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FRETT: Fall Risk Evaluation Tool For Traumatic Brain Injury A Master’s Thesis Project

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This thesis, written under the direction of the candidates' thesis advisor and approved by the Chair of the Master's program, has been presented to and accepted by the Faculty of the Occupational Therapy department in partial fulfillment of the requirements for the degree of Master of Science in Occupational Therapy. The content, project, and methodologies presented in this work represent the work of the candidates alone.

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Abstract

The goal of this thesis project was to develop an evidence-based multi-factorial assessment that appropriately measures fall risk in individuals with traumatic brain injury (TBI). The thesis team created an assessment they named FRETT (Fall Risk Evaluation Tool for Traumatic Brain Injury) that evaluates significant risk factors for falling in the TBI population through a variety of assessment tools. Methods included both portions of currently published assessments and original assessments developed by the thesis team. A manual was also developed with detailed instructions on how to perform and score FRETT. The target population for this project included the occupational therapists, physical therapists, and nurses that work at the CareMeridian rehabilitation facility in Fairfax, CA, Kentfield Rehabilitation Specialty Hospital in Kentfield, CA, and California Pacific Medical Center Davies Campus in San Francisco, CA. The thesis team conducted three 45-minute presentations on the use of FRETT followed by question and answer sessions with the clinicians. Assessment of the project was conducted via surveys filled out by the clinicians immediately after attending the presentations. General feedback obtained from the surveys was positive. The participating clinicians indicated that FRETT could be a useful tool when working with higher functioning individuals with a history of TBI. The thesis team suggests a future research project to test the validity of FRETT.

Introduction and Statement of Problem

According to the Center for Disease Control and Prevention, an estimated 1.7 million people sustain a traumatic brain injury (TBI) annually (Faul, Xu, Wald, & Coronado, 2010). TBI can result in serious impairments, including issues with cognition, sensory processing, communication, and behavior (National Institute of Neurological Disorders and Stroke, 2002). As a result of these impairments, particularly cognition, an individual with TBI may also be more susceptible to a fall, which can further diminish one's ability to participate in meaningful activities. According to Bruckner and Herge (as cited in Wilgoss, Yohannes, & Mitchel, 2010), falls are a serious health concern. Falls not only cause mortality, but may also lead to psychosocial consequences, injury, and physical deterioration. Together, these consequences can negatively impact an individual's quality of life. Falls also increase the likelihood of institutionalization and result in increased economic costs.

Risk factors alone are major contributors to initial falls and recurrent falls in the TBI population (Medley, Thompson, & French, 2006). Cognitive impairment, visual dysfunctions, and balance disorders in the TBI population contribute to a decrease in overall functional mobility, which leads to an increased likelihood of falls (Cantin et al., 2007). Additional risk factors such as the use of psychotropic medication, polypharmacy, and environmental hazards have also been shown to increase the likelihood of falls. Understanding the specific risks associated with falls in the TBI population plays a major role in minimizing and preventing falls, thus allowing the individual to maintain meaningful activity in everyday life (Clemson, Manor, & Fitzgerald, 2003).

Currently, there is no assessment available that specifically targets fall risk in individuals with a history of TBI. Other groups, such as individuals with a history of stroke and the elderly, may exhibit functional limitations commonly shared in individuals with TBI. Research shows that fall risks in these groups can be accurately evaluated through the use of multi-factorial or functional assessments (Scott, Votova, Scanlan, & Close, 2007). Multi-factorial tools evaluate a variety of domains and therefore provide an overall picture of fall risk. Examining multiple domains for fall risk is important in the TBI population because they often exhibit dysfunctions across multiple systems. Therefore, it can be presumed that a multi-factorial assessment that targets the multiple risk factors specific to TBI can accurately predict fall risk in this population.

Background and Need, Purpose of Study

CareMeridian is a congregate care facility that provides specialized rehabilitation for a variety of populations, including individuals with TBI. However, the facility's clinicians do not currently have a fall risk assessment to accurately evaluate the fall risk of the residents with TBI. Specifically, CareMeridian is in need of a tool to help them identify residents that are still at an elevated risk of fall and thus may not be appropriate for discharge. Without an objective fall risk assessment that targets the TBI population, predicting falls in this population is solely based on the individual clinician's clinical reasoning. Additionally, unpredictable falls among individuals with TBI may further dampen improvement toward meaningful occupational performance. Therefore, the development of an evidence-based multi-factorial fall risk evaluation is significant not only due to the lack of such a tool, but also because CareMeridian's clinicians have a need for an evaluation tool to aid in identifying fall risk in individuals with TBI.

