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Screening for Traumatic Brain Injuries (TBI) in Veterans: A Quality Improvement Project to Change the Identification and Referral Process in Primary Care Providers.

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Abstract

Background: The incidence of traumatic brain injuries (TBI) among veterans has increased exponentially in those who served in Operation Enduring Freedom and Operation Iraqi Freedom. Identification and treatment for these injuries remains difficult due to variance in screening methods, interpretation of results, and barriers to access to care. *Purpose:* The goal of this quality improvement project is to improve TBI screening process offered to veterans by healthcare workers and providers in an outpatient VA clinic in the northeast. *Methods*: Current standards of practice and provider knowledge were assessed through focus groups, pre-intervention survey, followed by educational outreach to provide information specific to TBI and screening for this condition. Data about rates of diagnoses and referrals for a 4-month period prior to intervention were measured against those during the 4-month pilot period. Effectiveness of educational interventions were measured through post-intervention survey and follow-up focus groups. *Results:* Retrospective data indicated that 319 veterans presented for care during the 4 months prior to the initiation of the proposed change in process. Of this number, 10 screenings were performed by the provider/staff, resulting in 2 referrals for follow up. Out of the 100 veterans who presented to the CBOC during the implementation phase, 13 screenings were performed by the DNP student, 5 of which were positive. The change in process resulted in an increase in TBI screenings being performed on veterans presenting for care in the CBOC by 10%, which can be attributed to one or more of changes in process that occurred due to this project. Results from pre-intervention and post-intervention surveys indicate an increase in knowledge base on TBI symptoms and screening process. *Conclusion:* The screening process for identifying traumatic brain injuries in veterans is improved by increasing the knowledge about identifying TBI among healthcare providers, increasing the frequency of evaluation in veterans, and broadening the scope of which veterans are screened. Creating more effective TBI screening procedures in

primary care settings and using a well-defined and specific tool will increase rates of identification, leading to appropriate referrals, treatment, and improved health outcomes in veterans. Due to the Department of Veterans Affairs being a federally governed institution, the changes implemented during this project would require approval prior to being considered as a sustainable intervention throughout the entire organization.

Keywords: TBI, traumatic brain injury, veterans, VA, healthcare, access, cost, screening

Screening for Traumatic Brain Injuries (TBI) in Veterans: A Quality Improvement Project to Change the Identification and Referral Process in Primary Care Providers.

Introduction

As many as 233,425 military members have been diagnosed with a traumatic brain injury (TBI) between 2000 and 2011, most of which were determined to be in veterans who served in Operation Iraqi Freedom (OIF) and Operation Enduring Freedom (OEF) (Belanger, Vanderploeg, Soble, Richardson & Groer, 2012; Evans et al., 2013; Maguen, Lau, Madden & Seal, 2012a; Maguen, Lau, Madden & Seal, 2012b; Russell et al., 2013; VA/DoD, 2009). Military members are at risk for developing many health complications during service, however specific focus has been placed on traumatic brain injuries, and in response to this significant increase in findings, the Department of Veteran Affairs (VA) and The Department of Defense (DoD) created a task force to develop a guideline for identifying and treating TBI symptoms within the VA healthcare system (VA/DoD, 2009).

Background

Early identification is identified as an intervention for complications and decreased health outcomes associated with traumatic brain injury, which is recognized as one of the three most prevalent service related injuries in veterans who served in OIF/OEF (Geiling, Rosen & Edwards, 2012). Despite the intent of the VA and DoD to meet the needs of this demand, barriers to adequate and efficient diagnosis in this population continue to exist. Access to care directly affects appropriate diagnoses, and though there has been a significant increase in veterans utilizing VA healthcare, only 59% of OIF/OEF veterans received care through the VA system (Fleming, Crawford, Calhoun, Kudler & Straits-Troster, 2016).

One of the barriers to early identification of a traumatic brain injury in the veteran population with the current screening process, is variability in the results of TBI screenings, which rely on the details from the veteran's perspective alone (Van Dyke, Axelrod & Schutte, 2010). Variance in the interpretation of the results or indicators also impacts the outcome of screenings, which is reflected when increasingly detailed evaluations have been noted to be more accurate when determining the presence of an injury (Belanger et al., 2012; Maguen et al., 2012a). Clarifying symptoms that are specific to this condition also results in more precise diagnoses (Maguen et al., 2012b). The need to identify potential traumatic brain injuries in this population within primary care settings is indicated, however the limited number of veterans who seek care interferes with identification of the appropriate diagnosis (Evans et al., 2013; Maguen et al., 2012a; Russell et al., 2013).

Factors associated with higher rates of accessing care include older ages and symptom severity; additionally, exposure to combat has recently been determined to be a deterrent to seeking care (Fleming et al., 2016). The Centers for Disease Control and Prevention (CDC), National Institutes of Health (NIH), the Department of Defense (DoD), and the Department of Veterans Affairs (VA) (2013) recommend that screening for TBI among the OIF/OEF population should occur at contact with any health system within the VA, while recognizing the possibility for missed identification of injury if not seeking healthcare within the system. Even with increased focus on diagnosis, difficulty within the screening process remains, including the reliance on veteran reports to determine the presence of symptoms and misinterpretation of the findings on the part of the healthcare provider (Marshall et al., 2012; Maguen et al., 2012b).

Problem Statement

Risk of undiagnosed or misdiagnosed traumatic brain injuries among United States veterans, who served in Operation Iraqi Freedom and Operation Enduring Freedom, is indicated by the increased number of veterans presenting with symptoms of traumatic brain injuries, but do not receive appropriate follow up care (Marshall et al, 2012; CDC, NIH, DoD & VA, 2013; VA/DoD, 2009). Current practice requires reliance on veteran report of symptoms, and varying methods and interpretation of information, rather than identifying specific indicators such as dizziness, balance disturbance, light sensitivity, headaches, or memory problems. This paired with the lack of a reliable screening process available to primary care providers creates a barrier to diagnosis (Marshall et al, 2012; Maguen et al., 2012b; CDC, NIH, DoD & VA, 2013; VA/DoD, 2009).

Organizational "Gap" Analysis of Project Site

VA/DoD Clinical Practice Guideline for the Management of Concussion-Mild Traumatic Brain Injury (VA/DoD, 2015) recommends that primary care providers perform screenings that utilize open ended questions, rather than providing checklists to veterans, to obtain accurate and detailed health histories and determine appropriate diagnoses. The VA placed a policy into effect in April 2007 that ensures that all OIF/OEF veterans will be screened for TBI at every encounter with a VA healthcare facility using a computer-based screening tool (United States Government Accountability Office, 2008). Though the use of a specific screening checklist is in use throughout the VA system, its validity and reliability has not been proven, and the consistency of its use has shown to remain a barrier to an effective diagnostic process (GAO, 2008).

Thorough education of staff and providers, and consistent use of a comprehensive and detailed screening tool is needed to meet the current expectations of the VA/DoD (2015).

