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## Evaluation of a Concussion Management and Discharge Education Training Module for Emergency Department Nurses

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Title: Evaluation of a Concussion Management and Discharge Education Training  
Module for Emergency Department Nurses

Submitted in Partial Fulfilment of the Requirement for the Degree of Doctor of  
Nursing Practice at the University of Kentucky

By:

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Louisville, Kentucky

2020

## Abstract

**Purpose:** The purpose of this project was to improve Emergency Department (ED) nurses' knowledge on identifying patients at risk for concussions and delivering effective concussion discharge education using an educational training intervention.

**Methods:** This project used a descriptive, non-randomized pre-post survey design. Participation involved three stages: a pre-education survey to assess baseline concussion education knowledge, an educational intervention consisting of a narrated PowerPoint presentation, and a post-education survey to evaluate knowledge on concussion discharge education. The intervention was delivered online via the UK Canvas educational platform.

**Results:** The majority of nursing staff participants were female (97%) and had a bachelor's degree as their highest level of education (91%). Of those participants, 23% did not have prior knowledge of concussion education, and roughly 75 % had less than 3 years of experience as a nurse. There was a statistically significant ( $p=0.005$ ) improvement in participants' knowledge of concussion discharge education from the pre-survey ( $M=20.1$ ,  $SD= 1.6$ ) to the post-survey ( $M=21.1$ ,  $SD= 1.4$ ).

**Conclusions:** Findings indicate that the educational training intervention helped ED nurses gain knowledge on how to identify concussions and deliver concussion discharge education to patients, over 18 years of age suffering from concussions. As head traumas continue to be a leading diagnosis in ED's and other Level-1 trauma settings, it is imperative to implement a standardized concussion discharge education training program for nurses such as the one implemented in this project to promote patient safety and wellbeing.

## Acknowledgements

I would like to thank the University of Kentucky College of Nursing as well as Norton and Baptist for their participation in my education. This Doctor of Nursing Project and program was fully funded by the University of Kentucky. I would like to thank Dr. Jean Edward for being mentor and advocate while advising me throughout this program as I adapt through the many transitions. I would like to thank my committee members, Dr. Justin Fraser, Dr. Patti Howard, Dr. Debbie Hampton as your support and feedback assisted me throughout this program and this projects success. Furthermore, I would like to extend my gratitude to Dr. Justin Fraser as he played a key part in this whole project from the PowerPoint development to the overall project's success. Also, I would like to extend a special thank you to Dr. Howard and her amazing team, as this project would not have been successful without the support of her staff and administrators in UK's ED. I would like to thank Dr. Amanda Wiggins for her assistance with the analysis of data and organization. Last but definitely not least, I would like to thank the program director, Dr. Melanie Hardin-Pierce as she played a major role in my leadership and skill development. Without her support and keen focus on my performance, I would not have developed into the person I am today. Furthermore, I would like to extend a congratulations and thank you to my wonderful colleagues as we have had this wonderful experience of sharing our lives throughout this DNP journey.

## Dedication

I would like to dedicate this work to my loving husband, Charles Frede for being my external supporter; I cannot thank you enough for encouraging me to make a difference and follow my dream as well as making many sacrifices to get me here. To my parents, for encouraging me throughout the process; even when life events tried to interfere. To my many friends, Ted and Claudia Bertuca, and many others for supporting me throughout the years to grow and expand my academic career. To my clinical mentor, Dr. Justin Fraser who has pushed me to grow in many subspecialties of neurology with encouragement and support of academic growth. To Dr. Jean Edward who has been a mentor to me throughout the majority of my professional and academic advancement. To Whitney Kurtz-Ogilvie, who has helped me grow throughout the entire process of my advanced education. To my concussion colleagues and mentors, for being there throughout my entire process of recovery and have contributed to my drive to help others with progressing neurological injuries and illness in the future as I advance in my career as a Doctor of Nursing in Acute Care.

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## Introduction

Concussions, otherwise known as mild traumatic brain injuries (mTBI) are one of the most under-recognized and frequently missed head injuries in the emergency department (ED). According to the Centers for Disease Control and prevention (CDC; et al., 2019), approximately 2 million people seek treatment for concussion every year. Ganti et al., (2015) reported that 1 in 5 patients diagnosed with a concussion returned to the ED within 72 hours and were admitted into the hospital for further evaluation.

A concussion can result from any trauma to the head. They are often associated with sports, falls, motor vehicle crashes (MVCs), and certain occupations such as military service. Missed concussions are a significant problem in the ED, due to a lack of specialized head trauma education and no universal standard of practice (Rowe & Eliyahu et al., 2018). General experience and education levels related to concussions vary among ED staff, and this can limit treatment, impact concussion discharge education, and influence the incidence of return visits within 72 hours of discharge (Villemure & Noline et al., 2011). A recent report on guidelines for neuroimaging decision-making and discharge instructions for concussion management reported inconsistencies in the types of guidelines used and the recommended time frame for follow-up care (Stern et al., 2017). Rowe and Eliyahu et al., (2018) discovered a lack of specialized head trauma education and training in the ED, particularly focusing on standards of practice, recognition of symptoms, and the ability to delegate care management of concussions to other providers.

Providing enhanced education on concussion care post discharge can help support ED nurses to increase their referral networks, within or outside their organizations, and to provide

the best care to patients with concussions (Veterans Affairs/Department of Defense; VA/DoD, et al., 2016). To narrow such a broad issue, this project focused on addressing concussion education needs in acute care facilities such as the ED in Level-1 trauma hospitals. The indication for concussion education and discharge management implementation as well as staff training have been a common theme among the literature (Wany et al 2017; Jackson et al 2017; Bay et al, 2017; Ganti et al, 2015; Minen et al, 2017).

### **Background and Significance**

Concussions account for 80% to 90 % of TBIs and are recognized as a national health concern (Center Disease Control; CDC et al., 2019). According to Stern & Seichepine (et al., 2017) the most widely used critical care reference for head trauma is derived from resources within the CDC. However, this formulation lacks follow-through and training for both staff and instructions on care post-concussion injury with adults after an MVC head injury. Villemure and Noline (et al., 2011) discovered that ED nurses are not receiving adequate training on how to manage head trauma. Additionally, studies conducted by Riggio and Wong (et al., 2009) and Walker and Pickett (et al., 2007), showed that compensation from insurance companies, state, and federal disability funding sources are linked to deficiencies in quality of care provided to patients with concussion injuries (CDC et al., 2019).

When evaluating educational tools, it is vital to assess their impact in a controlled manner. There are many supporting studies that raise concerns for ED nursing management of MVC victims, and whether education on head trauma is adequate for ED nursing staff. Since there are no standardized guidelines for training on discharge concussion education with the MVC adult population, the adoption of the Ontario Head Trauma guidelines has been routinely

recognized as a support tool for managing concussions and for educational training purposes in recent conferences with sports and veteran affair studies (American Academy Neurology; AAN Conference (et al., 2019). The educational intervention implemented in this project is expected to reduce missed concussions in the MVC population by increasing ED nurses' knowledge of concussions and proper discharge education for patients at risk for concussions. In addition, offering this training may influence nurses' perception of the importance of discharge education for promoting patient safety and improving care delivery outcomes.

### **Review of Literature**

Before delving deeper into the topic, it is important to note that the key terms concussion and mTBI are widely used interchangeably throughout the literature. To understand the literature on TBI education, a search was conducted using the following databases: CINAHL, Cochrane library, Medline, National clearing house, Psych INFO, PubMed, OVID and ProQuest, BioMed, Ovid, and National Medical Library. When conducting this systematic review of literature, the goal was to prove that there is more to concussion treatment than solely diagnosis and prevention; in the acute setting, it is also important to focus on post-incident management and discharge instruction. Naturally extending this, the review will go on to attempt to describe a bigger picture of the gaps associated with concussion management starting in the ED with initial management, through discharge planning and execution, ultimately looking at how post-concussion symptoms (PCS) can be minimized or prevented through discharge education training.

## Methods

While a number of studies were located, specific search criteria were constructed and then utilized in each database to cast a broad net, attempting to capture studies closely related to focusing on concussion and discharge education. Selected search terms include: “mTBI”, “adult”, “post-concussion”, “concussion”, “vision impairment”, “rehabilitation”, “emergency room visits”, “behavior problems”, “symptom management”, “sleep disturbance”, “impaired concentration and memory”, “care setting”, “mechanism of injury”, “diagnostic methods”, “head trauma protocol” and “discharge teaching”. The resulting studies were further refined by filtering criteria such as “greater than 16 years old”, “English language”, and date.

Inclusion criteria included terms such as “discharge” and “patient education” to focus on articles related to the hypothesis that discharge planning can have a significant impact on outcomes. Other inclusion criteria used included “functional outcome” and “rehabilitation” to ensure that studies were captured with long term tracking of subjects, in an effort to make sure only true “final” outcomes were considered. Studies focusing solely on concussion/mTBI in children were excluded, excepting for where a study may have included both adults and children in the population. For obvious reasons, articles older than 10 years were excluded, as were those speaking of “non-human trials.” The term “previous concussions” was also excluded to eliminate where possible the impact of repeated incidents from the study results.

## Findings

From the studies that were found, it became clear that there are gaps in guidelines for post-concussion discharge education and there is a distinct lack discharge planning education not well-described or tested in the literature.

