The next most commonly selected learning preference was "search on the internet," endorsed by more than half of low and high perceived knowledge nurses and almost three-quarters of the moderate perceived knowledge nurses. The third most commonly selected learning preference was "read an article," which was selected by almost all of the nurses, regardless of perceived knowledge group. Finally, the fourth most commonly selected learning preference was "attend a face-to-face continuing education class in-service," endorsed by half to one-third of all nurses.



## Discussion

We assessed nurses' beliefs about TBI and care of patients with TBI, along with nurses' learning preferences. We were able to divide nurses into three homogenous subgroups based on perceived knowledge: low, moderate, and high. Overall, nurses had many misconceptions about TBI and care of patients with TBI, some of which differed as a function of perceived knowledge. In this section, we discuss those misconceptions and implications for nurses' education and training and patient care.

Nurses in this study held multiple misconceptions, including inaccurate beliefs related to incidence of TBI and use of medical labels. For instance, nurses in this study had misconceptions about sex-based incidence rates of TBI, with some nurses agreeing with the misconception that TBI occurs equally in males and females. Yet, men have a higher incidence of TBI (Centers for Disease Control and Prevention, 2014). Nurses also had misconceptions about the statement, "Medical labels that specify TBI as mild, moderate, or severe are useful for development of nursing care plans." The majority of moderate and high perceived knowledge group nurses incorrectly agreed with this statement. Medical labels about the severity of injury, however, are not enough to develop a care plan; nurses also need results of patient performance on numerous neuropsychological, cognitive, and motor assessments to use in developing and directing the patient's care plan (Brooks, Aughton, Bond, Jones, & Rizvi, 1980; Hux et al., 1996; Mansour, Lajiness-O'Neill, & others, 2015). These misconceptions suggest that some inaccurate information might be provided to patients and families (Ernst, 2009). To prevent distribution of inaccurate information to patients and families, sufficient training and education on beliefs is needed.

Discrepancies regarding nursing performance to care for patients with TBI provide further evidence for the need more training and education. Most concerning was that a large majority of nurses disagreed that knowledge about moderate-to-severe TBI was important to their practice. Yet, our findings show almost all nurses in our sample agreed that nurses need specialized training to care for patients with moderate-to-severe TBI. Although some nurses agreed that nurses on their unit do a good job when caring for patients with TBI, most nurses reported lack of clarity on the role of nurses to care for patients with TBI in their workplace. Lack of clarity on care of patients with TBI is consistent with other research, where nurses did not feel they had sufficient training to care for these patients (Baker, 2012; Long et al., 2002a). Research has also shown that hospital units with more educated and experienced nurses have lower adverse occurrence rates (Blegen, Vaughn, & Goode, 2001; McHugh & Lake, 2010). Yet, our findings suggest variability in education, training, and consequently, nursing practice patterns, which may be associated with poor patient health outcomes (Seel et al., 2015). Overall, these findings provide evidence for the need for more education and training to improve nursing care of patients with moderate-to-severe TBI.

Our findings are similar to prior research that has shown rehabilitation staff, including nurses, had misconceptions about unconsciousness, amnesia, recovery, and rehabilitation after TBI (Farmer & Johnson-Gerard, 1997). Nursing-specific studies also showed nursing students had misconceptions about brain damage, amnesia, unconsciousness, and recovery (Ernst et al., 2009). However, these misconceptions may be present because knowledge in

the area of TBI is still emerging (Xiong, Mahmood, & Chopp, 2009); there are many questions about care and recovery that have yet to be answered as studies cite the need more for research on effective approaches for treatment of TBI and translation of knowledge into practice (Xiong et al., 2009). Thus, nurses with a high degree of skill may still not know the answers because knowledge is still evolving in this area. Emerging knowledge in the area of TBI might have caused nurses to respond inconsistently or with greater variability to items in the beliefs subscale. These misconceptions may persist over time as typical education and training focuses on establishing nursing knowledge and skills necessary for effective care (Gould, Berridge, & Kelly, 2007), but excludes nurses' beliefs. However, it is particularly important to address nurses' beliefs as beliefs have been shown to influence providers' behaviors (Grol, 1997). Given the possibility for misconceptions regarding care of patients with TBI, understanding nurses' beliefs and perceptions is imperative to effectively train and educate nurses who care for patients with TBI.