Current VA screening practice allows missed opportunities for identified injuries and a lack of appropriate referrals for treatment due to the reliance on an electronic system to determine the need for screening. Misinterpretation of results of screening tools and the use of screening tools that do not rely on TBI specific symptoms for diagnostic criteria continues to compound the problem. The lack of screening when indicated, along with nonspecific screening procedures lead to both the loss of follow up care when necessary, as well as, inappropriate referrals when focusing on symptoms that may be seen in other diagnoses (Belanger et al., 2012).

Review of the Literature

This literature review was performed from research articles found using Cumulative Index to Nursing and Allied Health Literature (CINAHL), Science Direct, Education Resources Information Center (ERIC), Medline, PubMed and Cochrane database searches. The following Medical Subject Headings (MeSH) terms TBI, traumatic brain injury, veterans, VA, healthcare, access, cost and screening were used to best locate information focusing on the current screening process for traumatic brain injuries in veterans. The inclusion criteria for the articles used was English language and published between the years 2010 and 2017 to gather the most recent perspective on this topic. Information about current guidelines and recommendations were retrieved from National Clearinghouse Guideline and the Department of Veterans Affairs.

The level of evidence in the articles and guidelines used in this literature review were measured against the Johns Hopkins Nursing Evidence-based Practice Rating Scale (JHNEBP) (Newhouse, Dearholt, Poe, Pugh & White, 2005). The JHNEBP scale ranges from the strongest quality of evidence, level I, for “experimental study/randomized controlled trial (RCT) or meta analysis of RCT” (Newhouse et al, 2005), and the weakest being level V for an “opinion of an individual expert based on non-research evidence” (Newhouse et al, 2005). Each of these studies

are level III, as the data has been collected through retrospective analysis, non-experimental methods. Six are rated highly as level III-A as "well-defined methods using rigorous approach; consistent results with sufficient sample size; use of reliable and valid measures" (Newhouse et al, 2005), while one study is level III-B, which meets the criteria of good quality due to limited sample size.

The findings are explained as follows to demonstrate an understanding of current practice, shortcomings that exist within this process, while determining potential advances that will best serve the veteran population when screening for TBI. While the severity of traumatic brain injuries may vary, and can result from either a closed or penetrating injury, they are recognized as temporary or permanent neurologic damage caused by external trauma (Marshall et al., 2012). Traumatic brain injuries are now recognized as one of the most common persistent injuries in the OIF/OEF veteran population. TBI present with late onset symptoms, can easily be misdiagnosed, and can lead to many complications later in life if not identified (Geiling et al., 2012).

Barriers in Screening Process

Evans et al. (2013) performed a national cohort study to determine trends of traumatic brain injury diagnoses in veterans and facilities, and results from TBI screenings on Operation Iraqi Freedom and/or Operation Enduring Freedom (OIF/OEF) veterans. The records of 170,681 veterans who received care through the VA between April 2007 and September 2008 were evaluated to determine who qualified to receive the TBI screening. A four-part screening process, which determined a known cause, presence of symptoms immediately after the incident, occurrence of new symptoms, and if symptoms exist at the time of screening, was initiated with 91.6% of eligible veterans. Inclusion criteria for the screening process were that the veterans

were actively receiving care though the VA. This process isolates a large group of the veteran population from being assessed for the presence of traumatic brain injuries (Evans et al., 2013).

One challenge for veterans accessing care is identified as homelessness, which then translates as a major barrier to the identification of TBI (Russell et al., 2013). With the assumption that TBI are under-identified in this group, data was retrieved about the 678 veterans receiving homeless services, of which 313 participated in the screening process. Of the total group of participants, 47% of the homeless veterans were identified to have a probable traumatic brain injury secondary to history of loss of consciousness (Russell et al., 2013). Although the results of this study indicate a high correlation between the potential for TBI and homelessness in veterans, the fact that only half of the potential group participated indicates the difficulty that exists in evaluating this population.

The VA recognizes that many veterans may not seek treatment if they are unaware that an injury has occurred or are unable to correlate symptoms with a TBI, and diagnoses will remain unidentified in veterans who do not present to a health care facility (GAO, 2008; Evans et al., 2013). Hendricks et al. (2012) counter that existing screening processes remain less than effective, as 21.6% of eligible veterans were identified as at risk for TBI when electronic records of 208,589 veterans were reviewed between October 1st, 2007 and July 31st, 2009. Of this group, only 54.6% of them received the follow up Comprehensive TBI Evaluation, and only 48.9% were determined to have a positive TBI diagnosis at this time (Hendricks et al., 2012). Although the initial screening was performed the majority of the time, due to noncompliance or inability to complete the process, a deficit in appropriate diagnosis remains in this population.

Errors in Screening

The increase in incidence of traumatic brain injuries infers that a necessity for functional screening practices exists. Van Dyke, Axelrod, and Schutte (2010) performed a test and re-test study to evaluate the reliability of one of the screening tools currently being used when evaluating the results for 44 OIF/OEF veterans. The first and second test were performed six months apart using the same tool, and the answers varied to such a degree that none were determined to have excellent reliability, and only 6 qualified as good-to-fair (Van Dyke et al., 2010). The results of both screenings were rated statistically with nominal values, with κ coefficients above 0.75 representing excellent, those between 0.40 and 0.75 being good to fair, and less than 0.40 qualifying as poor (Van Dyke et al., 2010). This lack of focus surrounding the consistency in TBI screening results compounds the difficulty that exists in obtaining accurate diagnoses through the screening process.

The screening process alone is not the only variable that may influence results. Maguen, Lau, Madden, and Seal (2012b) recognize that similar symptomology occurs with other conditions, such as post-traumatic stress disorder (PTSD), which can further complicate identifying specific indicators for TBI. In hopes to better clarify, data from 1,549 OIF/OEF post deployment TBI and PTSD screenings were analyzed to determine both overlapping symptoms and those found with TBI only. Of the veterans screened for TBI in this study, 25% screened positive, however screenings for PTSD and depression are twice as likely in this population than those who screened negative for TBI (Maguen et al, 2012b).

According to Maguen et al. (2012b), dizziness/balance disturbance, light sensitivity, headaches, and memory problems have been identified as TBI specific, while sleep disturbance and irritability can be seen in PTSD as well. Although this relied on retrospective data derived

from one specific population, the results can be considered reliable due to the large sample size and consistent results. Maguen et al. (2012b) infer that relying on more definitive results will assist in improving the reliability of the screening process.

Secondary Screening

Maguen, Lau, Madden, and Seal (2012a) addressed reliability of the traumatic brain injury screening process by comparing the initial method with the accuracy of secondary evaluation and its frequency of use in a sample of 465 OIF/OEF veterans. Of this patient group receiving care from the VA between April 2007 and June 2010, those who were determined to screen positive in the initial phase were followed to identify if further evaluation then occurred. The use of univariable and multivariable logistic regression to measure how demographic factors such as age, sex, race, marital status, branch of service, unit code, rank and number of deployment rates have impacted the screening process, along with which symptoms lead to follow up evaluation and times between the two screenings (Maguen et al, Jul. 2012a).