Rowe & Eliyahu (et al., 2018), demonstrating that MVC was the underlying cause of the highest percentage of brain injuries in the ED, and that concussions were often missed due to the presentation of other injuries. Rowe found that MVC patients who sustained a concussion were eight times more likely to have their concussion misdiagnosed – a full 16.4% of patients were not diagnosed immediately by a physician. When compared to those presenting with sports injuries, there was a statistically significant difference in the number of misdiagnoses of concussions related to MVC, perhaps due to other injuries masking mTBI, and this led to a demonstrably higher incidence of PCS in MVC patients.

Moving from diagnosis to treatment, Stern & Seichepine (et al., 2017) undertook a survey of patients presenting at the ED utilizing the AAN (American Academy Neurology) Practice parameter illustrating a variability in the adherence to evidence based clinical concussion guideline in EDs, to the point where 35% of ED respondents reported no evidence-based practice guidelines were used for evaluation with their concussion patients. Lack of strong guidelines and, in many cases, strong leadership can cause patient care to fall in quality – particularly in a chaotic environment such as the ED, as studied by Bosch & Tavender (et al., 2016).

A few studies specifically evaluated discharge guidelines and instruction. Bay & Strong (et al., 2011) focused on the hospital staff's lack of awareness of the CDC guidelines for moderate traumatic brain injury (mTBI), specifically around discharge teaching. Bay (et al., 2011) validated that nurses most often focus on an injury specific discharge instruction, and do not emphasize methods for preventing further complications. Bergman & Louis (et al., 2016) developed a discharge booklet that included pictures in addition to self-care and preventative information. Bergman (et al., 2016) went on to examine the impact of distributing the booklet at discharge, finding it to be more useful than typical hospital discharge instructions. However,

Rowe & Eliyahu (et al., 2018) reviewed discharge teaching handouts and compared those given to patients suffering from concussion as a result of MVC versus a sports injury and discovered a gap in instructions between the two.

Other studies focused on PCS symptoms and longer-term follow-up. Losoi & Silverberg (et al., 2016) discovered that patients demonstrated a decrease in lingering symptoms when presented upfront information on their injury and avoiding complications. Further, Losoi found better outcomes for those that had a follow-up visit with a clinician or specialist. Minen & Shome (et al., 2017) attempted to correlate acute care treatment and post-discharge care with the patient's return visits to ED. Minen found that most return visits to the ED within 72 hours can be prevented if appropriate immediate treatment protocols are followed and solid discharge instructions are provided.

Each of the studies mentioned above contributes to the understanding of concussion diagnosis, treatment and post-discharge care, and how these elements impact overall clinical outcomes. However, there was the existence of flaws that occurred with each analysis. Flaws exist within each study, for example, Ganti & Conroy (et al., 2015) shows the lack of consistency in recording patients and their follow-up or return visits to the ED. In another example, the Shah & Muncer (et al., 2003) study presented the difficulties in accurately assessing symptoms and conditions due limitations caused by barriers of culture and family dynamics. In the diagnosis realm, Ganti & Conroy (et al., 2015) found that many patients who suffer from a concussion lack neurological symptom upon initial presentation in the ED post MVA.

Bosch & Tavender (et al. 2016); Wany & Chaou (et al., 2017); and Jeyaraj & Clendenning (et al., 2013) each uncovered many gaps in care by neglecting to focus on clinician specialty affecting quality of care received by concussion patients in the ED setting. Therefore,

professional specialty training holds a collective value however, the training transferability and understanding of concussion discharge education presents a practice challenge in the ED staff.

Most of limitations in each of the studies suggests that there was incomplete follow-up from data collected such as the population follow up with another institution. For example, Bay & Strong (et al., 2011), manifested their survey responses by demonstrating the collected material received by experienced ED nurses as well as those who were familiar with mTBI care therefore adhesions to the CDC head trauma protocol results demonstrated might be lower than reported due to convenience sampling. Furthermore, 64 percent of those responses lacked the knowledge of standard procedures for patients with mTBI (Bay & Strong, et al., 2011).

Additionally, Alsalheen & Mucha (et al., 2010), sought out the inability to report immediate markers of concussion symptoms related to the severity of the symptoms such as loss of consciousness, amnesia and confusion which can interfere with predicting outcomes and lead to more treatments. Losoi & Silverberg (et al., 2016), inconsistently followed the DSM-1V diagnostic manual for PCS, due to the lack in a 3-month follow-up of the collection of data. However, at 1 year most of the patients did report PCS. Ganti & Controy, failed to retrieve patient follow up pertaining to the treatment information from another ED. This was a common factor amongst the majority of the studies in this review, as many patients either failed to follow-up with their clinician or sought care at other outlying hospitals. Furthermore, Rowe demonstrated there were limits of measurement during the study such as lack of knowledge on staff shortage and the relationship of discharge teaching to specific doctors or specialties. The implication of concussion discharge education training stems from most of trending research. More information on the supporting studies reviewed are further depicted in the synthesis table represented in Appendix G.

Furthermore, at a discharge level, the goal should be focused on prevention. Whether that discharge teaching tool be in the form of a handout or working with the providers with referrals to other clinicians. Professionals should be mindful of the access barriers to concussion education such as culture and family that would need to be addressed regarding the concussive patient. Lastly, pertaining to futuristic studies, concussion discharge education training should include links to valuable resources for both patient and families in the handouts as the need for additional longitudinal studies regarding discharge follow-up and management of concussion.

### **Theoretical Framework**

The conceptual framework used in this project was the transtheoretical change model. There are many existing methods for concussion discharge education, yet none that focus specifically on the foundation of staff education, or implementing the education in the ED (Villemure at el., Noline at el., 2011). Constructing a new, derivative method for discharge instructions applying the recent guidelines outlined by the VA/DoD and CDC on head trauma alone is not enough – hospitals must implement training and consistently supply this information to those diagnosed with an actual or suspected concussion. The transtheoretical model, a guidance tool for measuring the evolving stages of the execution of the training, and was applied in this project to support change in knowledge in aims for a ultimate change in practice (Melnik at el., Fineout-Overholt at el., 2015).

The transtheoretical model consists of five stages: precontemplation, contemplation, preparation, action and maintenance to determine the ED staff's readiness to move onto the next level, functioning as a checkpoint. This model was used as a guide to support in the level of momentum and readiness to proceed with influencing educational growth in current practice. In



order to ensure consistent application of the survey question on concussion discharge education training there was information on the educational intervention addressing MVC concussion specifically. Therefore, each survey question had evaluation measures validating knowledge retention among nursing staff reflected in surveys supporting more training for potential future studies. As outlined by DePompei et al., (2001), group learning to facilitate organization and concussion training aids in the improvement of care delivery of patient outcomes.

Maintaining new knowledge requires continually supporting staff buy-in through evidence of positive outcomes and the continuation of the practices introduced in the preparation stage (DePompei et al., 2001). It is important to continually evaluate the level of training among the staff prior to implementation of an educational intervention. With the introduction of the educational intervention, it is likely that there will be some errors with the maintenance and implementation process. The maintenance phase involves addressing errors that occurred during the action stage. In order to sustain organizational change, it is important to have effective leaders' mentor the nursing staff by providing continued training and education (Melnik et al., Fineout-Overholt et al., 2015). Therefore, adequate training is a critical factor for mitigating concussion discharge education and should be ongoing and mandatory.

### **Purpose**

The purpose of this project was to improve ED nurses' knowledge on identifying patients at risk for concussions and delivering effective concussion discharge education using an educational training intervention. Understanding ED nursing staff knowledge creates an avenue for the promotion of continued training on concussion education. By obtaining a baseline survey, the feedback received from ED nursing staff can aid in the identification of patients at risk for

concussions and support in the practice delivery of MVC concussion discharge education. Understanding ED nursing staff knowledge creates an avenue for the promotion of continued training on concussion education.

Specifically, the study aims were:

- 1.) To measure nurses' foundational knowledge of concussions and discharge education.
- 2.) To evaluate the impact of the educational intervention on changes in nurses' knowledge around delivering concussion discharge education to patients.

## **Project Methods**

### **Project Design**

This project used a descriptive, non-randomized pre-post test design. Participation involved three stages: pre-education survey to assess baseline concussion education knowledge, educational intervention, and post-education survey to evaluate change in knowledge on concussion discharge education. Pre-surveys were collected between October, 2019 and December, 2019 and post-surveys were collected between December, 2019 to February, 2020.

### **Setting And Agency Description**

This project was conducted at the University of Kentucky (UK) HealthCare's ED a Level-1 trauma center located in Central Kentucky. The ED at UK HealthCare is 1 of 20 medical centers in the United States to be verified for both pediatric and adult trauma care by the American College of Surgeons. The adult trauma bay area has 4 specific types of patients that include Level-1 critically injured adults, express care for those with less urgent conditions, acute

care and a separate pediatric emergency center for children. The UK HealthCare ED has been reported to provide care to approximately 130,000 patients in the year 2019.

### **Sample**

The sample for this study was recruited from a total of 121 ED staff nurses at UK HealthCare. The inclusion criteria included all nurses who work in the ED at UK HealthCare, including all shifts. The exclusion criteria included physicians and advanced practice providers, nurse assistants, unit secretaries, and non-ED nurses.

### **Congruence of DNP Project**

UK HealthCare's 2018-2020 mission, goals, and strategic plan promote cutting-edge patient care, research, and education through safe practice, and respect for the rights and responsibilities of nurses, patients, and families. The UK HealthCare staff has a wide range of specialties, which provided diverse perspectives for growth and improvement of patient safety (University of Kentucky Census et al., 2018). Evaluating staff knowledge on concussion discharge education within the ED aligns with the mission, goals and strategic planning of UK HealthCare, as its primary focus is on the safety and well-being of patients. Providing education and intervention strategies and assessing staff knowledge contributes to the goal of advancing patient safety for the adult MVC population. However, to achieve that goal, it is essential to first educate staff. This project aims to provide a valuable resource that promotes knowledge gap reduction and way to reduce barriers to healthcare access for the MVC population.