Regarding learning preferences, variations were present in the ways nurses preferred to learn about patient care related to patients with moderate-to-severe TBI. Most nurses preferred asking a colleague, followed by searching on the internet, and reading an article when they need to obtain information specific to care of patients with TBI. Findings on learning preferences were also similar to prior research (Watts et al., 2011). The finding that almost all nurses prefer asking a colleague when in need of information emphasizes the need to ensure all nurses have accurate beliefs about TBI and care of patients with TBI. As nurses often learn from each other via peer teaching and learning (Costello, 1989; Estabrooks et al., 2005; Secomb, 2008), adequate training and education is necessary to prevent the transfer of inaccurate information. Knowledge of nurses' learning preferences can also provide direction for effective modes of delivering training and educational interventions.

This survey can be used in both research and practice to determine nursing students and registered nurses' baseline beliefs about TBI and care of patients with TBI. Survey results validate and provide further evidence of previous research by indicating nurses hold misconceptions and/or strong variations in beliefs in care of patients with TBI; these misconceptions and variations in beliefs warrant further training and education. Educators and clinicians can use survey results to tailor nurses' education and training to dispel misconceptions and to come to a consensus on beliefs based on accurate information. For instance, nurse educators could have nurses at an individual-, unit-, or hospital-levels take the PBIS to determine presence of inaccurate beliefs. Training and educational interventions can then be designed at each level to address any inaccurate beliefs, such as holding unit in-services (unit-level) and nursing grand rounds (hospital-level), or by developing continuing education materials to be accessed by nurses as necessary (individual-level). Additional training and education on proper assessment of patients with TBI and appropriate documentation (Bay, 2011) may also address inaccurate beliefs. Other recommendations for effective nursing educational and training interventions documented in the literature include reflective learning (Forneris & Peden-McAlpine, 2006); course work (Keane, 1991); and simulated scenarios (Jeffries, 2005). Nurses may also refer to specific websites to receive training about care of patients with TBI, including: 1) Brain Injury Association of America Academy of Certified Brain Injury Specialists (Brain Injury Association of America, 2015a); 2) Michigan Traumatic Brain Injury Training Online (Michigan Department of Health and

Human Services & Brain Injury Association of Michigan, 2015), and 3) Defense and Veterans Brain Injury Center (Defense and Veterans Brain Injury Center, 2014).

Assessment of learning preferences through this survey provides direction on educational and training methods that are preferred by nurses, such as additional course work, on the job training, or attending a face-to-face seminar. Learning preferences also provide direction for development and testing of future interventions for nurse education and training specific to care of patients with TBI. In addition, our finding that “asking a colleague” is the preferred method of learning for nurses who desire information relating to TBI could support the role of a TBI unit expert or clinical nurse specialist/nurse educator to ensure nurses have a knowledgeable resource in close proximity. However, as data were collected from one hospital, findings should be used cautiously.”

Additional research is needed to better understand nurses’ beliefs about caring for patients with moderate-to-severe TBI. Future studies could compare the beliefs of nurses who care for patients with TBI on a regular basis (e.g., emergency, critical care, and rehabilitation nurses and case managers) to the beliefs of nurses who do not (e.g., psychiatric, transplant, and general medicine nurses). This would be helpful in directing development of educational and training interventions to reduce inaccurate beliefs/misconceptions based on frequency of care of patients with TBI. The majority of nurses who responded reported that their primary place of employment was an inpatient unit; however, nurses from some inpatient units may have responded less due to limited exposure to patients with TBI, less confidence in answering the survey, or the perception that they should not fill out the survey if they do not care for these patients on a regular basis. Thus, more research is needed to further determine beliefs of nurses in other hospital care settings as differing unit-based response rates may relate to the nature/rate of misconceptions. Finally, as the reported class structure was developed based on perceived knowledge items from the PBIS, more research is needed to determine nurses’ beliefs based on their actual level of knowledge compared to their level of perceived knowledge. Tests of actual knowledge may provide more insight into decisions nurses may make in their practice based on their actual knowledge when caring for patients with TBI.

Nurses must be knowledgeable about TBI and care of patients with TBI because patients, their families, and the lay public rely on nurses for accurate information. However, our findings show that misconceptions and variations in beliefs about TBI exist. These issues suggest variability in nursing practice patterns, which may be associated with poor patient outcomes (Seel et al., 2015). More education and training is needed for nurses to ensure they have factual information about TBI and to clarify the role of nurses in caring for patients with TBI.