The purpose of this project was to develop an evidence-based evaluation tool, named Fall Risk Evaluation Tool for Traumatic Brain Injury (FRETT), which determines the risk of fall for an individual with TBI. The target population of this project was CareMeridian Fairfax's clinicians, who were projected to implement the assessment on individuals with TBI at the facility. As a result of the development of a multi-factorial evidence-based fall risk evaluation tool, clinicians will have a an objective tool that is specific to the diagnosis of TBI. In addition, FRETT helps clinicians to identify if residents are appropriate for discharge or if further services are needed. Another goal of this project was to add to the knowledge base of the occupational therapy profession by addressing a specific need in rehabilitation.

Definitions

- *Clinician(s)* refers to the rehabilitation staff that will be involved in implementing FRETT at the facility. The staff includes nursing staff, occupational therapists, and physical therapists.
- *Cognition* is a term used to describe "the processes of thinking, reasoning, problem solving, information processing, and memory", according to the National Institute of Neurological disorders and Stroke (2002). *(What disabilities can result from a TBI, para. 2)*
- *Sensitivity* refers to the assessment's ability to identify a problem when a problem truly exists (true positive), or in this case, identification of those at risk for fall (Medley et al., 2006).

- *Specificity* refers to the assessment's ability to identify that there is no problem when no problem truly exists (true negative), or in this case, identification of those not at risk for fall (Medley et al., 2006).
- *Traumatic Brain Injury* is a form of acquired brain injury that occurs when a sudden trauma causes damage to the brain. TBI can result when the head suddenly and violently hits an object, or when an object pierces the skull and enters the brain tissue (National Institute of Neurological Disorders and Stroke, 2002).
- *Occupations* are "dynamic and action-oriented activities that support full participation in life" (Pendleton & Schultz-Krohn, 2006)

Literature Review

Traumatic brain injury (TBI) is a significant public health problem in the United States, with approximately 1.7 million people sustaining a TBI annually (Faul et al., 2010). A TBI can cause significant impairment, which can range in severity depending on the location and extent of the injury as well as age and health of the individual at time of injury. According to the National Institute of Neurological Disorders and Stroke (2002), some common impairments associated with a TBI include, "problems with cognition [thinking, memory, and reasoning], sensory processing [sight, hearing, touch, taste, and smell], communication [expression and understanding], and behavior or mental health [depression, anxiety, personality changes, aggression, acting out, and social inappropriateness]" (What disabilities can result from a TBI section, para. 1).

Consequences of Falls in the TBI Population

According to Bruckner and Herge (as cited in Wilgoss, Yohannes, & Mitchel, 2010), falls are a serious health concern because they can lead to mortality, increased incidence of injury, heightened fear of falls, reduced physical activity, institutionalization, and higher health care costs. In 2009, statistics showed that unintentional falls were the leading cause of nonfatal injury in the United States for all ages, resulting in a total of 8,765,597 falls. Among individuals ages 25 to 64 alone, there were 3,296,677 nonfatal injury related falls reported (CDC Wisquars, 2011). Moreover, falls have major economic consequences resulting in medical costs totaling $14,069,670,000 in 2005 with an additional $20,745,366,000 in work lost costs (CDC, 2011).

In addition to having a major economic impact, falls are a common cause of injury and mortality. Tinneti (as cited in Alexander, Rivara, & Wolf, 1992) indicated that 20% to 30% of people who fall suffered moderate to severe injuries such as lacerations, hip fractures, or head traumas. According to Dellinger and Stevens (2006), fractures are the most frequent type of injury from falls accounting for about one-third of all nonfatal injuries. Fractures are also the most expensive injury from falls comprising 61% of costs. Furthermore, research performed by Tinetti and Oleske (as cited in Härlein et al., 2009) showed that the risk of sustaining a fracture because of falls has tripled or quadrupled for older individuals with cognitive impairment. Superficial injuries and contusions were the second most frequent type of injury from falls (Dellinger & Stevens, 2006).

Falls may also result in more serious consequences such as brain injury. In the United States, falls are the leading cause of TBI, accounting for over 35% of all

incidences (Faul et al., 2010). The numbers are higher for certain age groups, with falls causing half of the TBIs among children ages 0 to 14 years old and 61% of all TBIs among adults aged 65 years and older (Faul et al., 2010). Additionally, falls are one of the main causes of spinal cord injury, resulting in 27.1% of spinal cord injury occurrences (Tewarie, Hurtado, Bartles, Grotenhuis, & Oudega, 2010). Individuals with TBI may be more susceptible to further brain damage because of a second fall. Subsequently, with an increased risk of falling, individuals with TBI have an increased chance of further sustaining serious injury.