Dizziness, headaches, irritability, memory problems, and sleep problems and visual problems were identified as specific symptoms of TBI that were reported by veterans (Maguen et al, Jul. 2012a). Three quarters of this sample received follow up testing secondary to screening results, with higher rates among those who were experiencing headaches, fewer among those who had longer gaps in time between referral, as well as having fewer women in the group who received further testing (Maguen et al, Jul. 2012a). While this demonstrates a reasonable correlation between the screening process and continued treatment, it does not account for false negative screenings that may have arisen from other diagnoses such as PTSD, as well as the possibly missed cases in the 25% that did not receive the second tier of the diagnostic process altogether (Maguen et al, Jul. 2012a).

With similar interest, Belanger, Vanderploeg, Soble, Richardson, and Groer (2012) utilized VA records between October 2007 and June 2010 to examine the relationship between a positive screening and the results of the Comprehensive TBI Evaluation. While 48,175 veterans were included in this research, and 41,684 of these veterans demonstrated positive results of the initial screening, there was only a positive result in 53% after further testing occurred. Of the total group of veterans included in this study, 47,056 were designated as having a TBI due to positive screening, however false positives were assumed to inflate the results due to the presence of mental health diagnoses (Belanger et al., 2012). While the need for further examination of veterans suspected of having TBI that was discussed by Maguen et al. (2012a) is echoed in this study, it also raises the concern for the lack of reliability of the screening process itself (Belanger et al., 2012).

Synthesis

The information found in the above articles indicates the necessity of an appropriate screening process for the identification of traumatic brain injuries, and evaluation of potential barriers to its efficacy. Although there is not a definitive way to completely resolve the barriers to seeking care through the VA, once the veteran presents, adequate assessments must take place in the best interest of these veterans (Evans et al., 2013; Maguen et al., 2012b; Russell et al., 2013). Reliable results can be obtained despite relying on gathering of details from the veteran's perspective alone, and minimizing the variance in interpretation when relying on specific indicators (Belanger et al., 2012; Van Dyke et al., 2010). Increasingly detailed evaluations have been noted to result in more accurate diagnoses, especially when relying on the presence of findings specific to traumatic brain injuries during the evaluation (Maguen et al., 2012a; Maguen et al., 2012b).

Evidence Based Practice: Verification of Chosen Option

The Veteran's Association recognizes that further research and adaptation of current policy must occur to meet recommendations for this high-risk population (CDC, NIH, DoD & VA, 2013; GAO, 2008; Geiling et al., 2012; VA/DoD, 2009; VA/DoD, 2015). To counter the potential impact veteran perspective may have on the results of traumatic brain injury screenings, the use of the specialized screening tool developed for the VA/DoD Clinical Practice Guideline is recommended (2009) (see Figure 1 in Appendix A for TBI screening tool). Education on symptom identification and interpretation, along with the use of open ended questions by the health care professional performing the screening, will result in more precise determinations of this diagnosis (GAO, 2008; Maguen et al., 2012a; Maguen et al., 2012b; Belanger et al., 2012; Van Dyke et al., 2010).

The use of this TBI screening tool that is driven by key symptoms and relies on specific feedback from the veteran while minimizing misdiagnoses through interpretation, is indicated in the improvement of the TBI screening process in primary care settings (GAO, 2008; VA/DoD, 2009; VA/DoD, 2015). While the current standard of care is an obvious attempt to meet recommendations, there are notable areas for improvement in screening for traumatic brain injuries in veterans. Despite the recognition of need and attempted response that is indicated in these articles, the translation into practice to ensure consistent identification of this condition among veterans is lacking. Further education about reliability and specificity of determining results of screenings must occur, followed by consistent use of the recommended tool, to improve diagnosis of traumatic brain injuries within this high-risk group.

Theoretical Framework/Evidence Based Practice Model

The theoretical framework that is the best basis for the development of an appropriate

TBI screening process includes a model for change. Lippitt's Change Theory includes detailed phases that facilitate change at the team level through democratic leadership, rather than autocratic, which improves investment and success in the process (Lippitt, Watson & Westley, 1958; Mitchell, 2013). The seven phases of Lippitt's Change Theory (Lippitt et al., 1958; Mitchell, 2013) incorporate the nursing process while addressing the assessment of a problem, planning for and initiating change, and evaluating its success (see Table 1 in Appendix B for Lippitt's Change Theory phases).

The first phase, in Lippitt's theory (Lippitt et al., 1958; Mitchell, 2013), includes determining the problem, which has been identified and addressed in the literature review above. Assessing motivation for change during Lippitt's second phase, is indicated at the organizational level of Veterans Affairs, while phase three addresses the enthusiasm and intent towards participation within the organization and among the healthcare providers engaging with the veterans. Determining the motivation for change from the provider and staff, as well as the VA as an organization continues during this phase. Planning occurs in Lippitt's fourth phase, when the intervention is determined and finalized, which in this instance includes utilizing the most effective screening tool and implementing a change in process (Lippitt et al., 1958; Mitchell, 2013). The goal of this phase includes determining how to produce the most change with the least amount of disruption to workflow and patient care.

The fifth phase in Lippitt's theory, includes determining the most appropriate agent for the change, such as the team or provider who is most engaged and invested in the change. For example, a primary care nurse practitioner who is responsible for the screening, diagnosis and referral for treatment of TBI, is ideal for participation. Initiation of the intervention occurs during phase six, which includes assessing efficacy and making alterations in the change process if

necessary (Lippitt et al., 1958; Mitchell, 2013). Throughout the quality improvement project, adaptations were made according to the needs of the staff and veteran participants which would be collected through verbal feedback and focus groups.

The seventh and final phase in this change theory (Lippitt et al., 1958; Mitchell, 2013) is when separation from the team occurs, and when the change becomes independently sustainable within the setting. The success of the intervention is largely improved by the investment and involvement of the participants, which is the basis of Lippitt's Change Theory (Lippitt et al., 1958; Mitchell, 2013). The effectiveness of the new TBI screening process is not only determined by data collection, but also by the opinions of the provider involved. During this section of the project, results are translated and presented to key stakeholders, who are then given the opportunity to continue the implementation after the completion of the project.

Goals, Objectives & Expected Outcomes

The outcome of this quality improvement project was addressed from two perspectives: the impact on the provider and the impact on the patient. The following two, multipart goals were identified (Anderson, Knestrick & Barroso, 2015; Bonnel & Smith, 2014).

Goal One. To improve staff's knowledge of the traumatic brain injury indicators and screening process.

Objectives	**Outcome Measures**
A. Primary care provider will attend educational outreach provided.	1. The 1 provider participating in the project will attend the educational outreach about the identification of traumatic brain injuries.
B. Primary care provider will be able to identify symptoms specific to traumatic brain injury.	1. 100% of providers will be able to accurately identify symptoms specific to traumatic brain injuries in the post-test. 2. There provider's ability to identify symptoms specific to traumatic brain injuries will improve in post-test scores.
C. Primary care provider will accurately describe the screening and referral process for TBI.	1. 100% of providers will be able to accurately determine the screening and referral process for TBI in post-test. 2. There will be an improvement in the provider's

	ability to determine the screening and referral process for TBI from pre-test and post-test.