## **Description Of Stakeholders**

This project involves and impacts several stakeholder groups. Firstly, the administration and support staff within ED at UK HealthCare have a shared interest in the outcomes of this study as the educational training could be considered for broader implementation within the organization. Everyone involved in concussion discharge education spanning from administrators and managers to nurses and patients have a stake in the outcomes of this project as it may affect the outcomes of practice delivery in concussion discharge. ED nursing staff will directly benefit from the training and influence how results of this study will be received, interpreted and implemented. Ultimately, the patients are the key stakeholders as the changes made with concussion discharge education delivery from this project will be directed at improving their outcomes.

## **Site-Specific Facilitators and Barriers**

A key site-specific facilitator to implementing this project was the support of UK HealthCare's ED director and management team. The cooperation of the ED administrators helped increase ED nursing staff participation in this project and facilitated data collection (See Letter of Support in Appendix A). There were no site-specific barriers identified, however their incomplete surveys and missing data were observed. The Principal investigator (PI) of the project did not have access to the Canvas, the educational training platform on which the training was provided to nurses, and therefore was unable to determine if the available of the training was accessed by the participants during the projected timeline prior to the post-survey distribution.

## Description of Project

### Evidence Based-Intervention

Prior to the implementation of the educational training, the PI developed and implemented informational handout on MVC adult discharge education within UK HealthCare *Krames*, an online patient education library with resources for patients on various health and health-related topics. This online platform is available to all nurses, other healthcare providers and patients at UK HealthCare to reference for their discharge educational needs in order to assist with concussion management. This study's educational training intervention was built using applications derived from this MVC discharge education handout. The educational training intervention developed for this study consisted of a online PowerPoint presentation narrated by the PI. The training was designed utilizing the best practices and evidence-based information from the CDC, the Ontario Head Trauma and the VA/DoD guidelines.

The training consisted of a brief introduction to the brain with the inclusion of complications of sustained head injuries such as concussions. This training emphasized symptom management and patient education while highlighting on effective discharge education for prevention of post discharge concussion related complications, such as post-concussion syndrome and return visits to the ED. The training also included education on the phases of concussion injuries, from the acute phase, consisting of asymptomatic signs within 24 hours, to 72 hours of red flag symptoms. See Appendix B to view sample content from the educational training.

## **Procedure**

### **IRB Approval**

Approval from the University of Kentucky Institutional Review Board (IRB) and the UK HealthCare Nursing Research Council (See Appendix C) was obtained prior collection of data. A waiver of documentation of informed consent was obtained from the IRB as depicted in Appendix D.

### **Measures and Instruments**

Participants completed pre- and post-surveys that were delivered online via REDCap. The surveys developed by the PI and experts in the field of concussion education using the latest evidence-based literature. The survey can be found in Appendix E. The pre-survey consisted of 27 questions and the post-survey had 33 questions. The pre-survey had an additional 6 demographic questions related to age, race, gender, job role, education level, and years of nursing experience. The other 27 survey questions, which were asked in both pre- and post-surveys included Likert scale, multiple choice, “yes or no”, and all that apply questions.

### **Data Collection**

All nursing staff members of UK HealthCare’s ED were sent individualized emails, which included a cover letter (See Appendix F), a link to the pre-survey and a unique access code to be used to complete pre- and post-surveys. These emails were distributed by the ED administrators using their nursing staff listserv. The cover letter informed potential participants about the research project, including specifics about the educational intervention and how to access it, and that completing both the pre- and post-surveys were optional. Additionally, the

staff were informed that the survey responses would be confidential. Nurses were permitted to participate in this project during work hours and lunch breaks with the support of ED administrators. If nurses agreed to participate in the project after reviewing the cover letter, they clicked the link provided in the email to complete the REDcap pre-survey using their unique access code. After completing the survey, participants were requested to access and view the educational module, which was available to them on Canvas, UK's educational platform. After viewing the educational module, participants were asked to complete the post-survey using the unique access code provided to them in the email. This allowed for the measurement of individual changes in knowledge by comparing those individual access codes. ED administrators support assisted in the distribution of email cover letters and survey reminders to maintain IRB compliance.

### **Data Analysis**

Descriptive statistics, including means and standard deviations or frequency distributions, were used to describe the characteristics of the sample. Of the 33 responses who completed both surveys, we were able to link individual responses; the paired t-test was used to examine changes in knowledge scores. All data analysis was conducted using SPSS, version 25, with an alpha of .05.

## Results

### Sample Characteristics

A total of 65 nurses completed the pre-survey and 47 completed the post-survey. Participants' ages ranged from 19-50 years with the majority of respondents (72%; see Table 1) between 19 and 29 years old. The majority of participants identified as female (97%), and 44% of those participants reported having an average of 1.5 to 3 years of nursing experience. Almost all participants reported their highest level of education as a Bachelor of Nursing degree (91%). Only 5% of the participants who completed both surveys were unaware of the existing handout for MVC discharge education, which was developed by the PI and is available on *Krames*.

### Knowledge Change From Training

There was a significant increase in knowledge from the pre-survey ( $M=20.1$ ,  $SD=1.6$ ) to the post-survey ( $M=21.1$ ,  $SD=1.4$ ;  $p=0.005$ ). In the pre-survey, an average sum of the questions were answered correctly with the range of scores from 16 to 23. In the post-survey, both the average and minimum scores increased with the average increasing 5% (from 20.1 to 21.1 out of 25) and the minimum increasing over 12% (from 16 to 18).

Of those who completed the pre-survey, only 72% participants ( $n=65$ ) reported having prior knowledge of concussion discharge education, compared to only 28% of participants who completed the post-survey. The average number of correct answers went from 20.1 to 21.1, which is an average increase of 1 question. In comparing the individual access codes, the 32 individual participants earned a wide range of scores demonstrating an average increase between both of the surveys, with the highest score being 6 questions as shown in Figure 1.



## **Influencing Knowledge Themes**

In the comparing the pre-survey and post-survey responses, there were a few themes pertaining to symptom identification and care management. One question addressed post-concussion symptoms and yielded varying answers in both surveys. While the educational intervention highlights the symptoms of post-concussion, participants still lacked full understanding of this content, as evidenced by post-survey results. Figure 2 demonstrates that participants' knowledge of post-concussion symptoms actually reduced from the pre-survey. Eighty-four percent of the participants in the pre-survey selected the correct response related to symptoms of a concussion that linger greater than 3 months, but only 78 % of those participants answered correctly in the post-survey (see Table 2).

Similarly, with the questions pertaining to the identification of red flag symptoms, the majority of the participants identified the correct response. However, there was a wide range of incorrect responses. As represented in Figure 3, the participants' response to the question "Which of these is not a red flag symptom," the majority of respondents answered correctly after the educational intervention. Another concussion management question assessed baseline knowledge of acute symptom management of a concussion injury. In the pre-survey, 13% of the participants selected the correct response, "turn off lights and do no activity," compared to 88% of the participants who selected incorrect responses. The post-survey yielded similar results, with zero participants selecting the correct response and 94% selecting the incorrect response.

Lastly, for the question focusing on care management and follow up referrals, results demonstrated that 62% of participants answered correctly in the pre-survey by selecting to "follow up with a primary care provider and neurologist after a concussion injury," compared to the post-survey, where 47 % of the respondents answered correctly (see Table 2). These findings

indicate some discrepancies that require further exploration into why participants scored better on these items in the pre-survey than the post-survey. In comparison, in another question addressing care management after an initial injury, 88% of participants answered correctly in the pre-survey by selecting “naps and to take frequent breaks,” while increasing their accurate response to the same question in the post-survey to a 94% (see Figure 4). These findings highlight the need for more research on the effectiveness of training.

## **Discussion**

The results of this study show that the concussion discharge education training module had a significant impact on the nurses’ knowledge of concussion symptoms, risk factors and discharge management. Findings indicated a significant improvement in the participants’ knowledge after they received the training. The fact that participants’ scores increased between both surveys highlights the value of providing nurses with continuing education to maintain consistency with concussion discharge management. Despite the majority of nurses reporting prior experience and education with concussion discharge education, study findings indicate a need for additional concussion discharge training for ED nurses, as critical gaps in knowledge were found.

### **Prior Knowledge and Experience**

Education is a key factor that contributes to the overall improvement of both nursing performance and patient outcomes. Continuing education can help decrease discharge complications such as return visits (Ganti et al., 2015). When nurses enter the workforce, especially in a high acuity setting, there is the expectation that they will maintain a certain skill

set warranting the need for continued training (Chanet et al., 2018). In this study, 71% of participants who completed the pre-survey reported having prior knowledge of proper concussion discharge and less than three years of nursing experience. Of those participants, 59% who had a Bachelor of Science in Nursing (BSN) degree also reported prior concussion knowledge. Additionally, of the total number of participants, only 23% of those participants who reported being at the BSN level of education reported having no prior experience with concussion discharge education (see Table 5). Despite the fact that most nurses reported having been educated about concussion discharge at some point in their nursing career, there are still clear knowledge gaps, as highlighted by the results of the pre-survey in this study. Therefore, it is crucial to offer continued training to ensure that these nurses are prepared to offer the best quality care as demonstrated in previous studies (Bosch et al., 2016; Wany et al., 2017; Jeyaraj et al., 2013).