### **Acknowledgements:**

The authors thank School of Nursing faculty and staff for guidance in survey development and assistance with research support.

**Funding:** This research was supported by the University of Wisconsin-Madison, School of Nursing and the NIH/NIGMS Initiative for Maximizing Student Development (PI, M. Carnes) Grant# R25GM083252.

## References

- American Association of Neuroscience Nurses. (2008). Nursing management of adults with severe traumatic brain injury. Retrieved from <http://www.aann.org/pdf/cpg/aanntraumaticbraininjury.pdf>
- American Cancer Society. (2015). What are the key statistics about breast cancer? Retrieved from <http://www.cancer.org/cancer/breastcancer/detailedguide/breast-cancer-key-statistics>
- Baker M (2012). Education requirements for nurses working with people with complex neurological conditions: Nurses' perceptions. *Nurse Education Today*, 32(1), 71–77. [PubMed: 21333416]
- Bay E (2011). Mild traumatic brain injury: a midwest survey about the assessment and documentation practices of emergency department nurses. *Advanced Emergency Nursing Journal*, 33(1), 71–83. [PubMed: 21317700]
- Blegen MA, Vaughn TE, & Goode CJ (2001). Nurse experience and education: effect on quality of care. *Journal of Nursing Administration*, 31(1), 33–39. [PubMed: 11198839]
- Brain Injury Association of America. (2015a). Academy of certified brain injury specialists. Retrieved from <http://www.biausa.org/acbis>
- Brain Injury Association of America. (2015b). Living with brain injury. Retrieved from <http://www.biausa.org/living-with-brain-injury.htm>
- Brooks DN, Aughton ME, Bond MR, Jones P, & Rizvi S (1980). Cognitive sequelae in relationship to early indices of severity of brain damage after severe blunt head injury. *Journal of Neurology, Neurosurgery & Psychiatry*, 43(6), 529–534.
- Browndyke JN, Santa Maria MP, Pinkston JB, & Gouvier WD (1998). Online neuropsychology project: A survey of general head injury and prevention knowledge between professionals and non-professionals. *Archives of Clinical Neuropsychology*, 13(1), 133.
- Celeux G, & Soromenho G (1996). An entropy criterion for assessing the number of clusters in a mixture model. *Journal of Classification*, 13(2), 195–212.
- Centers for Disease Control and Prevention. (2013). Traumatic brain injury. Retrieved from <http://www.cdc.gov/traumaticbraininjury/>
- Centers for Disease Control and Prevention. (2014). Report to congress on traumatic brain injury in the United States: Epidemiology and rehabilitation. Atlanta, GA: National Center for Injury Prevention and Control; Division of Unintentional Injury Prevention.
- Clogg CC (1995). Latent class models In *Handbook of statistical modeling for the social and behavioral sciences* (pp. 311–359). New York, NY: Springer.
- Corrigan JD, Selassie AW, Lineberry LA, Millis SR, Wood KD, Pickelsimer EE, & Rosenthal M (2007). Comparison of the Traumatic Brain Injury (TBI) Model Systems national dataset to a population-based cohort of TBI hospitalizations. *Archives of Physical Medicine and Rehabilitation*, 88(4), 418–426. 10.1016/j.apmr.2007.01.010 [PubMed: 17398241]
- Costello J (1989). Learning from each other: Peer teaching and learning in student nurse training. *Nurse Education Today*, 9(3), 203–206. [PubMed: 2755444]
- Couper MP, & Miller PV (2008). Web survey methods introduction. *Public Opinion Quarterly*, 72(5), 831–835.
- Dams-O'Connor K, Pretz C, Billah T, Hammond FM, & Harrison-Felix C (2015). Global outcome trajectories after TBI among survivors and nonsurvivors: A National Institute on Disability and Rehabilitation Research Traumatic Brain Injury Model Systems study. *The Journal of Head Trauma Rehabilitation*, 30(4), E1–10. 10.1097/HTR.0000000000000073
- Defense and Veterans Brain Injury Center. (2014). Webinars on traumatic brain injury.
- Dikmen SS, Machamer JE, Winn HR, & Temkin NR (1995). Neuropsychological outcome at 1-year post head injury. *Neuropsychology*, 9(1), 80.
- Duff MC, & Stuck S (2014). Paediatric concussion: Knowledge and practices of school speech-language pathologists. *Brain Injury*, 29(1), 64–77.
- Edwards G (2006). The training and education of nurses working in stroke care. *British Journal of Nursing*, 15(21), 1180–1184. [PubMed: 17170693]