Goal Two. To increase the rates of identification of traumatic brain injuries and appropriate referrals for treatment.

Objectives	Outcome Measures
A. Use of the proposed screening tool will increase the rates of identification of TBI.	1. TBI screening will be performed on 100% of veterans presenting for care who do not have a previously diagnosed TBI, and who have separated from service after October 1, 2001.
B. Change in screening process will increase rates of TBI diagnosis.	1. There will be a 3% increase in diagnosis of TBI from 4-months pre-intervention and 4-months post-intervention.
C. Change in screening process will increase rates of appropriate referral for treatment.	1. 100% of veterans who screen positive for TBI will have appropriate referrals.

Project Design

This intervention followed a quality improvement project framework with an evaluation design that assessed the current TBI screening process in a primary care clinic. Evaluation of the implementation of a process that resulted in more effective and accurate diagnoses and referrals for treatment for traumatic brain injuries was also included in this project. Quantitative and qualitative methods, including focus groups, staff feedback, journaling, personal communications, and descriptive statistics were used to determine the effectiveness of this intervention.

Project Site and Population

The setting for this project was one of the Veteran's Association community based outpatient clinic, servicing adult veterans of the United States Armed Services. This was a primary care setting that provides care to male and female veterans, ranging from ages 18 years to end of life. There was no discrimination of race, religion, gender, disability, or socioeconomic status, other than the requirement of having served in the Armed Services during or after Operation Iraqi Freedom or Operation Enduring Freedom. Because the veterans that were seen in

this population were not categorized by years of service or involvement in specific missions, such as OIF/OEF, all veterans were evaluated for the need for TBI screening during this process. Prior to screening, the only exclusion criteria were a pre-existing diagnosis of TBI or having separated from the military prior to October 1, 2001, which eliminated potential involvement in OIF/OEF (VA, 2015). All other criteria were inclusive, and data collected throughout the project was be categorized by those who screened positive and received referral for further treatment, and those who had negative screenings.

Staff participants included the Doctorate in Nursing Practice (DNP) student, provider (one nurse practitioner) and staff (one licensed practical nurse), with oversight from the nurse manager, who functioned as the project mentor. The work group for this project included one provider, his/her patient load that was seen in the office during the project timeframe, and the staff member working with him/her. During this process, the practitioner may have seen a patient on another provider's caseload, and though this patient would have been screened to ensure continuity in process, these patients were eliminated from the measured results after the completion of the project.

Setting facilitators and barriers.

Existing facilitators for this proposed change in practice include the CDC, NIH, DoD, VA, and DAO, as these organizations have identified a gap in current screening processes (CDC et al., 2013; GAO, 2008; VA/DoD, 2009; VA/DoD, 2015). Facilitators that were needed within the clinical setting included approval through the VA to perform this quality improvement project, the manager of the specific community based outpatient clinic, and the staff and provider who participated in the process. Approval to perform this quality improvement project was granted from the U.S. Department of Veterans Affairs through the VA Healthcare System

Research Determination process. Other barriers included the possibility that staff would demonstrate resistance to the change in process secondary to a fear of increased workload, which was accommodated for in the implementation plan.

Implementation Plan/Procedures

This project utilized focus groups, the collection of retrospective data, pre-and post-test methods to evaluate for change in knowledge among staff, and the implementation of a pilot screening process using a specific TBI tool. An educational outreach was provided to staff surrounding proposed changes in process and information about traumatic brain injury screenings. This included gathering information about the current standards of practice for screening for traumatic brain injuries in a community based outpatient clinic (CBOC), within the VA system. The process implemented the use of a TBI screening tool, as determined by the Veterans Association and Department of Defense guidelines (2009) that was used to screen each veteran presenting to the CBOC for primary care services, who did not have a previously diagnosed TBI.

Measurement Instruments

The screening tool used in this project was obtained from the Clinical Practice Guideline: Management of Concussion/mild Traumatic Brain Injury (VA/DoD, 2009), which has the ability to determine the presence of specific symptoms that indicate possible traumatic brain injury. Throughout the project, the person performing the screening asked questions and documented the veteran's response, however the screening tool remained in paper form as it was unreasonable to incorporate into the programming of VISTA for a trial period of four months. The knowledge of the provider and staff were measured through pre-test and post-test surveys, developed by the DNP student that included information from the VA/DoD Guideline (2009),

the Veteran's Health Initiative: Traumatic Brain Injury (VA Employee Education System, 2010), as well as the United States Government Accountability Office Report to Congressional Requesters: VA Health Care, Mild Traumatic Brain Injury Screening and Evaluation Implemented for OEF/OIF Veterans, but Challenges Remain (2008) (see Appendix C and D for pre- and post-intervention surveys).

Data Collection Procedures

The proposed process began with collection of data about current rates traumatic brain injury diagnoses and related referrals in the specific setting. The evaluation of staff's understanding of process through survey collection indicated potential barriers to the effectiveness of the current process and necessity for education that was included in the intervention. Information provided by the nurse practitioner involved in this project during the pre-intervention focus group, led to the reformatting of the tool being used, per the request to have it simplified for ease in use (see Appendix E for Revised Screening Tool). Implementation included use of a specific TBI screening tool for every veteran who did not have a previous diagnosis of a traumatic brain injury and presented to the primary care clinic. Each veteran presenting was asked if they had a history of TBI, and if the response was yes, the screening did not occur, as this process was meant to determine new cases only.

The Stetler Model of Research Utilization (see Figure 2 in Appendix F for Stetler Model) was used throughout this process to ensure that its implementation was thorough and detailed (Mateo & Forman, 2014; Stetler, 2001; Stetler & Marram, 1976). As with Lippitt's theoretical framework (Lippitt et al., 1958; Mitchell, 2013), the phases of this model that include the preparation, validation, comparative evaluation and decision making of the project were completed prior to the initiation of the process in the clinical setting. The first steps (Stetler's

phases 1-3, Lippitt's phases 1-4) occurred during the literature review and while gathering information about the need for change, the determination of an optimal tool, and determining the most effective process for screening. Stetler's third phase (Stetler, 2001; Stetler & Marram, 1976) continued to take place in the clinical setting, while Lippitt's phases 3 and 4 (Lippitt et al., 1958; Mitchell, 2013) transitioned into the practice setting as well.

In current practice, screening reminders are set based on indicators in the veteran's chart, and are performed during appointments of any kind. These reminders can be performed by either the provider or staff member, and are reset by the guidelines of the specific screening. Examples of current reminders are need for colonoscopy, diabetic foot exam, and outpatient medication reconciliation. These reminders are completed by staff during triage/check-in, or during the appointment by the provider. Although reminders can be performed by many levels of employees in this setting, to eliminate increase of workload for providers and staff, the screening process was performed by the DNP student only. The original intention was for the provider to participate in the screening process as well, however due to inability to incorporate this into workflow, this did not occur and screenings remained the responsibility of the DNP student.