### **Educational Intervention**

There is a lack of existing training opportunities and institutional policies and procedures on concussion discharge education, which further underlines the need for additional training for nurses (CDC et al., 2019). The responses in this study, although not significant, did result in an increase in staff knowledge regarding MVC discharge material after the implementation of training. Even though the majority of participants in this study were aware of the *Krames* handout for MVC discharge education, 6% reported not being aware. This study highlights an opportunity for administrators to ensure staff awareness of policies, procedures and other measures that are in place to prevent mismanagement of discharge education delivery for MVC concussion populations. Villemure et al. (2011) came to similar conclusions, finding that

although methods for concussion discharge education had existed for some time, nurses were not provided with adequate opportunities to receive this training. However, if they had been, this could have improved patient outcomes.

Incorporating educational tools, such as the MVC discharge education handout and the educational training developed for this study, especially within such a high acuity clinical setting, emphasizes the importance of continued competency training. These tools allow staff members to recognize the role they play in the workplace and learn how to implement that knowledge in concussion discharge education to their patients, as well as apply resources such as handouts to improve patient satisfaction (Chanet et al., 2018; Stern et al., 2017). Continually assessing nurses' knowledge and recognizing unique strategies for discharge education adds value for the execution of training in practice. Nurses in this study ultimately displayed an understanding of symptoms and follow-up management after participating in the educational intervention, even with 94% reporting pre-existing knowledge of the MVC discharge handouts in the pre-survey. In order to prevent further complications of concussions, particularly in high acuity settings with MVC populations, continued training and the application of a standard protocol can be used as a means to support care management outcomes.

Lastly, incorporating a training module for nurses at all levels of education and experience ensures that all nurses are exposed to the latest clinical knowledge about concussion discharge management. Also, implementing training in collaboration with other disciplines, such as rehabilitation medicine, neurology and psychology can bring together providers with various levels of experience to improve patient outcomes. Including providers and other specialists promotes the interdisciplinary management of patient discharge education. Continuing education

also increases nurses' awareness of the measures that reduce missed concussions, and the importance of educating patients to sustain their compliance with treatment recommendations.

### **Implications for Practice, Education and Future Research**

Findings from this study have several implications for nursing practice, education, and policy. Incorporating training to be applied for all levels of nursing staff adds support to improve practice management and outcomes of the patient. Even though many multidisciplinary facets of concussion care can be deferred for outpatient management, the delivery of discharge education in the acute care setting helps support early recognition of patient access barriers like follow up referrals, which can help optimize care outcomes and reduce readmissions. For this study, the assessment of nurses' baseline knowledge focused on a population of patients who have undergone multiple traumas and are at high risk for a concussion injury, a population for which discharge education about concussion is essential but often overlooked or delivered inadequately. Patients who are not educated about concussion symptoms and management are likely to develop complications and need to be rehospitalized, which places a high personal and financial burden on patients and the healthcare system (CDC et al., 2019). The educational training developed for this study could be broadened to other nursing populations and hospitals to expose others to the knowledge and skills needed to deliver effective concussion discharge education and to capture more effective measures for learning. Therefore, it is important to increase training at all levels of nursing practice in order to provide effective patient care.

Existing studies on concussion discharge education emphasize the need for handouts and other educational materials to support patient education as the key to preventing or minimizing complications of post-concussion symptoms after hospital discharge (Rowe et al., 2018; Stern et

al., 2017; Wany et al., 2017). It is of substantial importance that nurses prepare patients for optimal recovery by taking the time to thoroughly educate them about their risk for concussion injury complications. It is imperative for nurses to participate in continued training and education to maintain compliance and maintain consistency with the educational delivery. Advocating for patients through the delivery of discharge teaching minimizes the chance for missed concussions and promotes patient safety and satisfaction.

The finding that nearly half of the participants in this study had fewer than 3 years of experience in the ED presents a potential concern, as staff members with less experience could be at higher risk of accepting a culture of not adhering to guidelines if regulated training is not enforced. This study demonstrates that discharge education training can improve ED nurses' knowledge of concussion and proper concussion discharge education methods. Further investigation on ED staff nursing culture within specific institutions may contribute information needed to adapt training to meet unit or staff cultural needs. To maintain transparency, materials, such as the handout on MVC discharge which was developed by the PI and available on an online patient education library, and should be advertised during trainings. This would raise awareness of the accessibility of these educational tools to both nurses and patients.

Implementing clearer guidelines and protocols at a hospital organizational level could improve outcomes for patients at risk for concussion. Through the implementation of these policies, the MVC handout directed at optimal recovery can be a new standard guideline with the support of administrators. It is also essential that staff are continually educated on recent changes and address changes with the new policies through continued training. As concussion is an evolving area of learning and practice, implementing annual continuing education on concussion discharge can ensure staff competency and effective discharge management.

Future studies should focus on investigating how to remove barriers to effective concussion discharge education delivery and improve nurse education on concussion safety. Studies that incorporate demonstrations of various discharge teaching delivery methods would be beneficial. The existing barriers for concussion discharge can be hindered due to communication and the lack of adherence of practice interventions. As represented in this study, the changes in knowledge could be the difference in executing proper clinical discharge delivery and discharge interventions to patients (Stern et al., 2017).

These prior studies revealed that acute care settings neglected to focus on standards for clinical decision and management in the ED, specifically demonstrating that the lack of available concussion specialist or specialty training, hindered the quality of care received by concussion patients (Wany et al., 2017; Bay et al., 2016; Bergman et al., 2016; Baker-Collo et al., 2015). Furthermore, focusing on concussion-specific training benefits patients and hospitals by reducing rehospitalizations and cost expenses when discharge focuses on preparing the patient to recognize complicated signs and symptoms of concussion. Additionally, the collaboration between nurses and other specialists or providers within a higher organizational level, contributes to both interdisciplinary communication and overall better practice decisions that are focused on benefiting the patient's recovery.

### **Limitations**

There were several limitations to this study that warrant discussion. Even though both pre- and post-surveys generated a large sample size, the majority of participants did not complete the post survey, which yielded a smaller sample size (n=32). A larger sample size would have allowed for more variance in pre-post intervention sample data. Surveys were incomplete,

leading to limitations in data for certain questions that had to be removed altogether from the survey. The reliability and validity of the pre- and post-surveys have not been determined as it was generated by the PI and not trialed prior to this study.

The education intervention was intended to be accessed after pre-surveys were collected. However, due to the short timeframe of the study, there is a possibility that participants viewed the intervention prior to completing the pre-survey as they were exposed to the training by their peers. From the delivery of the pre-survey and the implementation of the post-survey there were overlapping time periods that could have limited participants from completing surveys. Furthermore, the study took place during the winter months when holidays could have impacted availability and interest among staff nurses. Performing the study over 6 months, between October and May would have provided more time for nurses to complete surveys and accommodated their staffing periods. Similarly, the delivery of the educational intervention via Canvas may have limited participation as nurses had to log-on to the system to access and view the training module.

### **Conclusion**

The overall goal of this project was to offer an educational intervention to improve ED nurses' knowledge of how to identify patients at risk for concussions and deliver effective concussion discharge education. Results showed a significant improvement in knowledge among ED staff nurses with regards to identifying concussions and delivering effective concussion discharge education. The majority of the ED staff nurses in this study gained knowledge from the educational intervention. This study helped identify concussion-related knowledge trends among ED nurses, which can help other ED staff members and administrators to work collaboratively



and find ways to implement continued training and education on concussion discharge management to ensure patient safety.

As nurse leaders with patient safety as one of our top priorities, we should support the development of new nursing skills through continued training around concussions. Ideally, this training will be implemented early on in nursing programs or in nursing orientation programs. Further assessment and continued revisions of the educational training intervention is needed, especially using an interdisciplinary approach as there is significant value in improving safety outcomes of our concussion patient population.

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## List of Tables

Table 1

*Demographics Table of Participants Pre-survey Only*

<b>Variables</b>	<b>Categories</b>	<b>% (n)</b>
<b>Age</b>	19-29	71.88 (n=23)
	30-40	21.88 (n=7)
	41-50	6.25 (n=2)
<b>Sex</b>	Male	3.13 (n=1)
	Female	96.88 (n=31)
<b>Nursing degree</b>	Associates	9.38 (n=3)
	Bachelors	90.63 (n=29)
<b>Years of Nursing experience</b>	0-1	31.25 (n=10)
	1.5-3	43.75 (n=14)
	3.5-5	9.38 (n=3)
	5-10	6.25 (n=2)
	>10	9.38 (n=3)

*Note: Not all participants complete all of the pre-survey questions  
Total participants N= 32*

Table 2

*Symptom and Complication Knowledge of Concussion Pre- and Post-Survey*

Survey Questions	Answer Options	Pre-survey (n=65) n (%)	Post-Survey (n=47) n (%)	Pre-survey (n=32) n (%)	Post-survey (n=32) n (%)
Prior knowledge of concussion of concussion education	*Yes	48 (71.6)	40 (80.0)		
	No	19 (28.4)	10 (20.0)		
Within the last year, have you provided discharge teaching to a patient who has suffered from a concussion?	Yes	55 (82.1)	43 (86.0)		
	No	12 (17.9)	7 (14)		
Which is not a red flag symptom of a concussion?	*Nausea and vomiting	24 (36.9)	21 (44.7)	10 (31.3)	17 (53.1)
	Worsening of a Headache	13 (20)	9 (19.1)	8 (25.0)	6 (18.8)
	Worsening of vision	1 (1.50)	2 (4.20)	1 (3.10)	2 (6.30)
	Bruising around the eyes	12 (18.5)	7 (14.9)	7 (22.0)	4 (12.5)
	Bleeding from the nose	15 (23.1)	8 (17.0)	6 (18.8)	3 (9.4)
If a person needs accommodations after a concussion, it is important to refer them to a cognitive psychologist of counselor?	*True	49 (76.6)	41 (87.2)	24 (75.0)	28 (87.5)
	False	15 (23.4)	6 (12.8)	7 (22.0)	4 (12.5)
Concussion normally happen to people who are weak and have a higher chance of hurting their head?	*No	59 (88.1)	43 (87.8)	27 (84.38)	27 (84.38)
	Yes	8 (11.9)	6 (12.2)	5 (15.63)	5 (15.63)
What is post- concussion syndrome?	*All of the answers apply	57 (87.7)	43 (91.5)	28 (87.5)	29 (90.6)
	The symptoms of a concussion are worse	1 (1.50)	1 (2.10)	1 (3.10)	1 (3.10)