- Ernst WJ, Trice AD, Gilbert JL, & Potts H (2009). Misconceptions about traumatic brain injury and recovery among nursing students. *The Journal of Head Trauma Rehabilitation*, 24(3), 213–220. [PubMed: 19461368]
- Estabrooks CA, Rutakumwa W, O’Leary KA, Profetto-McGrath J, Milner M, Levers MJ, & Scott-Findlay S (2005). Sources of practice knowledge among nurses. *Qualitative Health Research*, 15(4), 460–476. [PubMed: 15761093]
- Evans K, Hux K, Chleboun S, Goeken T, & Deuel-Schram C (2009). Persistence of brain injury misconceptions among speech language pathology graduate students. *Contemporary Issues Communication Sciences and Disorders*, 36, 166–173.
- Farmer JE, & Johnson-Gerard M (1997). Misconceptions about traumatic brain injury among educators and rehabilitation staff: A comparative study. *Rehabilitation Psychology*, 42(4), 273.
- Faul M, Xu L, Wald M, & Coronado V (2010). *Traumatic brain injury in the United States: Emergency department visits, hospitalizations and deaths 2002–2006*. Atlanta, GA: Centers for Disease Control and Prevention, National Center for Injury Prevention and Control.
- Fornieris SG, & Peden-McAlpine CJ (2006). Contextual learning: A reflective learning intervention for nursing education. *International Journal of Nursing Education Scholarship*, 3(1).
- Forssetlund L, Bjorndal A, Rashidian A, Jamtvedt G, O’Brien MA, Wolf F, ... Oxman AD (2009). Continuing education meetings and workshops: effects on professional practice and health care outcomes. *Cochrane Database of Systematic Reviews*, 2(2).
- Fraleigh C, & Raftery AE (1998). How many clusters? Which clustering method? Answers via model-based cluster analysis. *The Computer Journal*, 41(8), 578–588.
- Gould D, Berridge E-J, & Kelly D (2007). The national health service knowledge and skills framework and its implications for continuing professional development in nursing. *Nurse Education Today*, 27(1), 26–34. [PubMed: 16616397]
- Green RE, Christensen B, Melo B, Monette G, Bayley M, Hebert D, ... Mcilroy W (2006). Is there a trade-off between cognitive and motor recovery after traumatic brain injury due to competition for limited neural resources? *Brain and Cognition*, 60(2), 199–201. [PubMed: 16646119]
- Grol R (1997). Beliefs and evidence in changing clinical practice. *British Medical Journal*, 315(7105), 418–421. [PubMed: 9277610]
- Himanen L, Portin R, Isoniemi H, Helenius H, Kurki T, & Tenovu O (2006). Longitudinal cognitive changes in traumatic brain injury: A 30-year follow-up study. *Neurology*, 66(2), 187–192. 10.1212/01.wnl.0000194264.60150.d3 [PubMed: 16434651]
- Hintze JL (1987). *Number Cruncher Statistical System: Version 5.0 5-87*: [handbook]. NCSS.
- Hooper SR (2006). Myths and misconceptions about traumatic brain injury: Endorsements by school psychologists. *Exceptionality*, 14(3), 171–182.
- Hux K, Walker M, & Sanger DD (1996). Traumatic brain injury knowledge and self-perceptions of school speech-language pathologists. *Language, Speech, and Hearing Services in Schools*, 27(2), 171–184.
- Jeffries PR (2005). A frame work for designing, implementing, and evaluating simulations used as teaching strategies in nursing. *Nursing Education Perspectives*, 26(2), 96–103. [PubMed: 15921126]
- Keane M (1991). Acceptance vs. rejection: Nursing students’ attitudes about mental illness. *Perspectives in Psychiatric Care*, 27(3), 13–18. [PubMed: 1788046]
- Linden MA, & McClure J (2012). The causal attributions of nursing students toward adolescent survivors of brain injury. *Nursing Research*, 61(1), 58–65. [PubMed: 22166910]
- Linden MA, & Redpath SJ (2011). A comparative study of nursing attitudes towards young male survivors of brain injury: A questionnaire survey. *International Journal of Nursing Studies*, 48(1), 62–69. [PubMed: 20965077]
- Long AF, Kneafsey R, Ryan J, & Berry J (2002a). Exploring qualified nurses’ perceptions of the relevance of education in preparation for their role in rehabilitation. *Nurse Education Today*, 22(2), 136–143. [PubMed: 11884194]
- Long AF, Kneafsey R, Ryan J, & Berry J (2002b). The role of the nurse within the multi-professional rehabilitation team. *Journal of Advanced Nursing*, 37(1), 70–78. [PubMed: 11784400]