As the phases of both the Stetler model (Stetler, 2001; Stetler & Marram, 1976) and Lippitt's Change Theory (Lippitt et al., 1958; Mitchell, 2013) overlap, the following procedures were guided by both. Once the data on preexisting traumatic brain injuries, and new diagnoses that occurred within the four months prior was collected, knowledge was assessed and education took place. Pre-intervention focus groups were provided to gain commitment from staff to participate, and evaluate how best to implement this plan (Phase 3). A pre-intervention survey was provided to determine the existing knowledge that the staff participants had on current TBI

screening and referral processes, and symptoms and treatment for this diagnosis, followed by educational outreach.

This education occurred among the providers and other staff who would have performed the screening, and included information about the specific tool being used, the identification of key universal symptoms, and the new process itself. Along with identifying the necessity to alter the presentation of the screening tool to accommodate usability, another change in process that was identified was the DNP student's ability to identify a veteran's eligibility for the screening process through medical records. Records were reviewed to determine date of separation, which would either include or exclude participants, and if appropriate, the screening process would continue.

Stetler's Phase 4 (Stetler, 2001; Stetler & Marram, 1976) coincides with Lippitt's Phases 5 and 6 (Lippitt et al., 1958; Mitchell, 2013), and included the utilization of the proposed screening tool by the DNP student. During this time, the DNP student performed the TBI screening while the staff member performs the patient triage/check in. The screenings being performed by the provider would have occurred during the interview portion of appointments. All positive screenings were then referred to the appropriate specialists, per current VA protocols (GAO, 2008).

A post-intervention focus group occurred to evaluate the change in staffs' perception and understanding of screening tool and process through a post-test, as well as staffs' input on the success of the process. The evaluation of provider and staff's understanding of process through survey collection indicated potential barriers to the effectiveness of the current process and necessity for education that was included in the intervention. Evaluation of the data collected throughout the project determined if an increase occurred in identified and appropriately referred

traumatic brain injuries in veterans presenting to a primary care setting. Lastly, the calculation of change in provider and staff perception and understanding of screening tool and process was measured through a post-test survey. This final stage in the process (Stetler's Phase 5 and Lippitt's Phase 7) included evaluating the success of the implementation, acknowledging necessary adjustments, and determining whether a change resulted during the final phase (Lippitt et al., 1958; Mitchell, 2013; Stetler, 2001; Stetler & Marram, 1976).

Data Analysis

The results of this project will be described in both quantitative and qualitative measures. The qualitative data of this project was gathered through focus groups, staff and provider feedback, journaling, and informal personal communications. Quantitative data will explain descriptive statistics reflecting survey results, as well as, identifying improvement from the intervention when measured against retrospective data.

Results

Pre-Intervention Data

Retrospective data that was collected by the nurse manager and interpreted by the DNP student, indicated that provider whose panel was being followed throughout this project, examined 319 veterans during the 4 months prior to the implementation phase. 31 of these veterans were eligible to be screened for traumatic brain injuries according to current VA standards, which include history of active duty service in a combat zone and have separated from the military after September 11, 2001 (VA, 2017). Screenings are performed once upon entry into the VA system, referrals take place if screening is positive, and reminder process is discontinued if the result is negative (VA, 2017).

Of the 31 veterans who were identified as appropriate, 10 of them received TBI screenings by the provider or staff member, 2 of which were positive, resulting in referrals for follow up. The other 21 veterans were not screened since they either had a history of a negative screening and no further monitoring was indicated, or they did not meet criteria because they were found to have not served in an active combat area. The results discussed from retrospective data are based on an approximate 40-hour work week by provider, over the 4-month timeframe that was evaluated.

Implementation Data

Throughout the 4-month phase of implementation of the proposed intervention, screenings were performed on 15 days. During this timeframe, 100 veterans presented for appointments with the provider involved in this project. TBI screenings were performed on 13 eligible veterans, 5 of which were positive. Current VA process did not identify 3 of the veterans who were determined to have positive screenings through the implemented process. Of the 8 negative screenings, 5 veterans were noted to report a potential injury that could have caused a TBI, regardless of a lack of persistent injury. The 10 veterans excluded from the screening process either declined participation or missed their appointments without cancellation; 1 eligible veteran was known to be missed during this process. See Table 2 below for a comparison of pre- and post-intervention data.

Table 2: Comparison of Results

Number of veterans	4-month pre-intervention timeframe	4-month implementation timeframe
Seen in clinic	319	100
Eligible to be screened	31	23
Screenings performed	10	13
Eligible for referral	2	5

Educational Results

The questions on the pre-and post-intervention surveys ranged in topic to determine knowledge around identifying traumatic brain injuries and screening process, and answers varied from strongly agree to strongly disagree. Answers were then translated into numerical values of 1-5, 5 being strongly agree, 4 being agree, 3 being undecided, 2 being disagree, and 1 being strongly disagree. The results of both surveys differ between the provider and the ancillary staff member involved in the project. See Tables 3 and 4 for Pre-Intervention and Post-Intervention Survey Results.

Table 3: Pre-Intervention Survey Results

Question Number	Answer from Provider	Answer in Numeric Value	Answer from Staff Member	Answer in Numeric Value
1	Agree	4	Strongly Agree	5
2	Disagree	2	Strongly Agree	5
3	Disagree	2	Agree	4
4	Agree	4	Agree	4
5	Undecided	3	Agree	4
6	Strongly Disagree	1	Undecided	3
7	Agree	4	Agree	4
8	Agree	4	Agree	4
9	Undecided	3	Undecided	3
10	Strongly disagree	1	Undecided	3

Table 4: Post-Intervention Survey Results

Question Number	Answer from Provider	Answer in Numeric Value	Answer from Staff Member	Answer in Numeric Value
1	Agree	4	Strongly Agree	5
2	Agree	4	Strongly Agree	5
3	Strongly Agree	5	Strongly Agree	5
4	Agree	4	Strongly Agree	5

5	Agree	4	Strongly Agree	5
6	Agree	4	Agree	4
7	Strongly Agree	5	Agree	4
8	Agree	4	Strongly Agree	5
9	Agree	4	Agree	4
10	Strongly Agree	5	Strongly Agree	5

The provider's responses averaged 2.8, which translates to just below undecided, towards disagree, indicating an overall lack of knowledge. Areas of deficits in knowledge noted on the provider's survey included understanding the current TBI screening and referral processes, as well as being able to identify severity or prolonged symptoms of TBI. The responses from the staff member's pre-intervention survey resulted in an average of 3.9 or mostly agreeing with information, indicating a higher level of understanding than the NP.

The post-intervention survey, which was performed after the completion of the implementation phase and dissemination of results, indicated a diminished gap between the provider and staff member. The results from the provider showed responses between agree and strongly agree, with a numerical value of 4.3. The staff member continued to report a higher comfort level with information, however slightly, with a value of 4.7. This is again between agree and strongly agree, though this number indicates more strongly agree responses than the provider.