	The symptoms of a concussion have not gone away after 10-14 days	3 (4.60)	2 (4.30)	1 (3.10)	0
	The patient has a history of multiple concussion injuries, mood disorders, anxiety and depression	4 (6.20)	1 (2.10)	2 (6.20)	1 (3.10)
If a patient is in uncontrolled pain after an immediate concussion injury and comes into the emergency room for care, what is the correct thing to do as the nurse?	*Turn off lights and leave patient alone to rest	7 (10.8)	3 (6.4)	4 (12.5)	0
	Discharge the patient home to rest	0	0	0	0
	Give the ordered opioid medication	3 (4.60)	2 (4.30)	1(3.1)	2 (6.20)
	Give no medication and conduct a neurological exam	55 (84.6)	42 (89.4)	28 (87.5)	30 (93.7)
There is a discharge summary for motor vehicle populations available for patients at the hospital to educate them about managing their concussions?	1 True*	61 (95.3)	46 (100.0)	29 (90.6)	31 (96.8)
	2 False	3 (4.70)	0	2 (6.20)	0
A patient with a concussion injury should follow up with:A patient with a concussion injury should follow up with:					
	*PCP and neurologist	43 (66.2)	22 (46.8)	20 (62.5)	17 (53.1)
	PCP only	8(12.3)	8 (17.0)	6 (18.7)	5(15.6)
	Neurologist only	0	0	6 (18.7)	10 (32.2)
	Concussion specialist only	0	1 (2.10)	0	0



Factors that can delay a concussion recover include:	*Family and social stressors	54 (81.8)	39 (83.0)	26 (81.3)	28 (88)
	Brain rest	5 (7.60)	2 (4.30)	3 (9.30)	1 (3.20)
	Family history of diabetes	0	0	0	0
	No history of mental health problems like anxiety	1 (1.5)	0	1(3.10)	3 (9.30)
	None of the above answers apply	6 (9.10)	6 (12.8)	2 (6.20)	3 (9.30)

*Data in n=65 and n=47 includes participants that did not participate in both surveys, n=32 includes participants that completed both surveys, \* is correct respons*

Table 3

## Knowledge of Concussion Care Management Pre and Post survey

Survey Questions	Answer Options	Pre-survey (n=65) n (%)	Post-Survey (n=47) n (%)	Pre-survey (n=32) n (%)	Post-survey (n=32) n (%)
Concussion symptoms may not be present on the initial exam and symptoms can be delayed	*True	64 (98)	46 (97.8)	32 (100)	32 (100)
	False	0	0	0	0
Frequent naps and daytime breaks are advised during the initial recovery phase of a concussion?	*True	56 (87.5)	44 (93.6)	28 (87.5)	30 (93.7)
	False	8 (12.5)	3(6.40)	3 (9.30)	2 (6.20)

*Note: Not all participants completed both surveys, n=32 has participants that completed both surveys, \* correct response*

Table 4

*Knowledge Gained from Educational Intervention (Comparison Pre- and Post-survey)*

Group	Mean	SD	Knowledge score Min (0-25)	Knowledge score Max (0-25)	T	P
Pre-Education Score	20.1	1.6	16	23	3.05	.005
Post-Education Score	21.1	1.4	18	23		

*Note: 32 participants completed pre and post test*  
*DF t value Pr>[t]*  
*31 3.05 0.0047*

Table 5

*Trends in Gender, Education and Prior Knowledge Pre-Survey Only (n=65)*

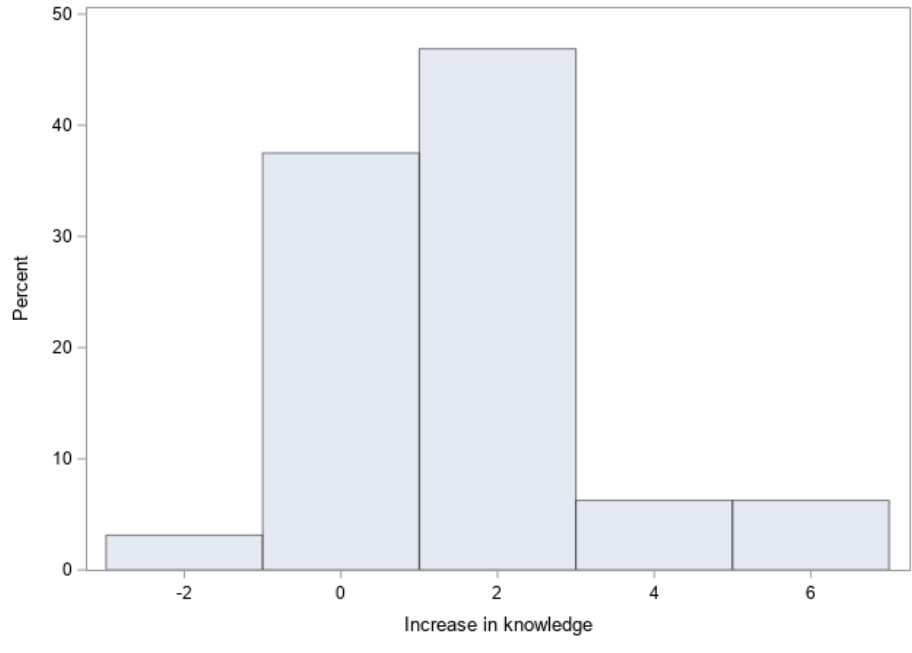
Survey Question		Prior Concussion Knowledge		P
		Yes n (%)	No n (%)	
Sex	Male	5 (7.6)	0	.310
	Female	42 ( 64.6)	18 (27.7)	
Level of Education	Associates	4 (6.2)	2 (3.10)	.520
	Bachelors	38 (58.5)	15 (23.1)	
	Masters	5 (7.70)	1 (1.50)	

*Note: n=65, not all participants participated in the pre-survey*

## List of Figures

Figure 1

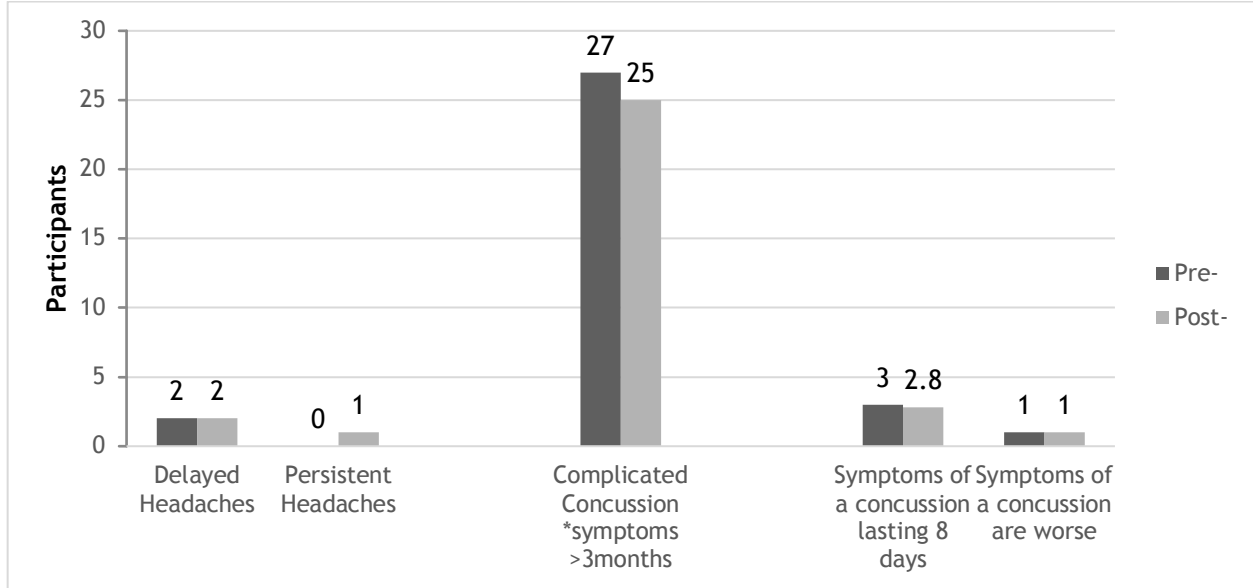
*Distribution of Average Score Changes Among Nursing Participants*



*Note Of participants (n=32) distribution of average change scores of individuals' pre-and post surveys, average score of 1 increase, and maximum score of 6.*