- Lunney M, McGuire M, Endozo N, & McIntosh-Waddy D (2010). Consensus-validation study identifies relevant nursing diagnoses, nursing interventions, and health outcomes for people with traumatic brain injuries. *Rehabilitation Nursing*, 35(4), 161–166. [PubMed: 20681391]
- Mansour A, Lajiness-O'Neill R, & others. (2015). Call for an integrative and multi-disciplinary approach to traumatic brain injury (TBI). *Psychology*, 6(04), 323.
- McDonald RP (1970). The theoretical foundations of principal factor analysis, canonical factor analysis, and alpha factor analysis. *British Journal of Mathematical and Statistical Psychology*, 23(1), 1–21. 10.1111/j.2044-8317.1970.tb00432.x
- McHugh MD, & Lake ET (2010). Understanding clinical expertise: Nurse education, experience, and the hospital context. *Research in Nursing & Health*, 33(4), 276–287. [PubMed: 20645420]
- McQuillan KA, & Mitchell PH (2002). Traumatic brain injuries. In McQuillan KA, Von Rueden K, Hartstock RL, Flynn MB, & Whalen E (Eds.), (3rd edition, pp. 394–461). Philadelphia, PA: W. B. Saunders Company.
- Michigan Department of Health and Human Services, & Brain Injury Association of Michigan. (2015). Michigan traumatic brain injury online training. Retrieved from <https://mitbitraining.org/>
- Millis SR, Rosenthal M, Novack TA, Sherer M, Nick TG, Kreutzer JS, ... Ricker JH (2001). Long-term neuropsychological outcome after traumatic brain injury. *The Journal of Head Trauma Rehabilitation*, 16(4), 343–355. [PubMed: 11461657]
- Muthén LK, & Muthén BO (2010). *Mplus User's Guide: Statistical Analysis with Latent Variables: User's Guide*. Muthén & Muthén.
- Novick MR, & Lewis C (1967). Coefficient alpha and the reliability of composite measurements. *Psychometrika*, 32(1), 1–13. [PubMed: 5232569]
- Authors [A]. (under review) Nurses' perceived knowledge, perceived confidence, and training to care for patients with traumatic brain injury.
- Authors [B]. (under review) Nurses' perceptions of caring for patients with traumatic brain injury: A psychometric study.
- Pryor J, & Smith C (2002). A framework for the role of registered nurses in the specialty practice of rehabilitation nursing in Australia. *Journal of Advanced Nursing*, 39(3), 249–257. [PubMed: 12121525]
- Rao V, Bertrand M, Rosenberg P, Makley M, Schretlen D, Brandt J, & Mielke M (2010). Predictors of new-onset depression after mild traumatic brain injury. *The Journal of Neuropsychiatry and Clinical Neurosciences*, 22(1), 100–104. [PubMed: 20160216]
- Redpath SJ, Williams WH, Hanna D, Linden MA, 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. [PubMed: 20455671]
- Ruiz JG, Mintzer MJ, & Leipzig RM (2006). The impact of e-learning in medical education. *Academic Medicine*, 81(3), 207–212. [PubMed: 16501260]
- Ryan DL (2009). Caring for patients with traumatic brain injuries: Are you up to the challenges? *American Nurse Today*, 4(8), 18–22.
- Saban KL, Smith BM, Collins EG, & Pape TL-B (2011). Sex differences in perceived life satisfaction and functional status one year after severe traumatic brain injury. *Journal of Women's Health* (2002), 20(2), 179–186. 10.1089/jwh.2010.2334
- Secomb J (2008). A systematic review of peer teaching and learning in clinical education. *Journal of Clinical Nursing*, 17(6), 703–716. [PubMed: 18047577]
- Seel RT, Barrett RS, Beaulieu CL, Ryser DK, Hammond FM, Cullen N, ... Horn SD (2015). Institutional variation in traumatic brain injury acute rehabilitation practice. *Archives of Physical Medicine and Rehabilitation*, 96(8), S197–S208. [PubMed: 26212397]
- Shih T-H, & Fan X (2009). Comparing response rates in e-mail and paper surveys: A meta-analysis. *Educational Research Review*, 4(1), 26–40. 10.1016/j.edurev.2008.01.003
- Swift TL, & Wilson SL (2001). Misconceptions about brain injury among the general public and non-expert health professionals: An exploratory study. *Brain Injury*, 15(2), 149–165. [PubMed: 11260765]