Communication Findings

Information gathered through personal communication and in focus groups indicated common themes, as well as individual concerns from participants. A large concern for impact of process increasing workload for either the provider or staff member was discussed by both participants. Although the process was adapted to manage this effect, an overall concern for

current expectations was evident when addressing the need for increasing surveillance on this area of concern. One perspective from the provider was that more importance be placed on the knowledge and responsibility for ancillary staff to complete these screenings to alleviate workload for providers.

Concerns discussed about the veteran perspective arose from both the provider and the veteran participants as well. During the screening process, many veterans minimized the severity of either the initial injury or the symptoms that followed. This was noted to be one of the causes for the previous negative TBI screenings for participants, along with reports that the veterans did not identify the initial injury as a potential cause of a TBI. Upon entry into the VA system, veterans and the provider both report an inordinate amount of questions that are asked, which impacts the value of the TBI screening process taking place during this time.

Veterans reported a feeling of wanting to complete the process as quickly as possible, which sometimes led to a neglect to report the symptoms. The provider discussed the concern that veterans may not report symptoms at the initial visit due to concerns about how it will be perceived and who it will be reported to. These topics indicated barriers to collecting effective data during the initial TBI screening, which also offered a greater opportunity for the implemented screening process to be successful.

Interpretation/Discussion

According to the data discussed above, 9.7% of the veterans who presented during the pre-intervention phase were found to be eligible for screenings, while only 3.1% received screenings. During the implementation phase 23% of veterans were identified for the screening process, and 13% of the total number were screened for TBI. The implementation resulted in an increase in TBI screenings being performed on veterans presenting for care in the CBOC by

approximately 10%, which can be attributed to one or more of changes in process that occurred due to this project. Of importance to note, the pre-intervention population number does not include veterans who did not arrive to the clinic for their appointments, while the implementation population does.

When addressing the results of this project in respect to the previously determined goals, it is evident that they have been met overall. The first goal was to improve staff's knowledge of the traumatic brain injury indicators and screening process, which was achieved by the provider attending the educational outreach, reporting he ability to identify symptoms specific to traumatic brain injuries, as well as, having a better understanding of the screening and referral process. The second goal, to increase the rates of identification of traumatic brain injuries and appropriate referrals for treatment, was attained through the use of the proposed screening tool, an increase in screenings, which then resulted in an increase in appropriate follow up. Although TBI screenings were not performed on 100% of eligible veterans, an improvement was noted. An increase in diagnosis of TBI throughout this process, as identification of risk and concerning symptoms occurs at this level of care, while diagnosis takes place after the referral.

Though the increase in efficacy between the two screening tools was not measured in this process, the increase in frequency of screenings and broader scope of who was screened demonstrated an improvement in screening and identification of potential TBI. Limitations that impacted this project include the lack of accessibility to veterans to perform screenings by the DNP student due to the minimal amount of days available in the clinic, along with the inability of the provider to incorporate the proposed intervention into workflow without decreasing productivity. Other limitations included the continued reliance on report from the veteran, however this was minimized by the DNP student asking specific TBI symptom related questions.

Despite the effectiveness of this intervention, a barrier to care remains that the target population does not access care consistently, which is evidenced by the no-show rates noted in this project.

Cost-Benefit Analysis

The costs associated with this quality improvement project resulted largely from data collection and staff training. Capital investments are not included in the estimated cost, as the data collection was obtained from medical records and through assistance from the project mentor. This process was intended to result in no cost to the facility, as the DNP student was responsible for implementation, monitoring of process, and collection of results, other than the need for assistance in obtaining data from existing records. The greatest cost resulted from the hourly wage of the nurse manager who assisted in collecting retrospective data from medical records, as well as providing support and acting as a resource for the DNP student throughout the project as project mentor.

Educational costs were absorbed by the DNP student, excluding the hourly wage of the participating licensed practical nurse (LPN) and nurse practitioner (NP) that were required for pre/post intervention focus groups, educational outreach on the proposed process and TBI diagnosis, and the pre/post-intervention survey determining staff knowledge. The initiation of pilot screening process by DNP student required no cost, as it was incorporated into normal workflow. Evaluation of results of change in process compared to the existing screening process were performed by the DNP student. To minimize cost and interference, the DNP student incorporated the majority of this process into the workflow of the one provider and one staff member included in this process.

The benefits and value of this quality improvement project can only be approximated when acknowledging traumatic brain injuries as one of the three most costly post-service injuries

in this population, that are projected to result in up to 54 billion dollars in healthcare costs between 2011 and 2020 (Geiling et al, 2012). Early and appropriate diagnosis within primary care settings is suggested as a leading preventative intervention to combat costs associated with long-term complications from TBI (Geiling et al, 2012). If incorporated in the standards of care in this VA clinic, the proposed change in practice has the potential to decrease healthcare cost for the VA and the veterans themselves, but also improve the quality of life and health outcomes for veterans with traumatic brain injuries.

Timeline

This project took place over seven months from October, 2017 to April, 2018, four of which included implementation of the proposed intervention.

Ethical Considerations/Protection of Human Subjects

U.S. Department of Veterans Affairs provided approval to move forward as a non-research project through the VA Healthcare System Research Determination process, as discussed above. The University of Massachusetts, Amherst (UMass) Internal Review Board (IRB) was provided with this information which then facilitated final approval being obtained prior to initiating the DNP project. The official IRB Determination Form was submitted to UMass as soon as the proposal was approved. This quality improvement project upheld the ethical principles required when working with human subjects, including respect for others, beneficence, and justice. The participants in this project provided informed consent, as required because the subjects will have face-to-face contact throughout the process.

All data collected through retrospective collection or through intervention was de-identified to protect the privacy of the participants, as determined by the Health Insurance Portability and Accountability Act of 1996 (HIPAA) which was developed to protect the privacy

of patients' health information (Department of Health and Human Services, 2013). All data stored electronically was password protected, and stored separately from the identification key used to categorize information, and all hard copies of files was stored in a secure area only accessible to the project facilitators.

Throughout this project, the standards of care in a primary care office were upheld by the DNP student, as well as by the clinic employees involved. Each participant had the right to be informed of any risk that may occur due to intervention, however there is no increased risk associated with participation in this project when compared to other veterans seeking care at the VA clinic. Possible benefits included the potential identification and referral for treatment for a traumatic brain injury that may otherwise have remain unidentified.

Conclusion

Increase in occurrences of traumatic brain injuries may not be avoided, however this change in presentation must be met with an improvement in practice to meet best practice standards. Inadequate screening processes results in the continued risk for undiagnosed traumatic brain injuries in Operation Enduring Freedom and Operation Iraqi Freedom veterans, which then have the potential to compound into complex and chronic health problems (CDC et al., 2013; GAO, 2008; Geiling et al., 2012; VA/DoD, 2009; VA/DoD, 2015). This intervention focused on improving the education of healthcare employees and providers, initiating a screening protocol to identify symptoms of traumatic brain injuries in veterans who may have otherwise not been assessed (Belanger et al., 2012; Evans et al., 2013; Fleming et al., 2016; Maguen et al., 2012b; Russell et al., 2013; Van Dyke et al., 2010).