Figure 2

*Knowledge Changes of Post-Concussion Symptoms Pre vs. Post*

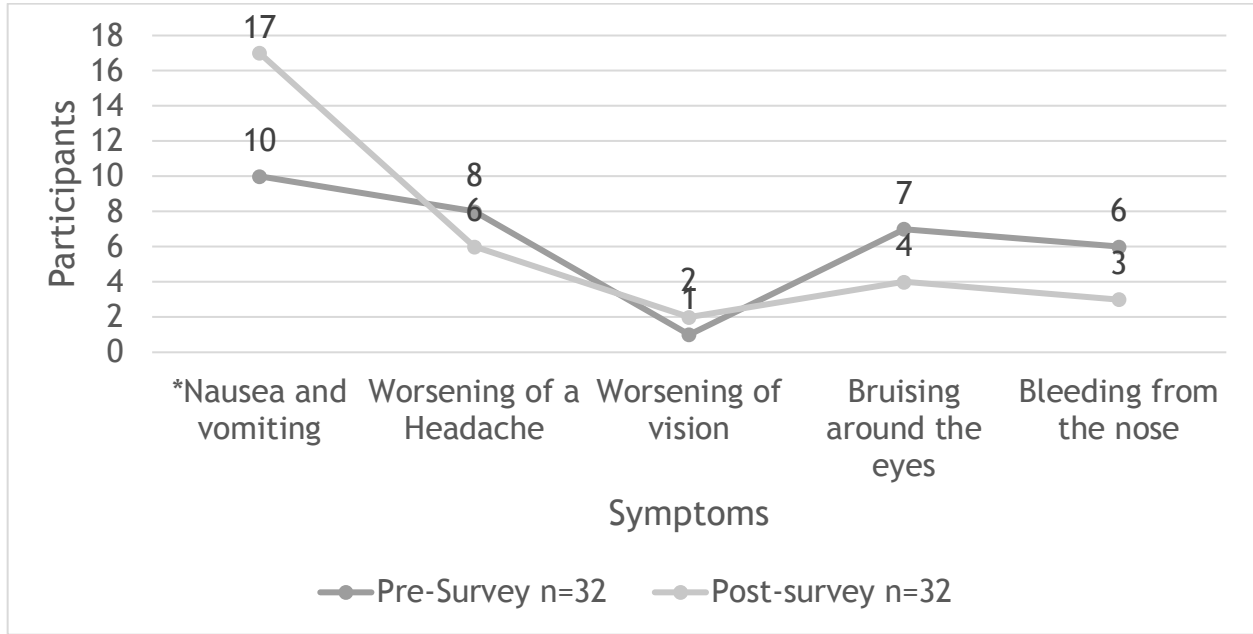


Note: n=32, 1-participant did not complete the questionnaire

Complicated concussion symptoms are correct response, variability in responses pre vs post

Figure 3

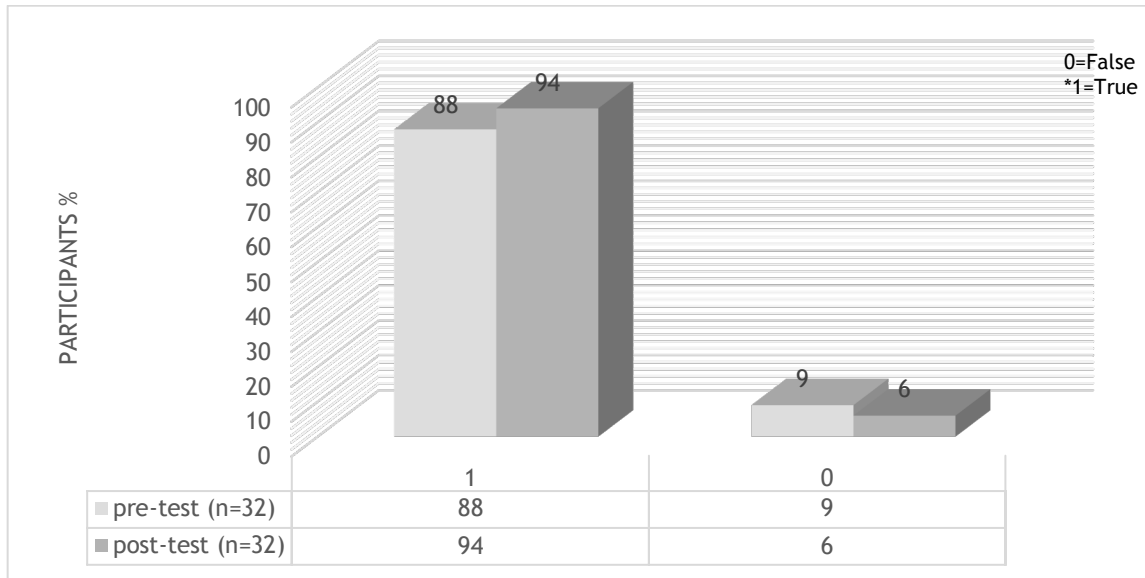
*Knowledge of Red Flag Symptoms of Concussions Pre vs. Post*



*Note- Total response of those who completed the Pre-and Post-Survey, n=32,  
\*nausea and vomiting are correct response*

Figure 4

*Knowledge of Referral Management Pre vs. Post*



*Note=Not all participants participated in both surveys, n=32 reflects those who attempted to complete both surveys, % of participants who select 0, and 1. \* is correct.*



## Appendices

### Appendix A: Letter for Support



August 16, 2019

To Whom It May Concern

The Emergency Department Management team will help Carmen Frede, Principal Investigator (PI), distribute emails to UK ED Nursing Staff throughout the research project period to maintain anonymity. We, the ED management team will help with emailing cover letters provided by PI, Carmen Frede.

A handwritten signature in black ink that reads 'Stephanie Carry'.

Stephanie Carry, MSN, RN, CEN  
Patient Care Manager  
Emergency and Trauma Services  
University of Kentucky

1000 S. Limestone Street, Room A.00.401 | Lexington, KY 40536 | P: 859-323-6531 | F: 859-257-2814 | [ukhealthcare.uky.edu](http://ukhealthcare.uky.edu)

## Discharge Education

### How do I care for myself at home?

#### The basics:

- Get plenty of rest and sleep.
- Avoid activities that are physically and mentally demanding. Some examples are doing taxes and riding a bike.
- Slowly go back to doing normal activities. Stop quickly if your symptoms get worse.
- Do not drink alcohol.
- Ask your neurologist or primary care doctor when it is safe to drive, go to work, do physical activities, and operate heavy machines
- Get a vision test.

#### The first 2 days after your injury:

- **Caregiver:** Have another adult watch you during this time. This person should help you avoid stress and look for symptoms.
- **Warning signs:** Return to the hospital if you have any of the warning signs listed.
- **Rest and sleep:** Get lots of rest (both physical and mental). Avoid hard physical activity for at least 24 hours. It is fine for you to sleep, but someone should check on you every four hours to make sure you are okay.
- **Driving:** Do not drive for at least 24 hours. Do not drive until you feel much better and can concentrate properly. Talk to your doctor before you drive.
- **Alcohol and drugs:** Do not drink alcohol or take sleeping pills or recreational drugs in the next 2 days. All of these can make you feel worse. And they make it hard for other people to tell if the injury is affecting you or not.
- **Pain relief:** Use acetaminophen (such as Tylenol) for headaches.
- **Sports and recreational activity:** No sports until your doctor clears you.

**See your primary care doctor or visit the emergency department if you do not get better.**

### Follow up appointments

After you leave the hospital, make an appointment with **your primary care doctor**.

- If your symptoms are severe enough, your doctor may refer you to a specialist at UK HealthCare.
- For symptoms that last longer than 4 weeks after the injury, ask your doctor to send a referral to UK Neuropsychology at (859) 323-5661.

### Referrals

We **recommend referrals** to providers marked below. Your primary care doctor can refer you.

Neuropsychological tests \_\_\_\_  
Sports medicine \_\_\_\_

Neurosurgery \_\_\_\_  
Physiatrist \_\_\_\_

Neurology \_\_\_\_  
Psychiatrist \_\_\_\_

Other \_\_\_\_\_

### **What are the warning signs that I need help?**

**If you have any of these symptoms, call 911 or go to the nearest emergency department.**

- Fainting or blacking out, drowsiness, or cannot be woken up
- A constant severe headache or a headache that gets worse
- Vomiting or throwing up more than 2 times
- More confused or restless
- Cannot remember new events, or recognize people or places
- Acting strange and speech problems
- Having a seizure, such as any violent movement or jerking arms or legs
- Cannot move parts of your body
- Weakness in arms or legs
- Vision problems
- Being unsteady on your feet or balance problems
- Frequent fluid such as blood draining from the nose or bleeding from the ear(s)
- Any symptom that concerns you, your family members, or friends

### **How can I prevent another concussion?**

Take these steps to lower your risk of concussion.

#### **At home:**

- Look for things that could trip you. Pick them up or move them out of the way. This includes cords and rugs that will not lay flat.
- Have good lighting in your living area.
- Place non-slip mats on slick floors and in tubs and showers.
- Use handrails on stairs and safety handle in showers.

#### **For travel and activities:**

- Always wear a seat belt in vehicles. Have children sit in safety seats.
- After you are cleared by your doctor, wear a helmet that fits well for any activity that has a risk of head injury. Examples include contact sports like football, hockey, or skiing, and riding a horse, skateboard, bike, ATV, or motorcycle.