- Verhoeven KJ, Simonsen KL, & McIntyre LM (2005). Implementing false discovery rate control: Increasing your power. *Oikos*, 108(3), 643–647.
- Watts DD, Gibbons S, & Kurzweil D (2011). Mild traumatic brain injury: A survey of perceived knowledge and learning preferences of military and civilian nurses. *Journal of Neuroscience Nursing*, 43(3), 122–129. [PubMed: 21796028]
- Xiong Y, Mahmood A, & Chopp M (2009). Emerging treatments for traumatic brain injury. Retrieved from <http://informahealthcare.com/doi/abs/10.1517/14728210902769601>
- Yuhasz JE (2013). Misconceptions about traumatic brain injury among correctional health care professionals. *Journal of Correctional Health Care*, 1078345812474644.

**Table 1.**

Percent Values of Beliefs Items by Latent Class (n=513)

Beliefs Items.	Agree vs. Disagree	Perceived Knowledge Classes					
		Low Perceived Knowledge (n=133)		Moderate Perceived Knowledge (n=242)		High Perceived Knowledge (n=138)	
		n	%	n	%	n	%
Please rate your agreement or disagreement with the following statements.							
1. To assess and/or treat patients with TBI, nurses need specialized TBI educational materials.	Agree	121	90.97	218	90.08	133	96.37
	Disagree	12	9.03	24	9.92	5	3.63
2. The challenges of patients with TBI are typically more difficult to assess than the challenges of patients with other disabilities.	Agree	107	80.45	183	75.61	116	84.05
	Disagree	26	19.55	59	24.39	22	15.95
3. Knowing the location of brain damage from TBI helps in the development of nursing care plans that meet patients' needs.	Agree	130	97.74	228	94.21	135	97.82
	Disagree	3	2.26	14	5.79	3	2.18
4. Knowledge of a patient's background prior to TBI is necessary when developing a nursing care plan.	Agree	30	22.56	46	19.01	32	23.19
	Disagree	103	77.44	196	80.99	106	76.81
5. Patients with TBI often display behavior problems.	Agree	117	87.96	199	82.23	105	76.08
	Disagree	16	12.04	43	17.77	33	23.92
6. TBI is equally common in males and females.	Agree	21	15.79	69	28.17	39	28.27
	Disagree	112	84.21	176	71.83	99	71.73
7. Men and women recover in the same way after having a TBI.	Agree	15	11.28	28	11.58	12	8.70
	Disagree	118	88.72	214	88.42	126	91.30
8. Men and women require different types of care after having a TBI.	Agree	91	68.42	191	78.92	120	90.90
	Disagree	42	31.58	51	21.08	12	9.10
9. Family involvement in patient care is no different for men and women who are receiving care after having a TBI.	Agree	48	36.10	95	39.26	47	34.06
	Disagree	85	63.90	147	60.74	91	65.94
10. Recovery following TBI may continue for several years.	Agree	131	98.49	241	99.58	135	97.82
	Disagree	2	1.51	1	0.42	3	2.10
11. Greater variability exists in the population of patients with TBI than exists in populations of other patients with disabilities.	Agree	112	84.21	192	79.33	100	72.46
	Disagree	21	15.79	50	20.67	38	27.54
12. The role of registered nurses in regard to care of patients with TBI is clearly understood in my workplace.	Agree	100	75.18	77	31.81	24	17.39
	Disagree	33	24.82	165	68.19	114	82.61
13. Medical labels that specify TBI as mild, moderate, or severe are useful for development of nursing care plans.	Agree	29	21.81	177	73.15	105	76.09
	Disagree	104	78.19	65	26.85	33	23.91
14. Nursing care plan goals for patients with TBI may need to be revised more frequently than nursing care plan goals for patients with other types of disabilities.	Agree	109	81.95	199	82.23	108	78.26
	Disagree	24	18.05	43	17.77	30	21.74
15. Nurses on my unit do a good job when providing care to patients with moderate-to-severe TBI.	Agree	122	91.72	195	80.57	84	60.86
	Disagree	11	8.28	47	19.43	54	39.14
16. Nurses need specialized training to provide care to patients with moderate-to-severe TBI.	Agree	122	91.72	218	90.08	134	97.10
	Disagree	11	8.28	24	9.92	4	2.90