The implications of this quality improvement project include that relying on specific symptoms of TBI, increasing the frequency of screenings and broadening scope of who is

screened improves rates of identification among Veterans. Relying on the use of a tool that targets definitive indicators and minimizes misdiagnoses of comorbidities (Belanger et al., 2012; GAO, 2008; Van Dyke et al., 2010). The utilization of patient interactions in primary care settings will continue to improve the diagnostic process by optimizing the potential for identifying concerns with each instance of contact which will then result in referrals to necessary specialists for follow up and treatment (CDC et al., 2013; Fleming et al., 2016; GAO, 2008; Geiling et al., 2012; VA/DoD, 2009; VA/DoD, 2015). Appropriate identification of traumatic brain injuries will then result in referrals to necessary specialists for follow up and treatment, thus reducing the overall risk of the veterans and improving health outcomes (Belanger et al., 2012; GAO, 2008; Maguen et al., 2012a; VA/DoD, 2009; VA/DoD, 2015).

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Appendix A

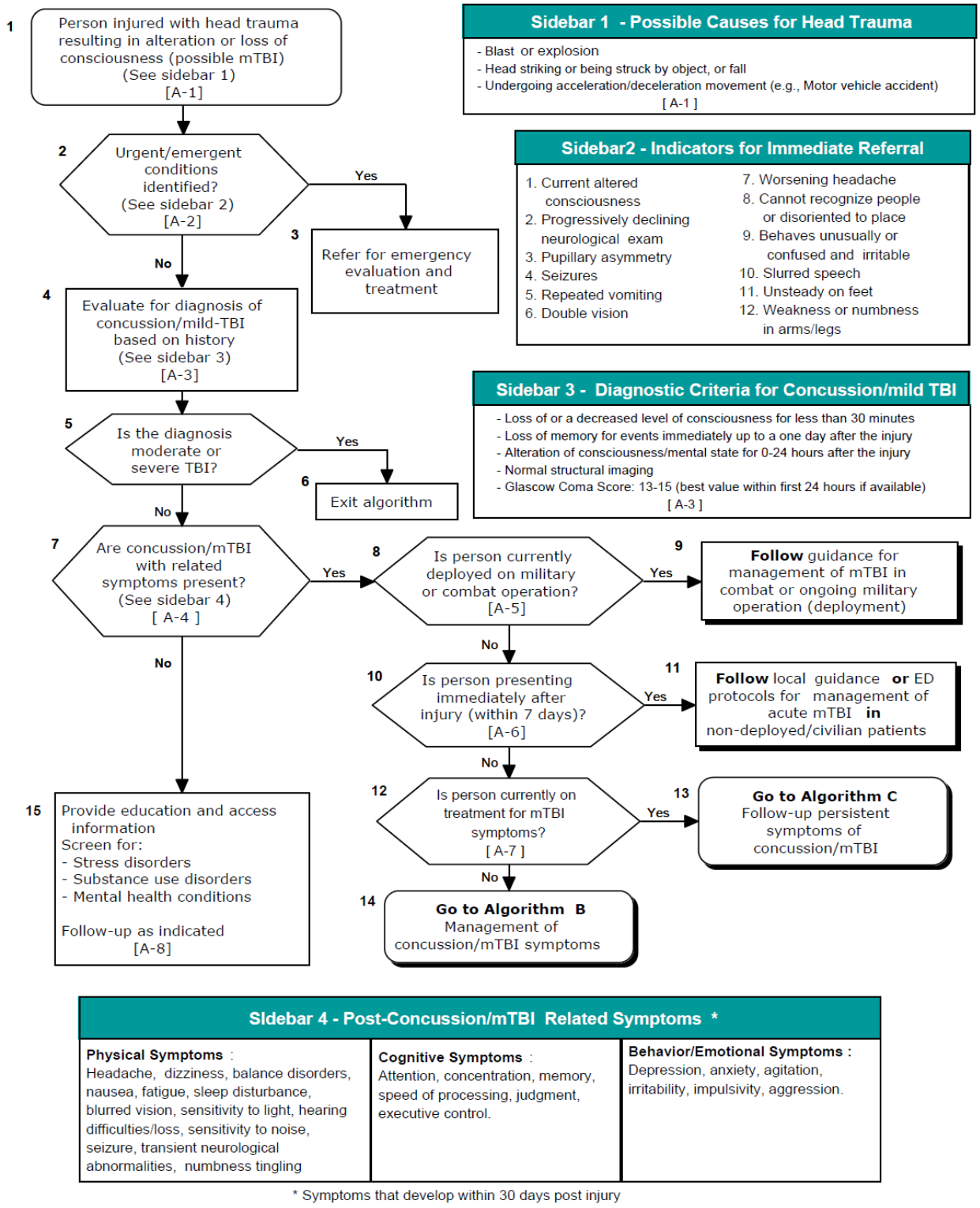

Figure 1. Screening Tool VA/DoD, 2009

Appendix B

Table 1

Lippitt's Theory

Box 2 Lippitt's theory compared with the nursing process

Nursing process elements	Lippitt's theory
Assessment*	*Phase 1*. Diagnose the problem
	Phase 2. Assess motivation/capacity for change
	Phase 3. Assess change agent's motivation and resources
Planning†	*Phase 4*. Select progressive change objective
	Phase 5. Choose appropriate role of the change agent
Implementation‡	*Phase 6*. Maintain change
Evaluation‡	*Phase 7*. Terminate the helping relationship

Key: * Assessment = Lewin's unfreezing stage
† Planning/implementation = Lewin's moving stage
‡ Implementation/evaluation = Lewin's refreezing stage

(Lewin 1951, Lippitt *et al* 1958, Pearson *et al* 2005)

Mitchell, 2013

Appendix C

Traumatic Brain Injury (TBI) Screening Pre-Intervention Survey

1. I have a good understanding of what triggers TBI screening in the current screening process.
   ☐ Strongly Agree ☐ Agree ☐ Undecided ☐ Disagree ☐ Strongly Disagree

2. I have a good understanding of the content of the current TBI screening tool.
   ☐ Strongly Agree ☐ Agree ☐ Undecided ☐ Disagree ☐ Strongly Disagree

3. I have a good understanding of the treatment referral process.
   ☐ Strongly Agree ☐ Agree ☐ Undecided ☐ Disagree ☐ Strongly Disagree

4. I have a good understanding of VA/DoD recommendations for TBI screenings currently.
   ☐ Strongly Agree ☐ Agree ☐ Undecided ☐ Disagree ☐ Strongly Disagree

5. I feel that the current TBI screening process is effective.
   ☐ Strongly Agree ☐ Agree ☐ Undecided ☐ Disagree ☐ Strongly Disagree

6. I feel comfortable determining the severity of a TBI.
   ☐ Strongly Agree ☐ Agree ☐ Undecided ☐ Disagree ☐ Strongly Disagree

7. I can identify three symptoms that are specific to TBI.
   ☐ Strongly Agree ☐ Agree ☐ Undecided ☐ Disagree ☐ Strongly Disagree