## Appendix C: Nursing Research Council Approval Letter



Office of Research Integrity  
IRB, RDRC

Modification Review

Approval Ends: 9/11/2020  
IRB Number: 52457

TO: Carmen Frede, BSN, RN College of Nursing  
PI phone #: 6169016173

PI email: Carmen.Frede@uky.edu

FROM: Chairperson/Vice Chairperson  
Medical Institutional Review Board (IRB)

SUBJECT: Approval of Modification Request  
DATE: 10/25/2019

On 10/24/2019, the Medical Institutional Review Board approved your request for modifications in your protocol entitled:

*Does a Concussion Education Intervention Impact How Emergency Nurses Delivery Discharge Instructions?*

If your modification request necessitated a change in your approved informed consent/assent form(s), the new IRB approved consent/assent form(s) to be used when enrolling subjects can be found in the "All Attachments" menu item of your E-IRB application. [Note, subjects can only be enrolled using consent/assent forms which have a valid "IRB Approval" stamp unless special waiver has been obtained from the IRB.]

Note that at Continuation Review, you will be asked to submit a brief summary of any modifications approved by the IRB since initial review or the last continuation review, which may impact subject safety or welfare. Please take this approved modification into consideration when preparing your summary.

For information describing investigator responsibilities after obtaining IRB approval, download and read the document "[PI Guidance to Responsibilities, Qualifications, Records and Documentation of Human Subjects Research](#)" available in the online Office of Research Integrity's [IRB Survival Handbook](#). Additional information regarding IRB review, federal regulations, and institutional policies may be found through [ORI's web site](#). If you have questions, need additional information, or would like a paper copy of the above mentioned document, contact the Office of Research Integrity at 859-257-9428.

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## Appendix D: IRB Approval Letter

IRB Approval  
10/24/2019  
IRB # 52457  
IRB2

### PROTOCOL TYPE

Which IRB

Medical  NonMedical

Protocol Process Type

Exemption  
 Expedited (Must be risk level 1)  
 Full

**IMPORTANT NOTE: Once you have saved your choices under "Which IRB" and "Protocol Process Type", you will not be able to change your selections. If you select the wrong IRB Type and/or your application is deemed eligible for a different Protocol Process Type, it may be necessary to create a new application.**

Please see below for guidance on which selections to make, and/or go to ORI's "[Getting Started](#)" web page. If you still have questions about which IRB or Protocol Process Type to choose, please contact the Office of Research Integrity (ORI) at 859-257-9428 **prior** to saving your selections.

#### \*Which IRB\*

The **Medical IRB** reviews research emanating from the Colleges of Dentistry; Health Sciences; Medicine; Nursing; Pharmacy and Health Sciences; and Public Health.

The **Nonmedical IRB** reviews research originating from the Colleges of Agriculture; Arts & Sciences; Business & Economics; Communications & Information; Design; Education; Engineering; Fine Arts; Law; and Social Work. The Nonmedical IRB does not review studies that involve administration of drugs, testing safety or effectiveness of medical devices, or studies that involve invasive medical procedures, regardless of from what college the application originates.

#### \*Which Protocol Process Type\*

Under federal regulations, an investigator's application to conduct a research project involving human subjects can be processed by the IRBs in three ways:

- by full review;
- by exemption certification;
- by expedited review.

The preliminary determination that a research project is eligible for exemption certification or expedited review is made by the investigator. For assistance in determining which review process type your IRB application is eligible for, please go to ORI's "[Getting Started](#)" web page.

**The revised Common Rule expanded exemption certification category 4 for certain secondary research with identifiable information or biospecimens. The regulations no longer require the information or biospecimens to be existing. For more information see the [Exemption Categories Tool](#).**

Appendix E: Survey Tool

**Survey Questions:**

<b>Variable</b>	<b>Categories</b>
Age	19-29 30-40 41-50 51-60
Sex	Male Female Other: _____
Ethnicity	White Black Asian Native American Alaskan Native Pacific Islander Native Hawaiian Other: _____
Years of nursing experience in your current position?	0-1 1.5-3 3-5 5-10 >10
Level of nursing education:	Certificate Associates Bachelors Masters Doctorate
Do you have prior knowledge of concussion education pertaining to patient care?	1)Yes 2)No
Within the last year, have you provided discharge teaching to a patient who has suffered from a concussion?	1)Yes 2)No
Concussion/mTBI is the same diagnosis?	<b>1)Yes</b> 2) No
Concussions normally happen to people who are weak and high a higher chance of hurting their head?	<b>1)Yes</b> 2)No
Which is not a symptom of a concussion?	<b>1)Hallucinations</b> 2)Memory loss 3)Ringing in the ears 4)Headaches

Symptoms of a concussion include:	<ul style="list-style-type: none"> <li>1)Sadness</li> <li>2)Balance problems</li> <li>3)Increase sleepiness</li> <li>4)Nausea</li> <li><b>5)All of the above apply</b></li> </ul>
A patient should play video games, watch tv, text friends or use computer after an initial mTBI / concussion injury?	<ul style="list-style-type: none"> <li>1)Yes</li> <li><b>2)No</b></li> </ul>
Slurred speech, repeated vomiting and worsening of headache that doesn't go away are danger signs of concussion?	<ul style="list-style-type: none"> <li><b>1)True</b></li> <li>2)False</li> </ul>
What is the leading cause of mTBI in adults?	<ul style="list-style-type: none"> <li>1)Fall</li> <li><b>2)Motor vehicle accidents</b></li> <li>3)Bikes</li> <li>4)Sports injuries</li> </ul>
What is post- concussion symptoms (syndrome)?	<ul style="list-style-type: none"> <li>1)Delayed headaches</li> <li>2)Persistent headache only</li> <li><b>3) Complicated concussion symptoms lasting for longer than 3 months</b></li> <li>4) Concussion symptoms lasting 8 days</li> </ul>
Which is not a red flag symptom of a concussion	<ul style="list-style-type: none"> <li>1) Worsening of a headache</li> <li>2) Worsening vision</li> <li><b>3) Nausea and vomiting</b></li> <li>4) Bruising around the eyes</li> <li>5) Bleeding from the nose and ears</li> </ul>
People can reduce their chances of a concussion injury by:	<ul style="list-style-type: none"> <li>1)Wearing a seatbelt</li> <li>2) Placing a non-skid mat on the floor</li> <li>3) Wearing a helmet when riding a bike</li> <li><b>4) All of the answers apply</b></li> </ul>
Factor(s) that can delay a concussion recovery include:	<ul style="list-style-type: none"> <li>1) Brain rest</li> <li><b>2) Family and social stressors</b></li> <li>3) Family history of Diabetes</li> </ul>

	<p>4) No history of mental health like anxiety 5) None of the answers apply</p>
When do you refer a patient who has a concussion injury to a specialist?	<p>1) The symptoms of a concussion are worse 2) The symptoms of a concussion have not gone away after 10-14 days; 3) The patient has a history of multiple concussion injuries, mood disorders, anxiety and depression <b>4) All of the answers</b></p>
If a person's pupils are different sizes after a head injury is this a danger sign?	<p><b>1) True</b> 2) False</p>
A person may gradually return to regular activity once feeling better and has been cleared by primary care provider?	<p><b>1) True</b> 2) False</p>
Does increasing activities such as rest and limiting activities like exertion play key roles in concussion recovery?	<p>1) True <b>2) False</b></p>
Frequent naps and daytime breaks are advised during the initial recovery phase of concussion?	<p><b>1) True</b> 2) False</p>
If a person needs accommodations for a concussion, it is important to refer them to a cognitive psychologist or counselor?	<p><b>1) True</b> 2) False</p>
When do you refer a patient who has a concussion injury to a specialist?	<p>1) The symptoms of a concussion are worse 2) The symptoms of a concussion have not gone away after 10-14 days; 3) The patient has a history of multiple concussion injuries, mood disorders, anxiety and depression <b>4) All of the answers apply</b></p>



If a patient sustains one head injury/ concussion, are they at higher risk for another head injury/concussion?	<b>1)Yes</b> 2) No
A patient with an initial concussion injury, that patient should?	1) Should play video games 2) Watch TV, and text friends 3) Use a computer <b>4) Brain rest</b>
A patient with a concussion injury should follow up with either:	<b>1) PCP and a neurologist</b> 2) PCP only 3) Neurologist only 4) Concussion specialist only 5) Concussion specialist, and neurologist
If a patient complains of uncontrolled pain after a immediate concussion injury and comes into the emergency department for care, what is the correct thing to do as the nurse?	1) Discharge patient to go home and rest 2) Give the ordered opioid medication 3) Give no medication and conduct a neurological exam <b>4) Turn off lights and leave the patient alone to rest</b>
When discharging an alert and oriented patient with a diagnosis of a concussion from the emergency department and that patient does not have a driver / person available to them that can monitor them at home, do you allow this patient to drive?	1)Yes <b>2) No</b>
Brain foginess is one of the symptoms of a concussion.	<b>1)Yes</b> 2) No
There is a discharge summary for motor vehicle populations available for patients at the hospital to educate them about managing their concussions.	<b>1)True</b> 2) False
Concussion symptoms may not be present on the initial exam and symptoms can be delayed.	<b>1)True</b> 2)False

Note: **Bold** is correct response, Race was one of the main questions that was not recorded due to a coding issue with REDcap.