Beliefs Items.	Agree vs. Disagree	Perceived Knowledge Classes					
		Low Perceived Knowledge (n=133)		Moderate Perceived Knowledge (n=242)		High Perceived Knowledge (n=138)	
		n	%	n	%	n	%
17. Knowing about moderate-to-severe traumatic brain injury is important to my current nursing practice.	Agree	7	5.26	53	21.9	73	52.89
	Disagree	126	94.74	189	78.1	65	47.11

Author Manuscript

Author Manuscript

Author Manuscript

Author Manuscript

**Table 2.**

Pairwise Comparisons for Proportional Differences in Beliefs Items for the 3 Latent Classes (n=513)

Beliefs Items.	Perceived Knowledge Classes		
	Low vs. Moderate Perceived Knowledge	Low vs. High Perceived Knowledge	Moderate vs. High Perceived Knowledge
1. To assess and/or treat patients with TBI, nurses need specialized TBI educational materials.	p = 0.88	p = 0.14	p = 0.05
2. The challenges of patients with TBI are typically more difficult to assess than the challenges of patients with other disabilities.	p = 0.46	p = 0.60	p = 0.12
3. Knowing the location of brain damage from TBI helps in the development of nursing care plans that meet patients' needs.	p = 0.23	p = 0.98	p = 0.21
4. Knowledge of a patient's background prior to TBI is necessary when developing a nursing care plan.	p = 0.98	p = 0.98	p = 0.51
5. Patients with TBI often display behavior problems.	p = 0.26	p = 0.03	p = 0.26
6. TBI is equally common in males and females.	p = 0.03	p = 0.03	p = 0.98
7. Men and women recover in the same way after having a TBI.	p = 0.98	p = 0.64	p = 0.55
8. Men and women require different types of care after having a TBI.	p = 0.05	p = 0.006	p = 0.01
9. Family involvement in patient care is no different for men and women who are receiving care after having a TBI.	p = 0.68	p = 0.84	p = 0.49
10. Recovery following TBI may continue for several years.	p = 0.43	p = 0.81	p = 0.22
11. Greater variability exists in the population of patients with TBI than exists in populations of other patients with disabilities.	p = 0.43	p = 0.03	p = 0.24
12. The role of registered nurses in regard to care of patients with TBI is clearly understood in my workplace.	p = 0.006	p = 0.006	p = 0.01
13. Medical labels that specify TBI as mild, moderate, or severe are useful for development of nursing care plans.	p = 0.006	p = 0.006	p = 0.67
14. Nursing care plan goals for patients with TBI may need to be revised more frequently than nursing care plan goals for patients with other types of disabilities.	p = 0.98	p = 0.60	p = 0.51
15. Nurses on my unit do a good job when providing care to patients with moderate-to-severe TBI.	p = 0.01	p = 0.006	p = 0.006
16. Nurses need specialized training to provide care to patients with moderate-to-severe TBI.	p = 0.74	p = 0.12	p = 0.03
17. Knowing about moderate-to-severe traumatic brain injury is important to my current nursing practice.	p = 0.006	p = 0.006	p = 0.006

**Table 3.**

Percent Values of Learning Preferences by Latent Class (n=513)