8. I can identify 3 symptoms that may be confused with other diagnoses.
   ☐ Strongly Agree ☐ Agree ☐ Undecided ☐ Disagree ☐ Strongly Disagree

9. I can identify other diagnoses that may result with similar symptoms to TBI.
   ☐ Strongly Agree ☐ Agree ☐ Undecided ☐ Disagree ☐ Strongly Disagree

10. I can determine whether a patient is in the acute phase of TBI or is experiencing prolonged symptoms.
    ☐ Strongly Agree ☐ Agree ☐ Undecided ☐ Disagree ☐ Strongly Disagree

GAO, 2008; VA/DoD, 2009; VA Employee Education System, 2010

Appendix D

Traumatic Brain Injury (TBI) Post-Intervention Survey

1. I have a good understanding of the content of the TBI screening tool used during the QI project.
   ☐ Strongly Agree ☐ Agree ☐ Undecided ☐ Disagree ☐ Strongly Disagree

2. I have a better understanding of the treatment and referral process.
   ☐ Strongly Agree ☐ Agree ☐ Undecided ☐ Disagree ☐ Strongly Disagree

3. I have a better understanding of VA/DoD recommendations for TBI screenings currently.
   ☐ Strongly Agree ☐ Agree ☐ Undecided ☐ Disagree ☐ Strongly Disagree

4. I feel more comfortable determining the severity of a TBI.
   ☐ Strongly Agree ☐ Agree ☐ Undecided ☐ Disagree ☐ Strongly Disagree

5. I am more comfortable identifying three symptoms that are specific to TBI.
   ☐ Strongly Agree ☐ Agree ☐ Undecided ☐ Disagree ☐ Strongly Disagree

6. I am more comfortable identifying 3 symptoms that may be confused with other diagnoses.
   ☐ Strongly Agree ☐ Agree ☐ Undecided ☐ Disagree ☐ Strongly Disagree

7. I am more comfortable identifying other diagnoses that may result with similar symptoms to TBI.
   ☐ Strongly Agree ☐ Agree ☐ Undecided ☐ Disagree ☐ Strongly Disagree

8. I am more comfortable determining whether a patient is in the acute phase of TBI or is experiencing prolonged symptoms based on a timeframe.
   ☐ Strongly Agree ☐ Agree ☐ Undecided ☐ Disagree ☐ Strongly Disagree

9. I feel that the screening tool used in this QI resulted in more specific results than the current tool.
   ☐ Strongly Agree ☐ Agree ☐ Undecided ☐ Disagree ☐ Strongly Disagree

10. I feel that the educational outreach involved in this QI provided an increase in my knowledge about TBI.
    ☐ Strongly Agree ☐ Agree ☐ Undecided ☐ Disagree ☐ Strongly Disagree

GAO, 2008; VA/DoD, 2009; VA Employee Education System, 2010

Appendix E: Revised Screening Tool

Section 1:

1. Did you separate from the military after October 2001? **Yes** **No**
2. Have you been diagnosed with a TBI/head injury before? **Yes** **No**

If **yes to 1**, and **no to 2,** proceed to **Section 2:**

3. Have you had a change in mental status or loss of consciousness due to any of the following: blast, explosion, head hitting something or being hit by something, fall, motor vehicle accident?
   Yes **No**

If **yes to 3**, proceed to **Section 3:**

4. At the time of the injury did you have any of the following:
   - loss or decrease in level of consciousness for less than 30 minutes
   - loss of memory for events immediately up to one day after the injury
   - change in mental status/consciousness for 0-24 hours after the injury

   Yes **No**

If **yes to 4,** proceed to **Section 4:**

5. Have you had any of the following symptoms since the injury?

Physical	Cognitive	Behavioral/Emotional
Headache, **dizziness**, **balance disorders**, nausea, fatigue, sleep disturbance, blurred vision, **sensitivity to light**, hearing loss/difficulties, sensitivity to noise, seizures, transient neurological abnormalities, numbness, tingling	Attention, concentration, **memory**, speed of processing, judgment, executive control	Depression, anxiety, agitation, irritability, impulsivity, aggression

Yes **No**

If **yes** to any of the above symptoms including at least one **key symptom,** further evaluation is indicated.

(VA/DoD, 2009)

Appendix F

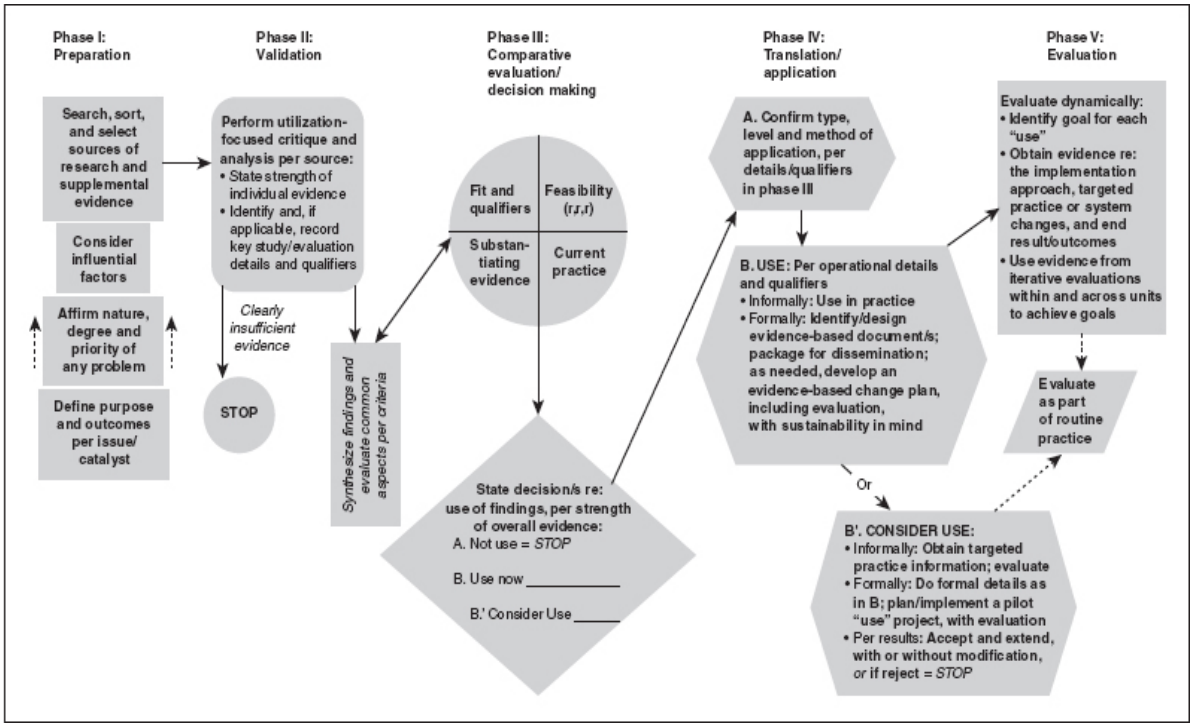

Figure 2: Stetler Model Stetler, 2001