## Appendix F: Cover Letter

IRB Approval  
10/24/2019  
IRB # 52457  
IRB2

Dear Nursing Staff Members of UK Emergency Department,

I, Carmen Frede am contacting you from the University of Kentucky, on behalf of The University of Kentucky College of Nursing, as a graduate student in the Doctor of Nursing Practice Program. You are being invited to participate in a research study, Does a Concussion Education Intervention Impact How Emergency Nurses Deliver Discharge Instructions? The purpose of this study is to promote concussion discharge education to nurses through the promotion of a PowerPoint podcast that contributes to the ability of quality and safety variables affecting mild Traumatic Brain Injury (mTBI) discharges from the ED. This research project proposes an educational intervention for ED nurses on concussion discharge teaching for use with adult patients that have been involved in a motor vehicle collision (MVC) and how to manage those who have been diagnosed with a concussion. If you agree to participate in this research project you will complete a baseline online survey assessing your knowledge of concussion discharge teaching. To do so, use the supplied access code and log in link that will be delivered to you in this cover letter email to place into the REDcap survey to maintain confidentiality. After you complete the pre-survey, you will then complete a PowerPoint podcast on Canvas. You have 30 days to complete the educational intervention, and after the education intervention you will complete a post-survey evaluation regarding your understanding of concussion discharge teaching variables using a different login access code and link. If you forget your login links or access codes, the ED administrators will be able to assist you with only that lost information. For confidentiality purposes of the research, the PI will not have access to the list of names and emails of the record ID that are linked to both access codes or links for both pre and post surveys of the participants.

If you agree to participate in the study, you will be asked to complete 2 online surveys on RedCap. The surveys will have 25 questions with answers that are presented in a Likert scale format (ranking questions answers 1 to 5). The total allotted time for this research project should be 20 minutes over 2 sessions. The benefit that may be derived from this research is that ED nurses will have increased knowledge about concussion discharge teaching and improve discharge teaching to concussion patients with an overall goal of reducing return visits to the ED for concussion.

We hope to receive a completed questionnaire from about 120 ED nurses. Your responses are essential to improving concussion discharge education and further inquiries in this topic. Of course, you have a choice about whether or not to complete the survey/questionnaires, but if you do participate, you are free to skip any questions or discontinue at any time.

Please be aware, while we make every effort to safeguard your data once received on our servers via REDCap, given the nature of online surveys, as with anything involving the Internet, we can never guarantee the confidentiality of the data while still en route to us.

Your responses will be confidential therefore within this cover letter you will receive 2 different access code and links for both the REDcap surveys so please keep that private as you are responsible for that information. The records of your participation in this study will be kept confidential to the extent permitted by law. The Emergency management team will be the distributors of this survey for confidentiality purposes. For this study, survey respondents will not ask to provide a name, email address to the PI. Staff is allowed to contribute to this research project during work hours, lunch breaks,

off work and report to the ED administration team regarding their status of schedule. Only the UK ED nursing administrative team can track the completion of the educational intervention via staff login through the canvas on the UK website.

Should you have any questions, you may contact Carmen Frede, the Principal Investigator, at 616.901.6173 per cell or email at crfr226@uky.edu. If you have any complaints, suggestions, or questions about your rights as a research volunteer, contact the staff in the University of Kentucky Office of Research Integrity at 859.257.9428 or toll-free at 1.866.400.9428.

The completion of this survey will be your consent to participate in the research project and your agreement of being sufficiently informed about the purpose of the project as well as the possibility of minimal to no risks and the many potential clinical practice benefits. However, minor psychological risks can occur. The potential risk to participants in this study is the possibility of psychological distress when completing the surveys. Your leaders will not know the results of your baseline or post surveys. They also will not know if you participated in the project. Your participation in this research project is entirely voluntary. Therefore, this survey completion, states that you as the participant, agree to partake in the research project, and have acknowledged that you are responsible for your confidential REDcap link and access and will use that code on the post-survey after the educational intervention. Consent to participate is considered voluntary and not a condition of their employment. The consent to participate in the project will be inferred by the consent of the employee completing the pre-survey or post-survey in REDcap. This research project will not affect any aspect of your employment or penalize any aspect of review of performance. This is an educational promotional project to facilitate the knowledge in practice awareness in concussion education. If you agree to these terms, please click on the link below to access the survey.

**Survey link will be copied here:** \_\_\_\_\_

**Access code here** \_\_\_\_\_

Thank you in advance for your assistance with this important project.

Sincerely,

Carmen Frede BSN, RN  
College of Nursing, University of Kentucky  
Phone: 616.901.6173  
Email: crfr226@uky.edu

Appendix G: Synthesis Table

**Review of Literature Synthesis Table**

Study Author	Year	Number of Participants	Mean Age (or Other Sample Characteristic That Is pertinent to Your Question)	Study Design	Intervention	Major Finding That Addresses Your Question
Alsalaheen & Mucha	2010	114 patients	16 children and 41 adults	RCT	Vestibular testing i.e. vestibular rehab	Symptoms improved after vestibular rehab in concussion pts (supports multidisciplinary therapy after concussion)
Baker-Collo & Jones	2015	79 patients	Greater than 15 of age	Cohort with Meta-analysis	Performances: neuropsychic, mood, post-concussion symptoms	Significant improvements from neurological baseline to 12 months with continuation of neuro-assessments (supports multidisciplinary approach after concussion i.e. cognitive rehab)
Bay, & Ribbens-Grimm	2015	65 participants	18-80 years old	Case study-Pilot	Classes i.e. PFM-GT & HLA-GT (newly developed interventions)	Significant, increased satisfaction and participation in classes than over the phone. More frustration, lack of understanding in phone classes.

Bay& Strong	2011	87 nurses	45.87 years	Descriptive study	CDC-ACE guidelines	Increase awareness that there is a lack of usage and systematic procedure for discharge teaching after mTBI.
Bergman & Louis	2016	12 patients	47years	Systematic Review	Concussion booklet	Neutral - Concussion booklet easier to use than standardized hospital discharge information, data could not conclude all patients receiving booklets
Bosch & Tavender	2016	42	n/a, however occupation such as senior level was stated	RCT	Recognized factors to improve management of care with mTBI patients (subjective interviews)	Barriers of inter-professional collaboration was demonstrated, attitudes towards guidelines found the performance of unwritten rules in doctors rather than nurses preferred guidelines in surgical methods, ED doctors and specialists varied on opinions which is highly relevant to the entry point of the ED.
DePompei & Frye	2001	21 patients	9-55 ages	Quality improvement	Community protocol	Increased awareness of brain injury resources

Ganti & Conroy	2015	2787	28+/-10.67 years	RCT	Identify possible predictors for 72 returns to ED visit in mTBI pts	Neurological symptoms are not always present at initial exam at the ED
Jeyaraj & Clendenning	2013	12 clinicians	n/a	Case study	Perceptions affecting care of outpatient TBI patients	Increase in awareness to make early referrals to mTBI patients for prevention
Losi & Silverberg	2015	74 patients mTBI 40 controls	37.0 20	Cohort	Follow-up intervals and symptom management	Increased recovery and management of Post-concussion symptoms
Minen & Shome	2017	19 patients	19-89 years range of participants	Cohort with Meta-analysis retrospective	Management of care provided to patients who presented to ED who have revisits within 72 hrs.	Significant-most patients were not evaluated properly or discharged properly i.e. provided discharge instructions
Rowe & Eliyahu	2018	250, 222 reached for follow up patients	38.33	Cohort	Influence of electronic handouts on concussions eCPG)	Decrease in concussion symptoms. With Pts who received handouts reported fewer symptoms
Rowe & Eliyahu	2018	250 patients	35	Cohort	CTAS tool	Decreased implementation – missed opportunities in ED
Stern & Seichepine	2017	72 respondents	n/a- professionals in medical industry	RCT	Evaluation of Concussion care practices and evidence care practice of concussion pts in ED	SD-decrease in use of clinical practice guidelines for concussion
Stuart & Mandleco	2012	52 patients	Ages 18-28 years	Case study-pilot	Education on mTBI provided by ED and further health care was obtained after ED visit.	SD- Decrease in instructions provided to patients, support discharge instructions to

						mTBI patients are missed. Providing important data on mTBI can slip undetected in ED due to the presentation of other injuries i.e. urgent subjective complaints. Also, most research focuses on Sports.
Shah & Muncer	2003	78	28 +/-10.67	RCT	Various scales to predict outcome of mTBI patients such as Shah's (MBI) modified version of Barthel index, DRS, GSC	MBI can aide in predictions to detect in early concussion symptoms and make referrals due to recognition & function ability scores for rehabilitation.
Thomas & Apps	2018	99 patients	13.7years	RCT- Perspective randomized control	Compliance with discharge instructions (strict rest) evaluated with diary	Decrease significance in strict rest has on the younger population, may impact adult-no study conducted
Villalobos & Bilbao	2017	60 patients	38.35	Qualitative	Ad-HOC scale	Increase improvements post treatment time in experiment group (AD) i.e. who received program from functional performance after mTBI.
Villemure & Nolin	2011	354 patients	37.25 years	cohort	RPCSQ (checklist questionnaire)	Increased in reporting symptoms compared to a free report method, loss

						of data when focused on only highlighted symptoms
Wany & Chaou	2017	2815 patients	39 years old	SR -systematic review	Evaluation of ED visits	Protocols are inconsistent-but data significant (one protocol states if CT is negative and patient has no neuro deficits patient can discharge home safely)

**Legend:** PTA-Post-traumatic amnesia, RPQ -Rivermead Post Concussion questionnaire, RCT-Randomized Control Trial, MBI- Modified Barthel Index, AD- Awareness Defecit ,Ad-HOC scale—scale to measure awareness of deficit of mTBI, CTAS -Canadian triage and acuity scores, DRS-Disability rating scale, Novel of SMP-self management program, eCPG-concussion specific handout, CDC-ACE- Center Disease Control Acute Concussion Evaluation, TBI-Traumatic Brain Injury, mTBI-minor Traumatic Brain injury, PFM-GT & HLA-GT- Positive focus mindfulness & health enhancement program of guided therapy