Learning Preferences.	Selected vs. Not Selected	Perceived Knowledge Classes					
		Low Perceived Knowledge (n=133)		Moderate Perceived Knowledge (n=242)		High Perceived Knowledge (n=138)	
		n	%	n	%	n	%
If you need to learn about patient care related to patients with moderate-to-severe TBI, where do you usually get the information (Check all that apply)?							
Ask a more experience colleague	Selected	116	87.21	222	91.73	119	86.23
	Not Selected	17	12.79	20	8.27	19	13.77
Consult a textbook	Selected	48	36.09	87	35.95	50	63.77
	Not Selected	85	63.91	155	64.05	88	36.23
Read an article	Selected	72	54.13	116	47.93	61	44.20
	Not Selected	61	45.87	126	52.07	77	55.80
Search on the Internet	Selected	83	62.40	178	73.55	85	61.59
	Not Selected	50	37.60	64	26.45	53	38.41
Complete an Internet based continuing education course	Selected	39	29.32	62	25.61	31	22.46
	Not Selected	94	70.68	180	74.39	107	77.54
Attend a face-to-face continuing education class in-service	Selected	70	52.63	76	31.40	41	29.71
	Not Selected	63	47.37	166	68.60	97	70.29
Attend a conference	Selected	41	30.82	43	17.76	22	15.94
	Not Selected	92	69.18	199	82.24	116	84.06
Other	Selected	9	6.76	21	8.67	7	5.46
	Not Selected	124	93.24	221	91.33	121	94.54

**Table 4.**

Pairwise Comparisons for Proportional Differences in Learning Preferences for the 3 Latent Classes (n=513)

Learning Preferences.	Perceived Knowledge Classes		
	Low vs. Moderate Perceived Knowledge	Low vs. High Perceived Knowledge	Moderate vs. High Perceived Knowledge
Ask a more experience colleague	p = 0.42	p = 0.97	p = 0.27
Consult a textbook	p = 0.98	p = 0.98	p = 0.98
Read an article	p = 0.52	p = 0.30	p = 0.76
Search on the Internet	p = 0.08	p = 0.98	p = 0.04
Complete an Internet based continuing education course	p = 0.76	p = 0.48	p = 0.76
Attend a face-to-face continuing education class in-service	p = 0.01	p = 0.01	p = 0.92
Attend a conference	p = 0.01	p = 0.01	p = 0.89
Other	p = 0.76	p = 0.89	p = 0.52

Author Manuscript

Author Manuscript

Author Manuscript

Author Manuscript

**Table 5.**

Mean Values of Demographic Indicators by Latent Class (n=513)

Demographic Indicators	Perceived Knowledge Classes		
	Low Perceived Knowledge mean (SD)	Moderate Perceived Knowledge mean (SD)	High Perceived Knowledge mean (SD)
Years since graduation from highest nursing degree	10.07 (8.94)	10.36 (10.04)	12.86 (11.37)
Total years in active nursing practice, years	12.29 (9.87)	12.07 (11.05)	14.24 (11.83)
Total years in current nursing position, years	5.49 (5.94)	5.85 (6.84)	6.46 (6.50)
Frequency of care			
Patients with moderate-to-severe TBI	3.50 (1.40)	2.59 (1.36)	2.57 (1.84)
Men with moderate-to-severe TBI	3.42 (1.43)	2.69 (1.66)	2.49 (1.87)
Women with moderate-to-severe TBI	3.14 (1.56)	2.55 (1.67)	2.58 (1.98)

Author Manuscript

Author Manuscript

Author Manuscript

Author Manuscript

**Table 6.**

Pairwise Comparisons for Mean Differences in Demographic Indicators for the 3 Latent Classes (n=513)

Demographic Indicators	Mean Differences Between Paired Classes (95% CI)		
	Low vs. Moderate Perceived Knowledge	Low vs. High Perceived Knowledge	Moderate vs. High Perceived Knowledge
Years since graduation from highest nursing degree, years	p = 0.81	p = 0.05	p = 0.09
Total years in active nursing practice, years	p = 0.85	p = 0.22	p = 0.18
Total years in current nursing position, years	p = 0.74	p = 0.55	p = 0.60
Frequency of care			
Patients with moderate-to-severe TBI	p = 0.003	p = 0.002	p = 0.96
Men with moderate-to-severe TBI	p = 0.003	p = 0.002	p = 0.50
Women with moderate-to-severe TBI	p = 0.003	p = 0.002	p = 0.96

Author Manuscript

Author Manuscript

Author Manuscript

Author Manuscript