In addition to superficial injuries, fractures, head injuries, and spinal cord injuries, falls can also lead to psychosocial consequences such as fear of falling (Gill, Taylor, & Pengelly, 2005; Harding & Gardner, 2009; Jorstad et al., 2005; Lachman et al., 1998; Li, Fisher, Harmer, McAuley, & Wilson, 2003; McGrath, 2006; Mitchell & Jones, 1996). In a descriptive study, McGrath (2006) looked at fear behavior in 105 adults with acquired brain injury at a regional inpatient neurological rehabilitation unit. Observers (physical and occupational therapists) rated participants on the degree to which fear interfered with therapy. Eighty-two of the participants who had the cognitive ability also gave self-ratings of fear. According to the results, fear behavior was identified in 38% of the participants in the physical therapy setting and 33% in the occupational therapy setting. Participants' ratings of fear were even higher with 64% of participants reporting fear, and 40% reporting fear that was high enough to cause significant distress. The observers and participants also described the specific factors that caused the fear. Twenty-one of the 32 descriptions regarding fear-provoking activities, as provided by the observers, referred to activities that involved risk of falling including transferring, walking, standing, and

therapy. Of the 29 descriptions provided by the participants, 11 of them referred to activities that involved risk of falling. These findings suggested that fear of falling was a significant phenomenon in individuals who sustained a brain injury (McGrath, 2006).

Fear of falling is a serious concern because it can result in self-induced restrictions in activity, and could further lead to muscle and lower-extremity strength depletion. Not only does decreased conditioning lead to an increased risk of fall, but many researchers recognize that these factors can also cause the individual to withdraw and become isolated, resulting in a significant reduction in quality of life. Functional decline may also necessitate institutionalization for the individual and therefore increased health care expenditure. (Gill et al., 2005; Harding & Gardner, 2009; Jorstad et al., 2001; Lachman et al., 1998; Li et al., 2003; Mitchell & Jones, 1996). An explorative qualitative study conducted by Kong and colleagues (2002) looked at the psychosocial consequences of falling in a group of 20 older Chinese patients who had recently experienced a fall. Based on semi-structured interviews, their findings showed that 18 out of the 20 participants revealed feelings of powerlessness. Half of the participants expressed feelings of fear, which included fear of becoming immobilized, being unable to self-care, and inability to perform usual social activities (Kong, Lee, Mackenzie, & Lee, 2002). Psychological consequences from falling can have a significant impact on one's quality of life. Therefore, it is important to recognize and address these potential consequences from falls.

Fall Risk Factors in the TBI Population

Risk factors are major contributors to falls in the TBI population (Medley et al., 2006). Cognitive impairments, visual impairments, and balance disorders have all shown

to compromise gait patterns, postural stability, and executive functioning in individuals with TBI (Cantin et al., 2007). When these systems are not working properly, there is an increased likelihood of a fall (Cantin et al., 2007). Researchers have identified additional risk factors for falls in the elderly that also coincide with the TBI population, including the use of psychotropic medication and environmental influences. It is important to note that falls among the TBI population involves multiple factors. Understanding risks associated with falls plays a major role in minimizing falls, preventing falls, and maintaining meaningful activity (Clemson, Manor, & Fitzgerald, 2003).

Cognitive deficits as a fall risk factor. Cognitive impairments are among the most common symptoms of dysfunction in individuals with TBI. Cognitive deficits often cause the individual with TBI to become easily confused or distracted and have difficulties with concentration and attention. Individuals with TBI may also have issues with executive functioning, which includes planning, reasoning, organizing, problem solving and making judgments (National Institute of Neurological Disorders and Stroke, 2002).

Researchers have recognized cognitive impairment as a risk factor for falls (Vassallo et al., 2008). In a prospective observational study, Vassallo and colleagues (2008) looked at the occurrence of falls in 329 cognitively impaired and 496 non-cognitively impaired individuals who were admitted for rehabilitation in a community hospital in the United Kingdom. The results indicated that the cognitively impaired group had a higher percentage of fallers, recurrent fallers, and fall-related injury compared to the non-cognitively impaired group. Suzuki and colleagues (2005) found similar results in a study that examined 246 individuals with stroke in a rehabilitation

ward. The researchers found that individuals with a lower cognitive score (below 29) on the Functional Independence Measure were more prone to falls (Suzuki et al., 2005) Additionally, a study by Tinneti and colleagues (as cited in Härlein, Dassen, Halfens, & Heinze, 2009) found that individuals with cognitive impairment had a two-to-threefold risk of falling compared to non-cognitively impaired persons, resulting in a 60% to 80% annual incidence of falls.

Walking is a dual task that requires cognitive abilities, including increased attention and executive function, as well as physical abilities (Sheridan & Hausdorff, 2007). It is commonly accepted that individuals with TBI suffer from deficits in divided attention, or the inability to attend to more than one task at a time. Cantin and researchers (2007) looked at whether or not decreased attention is a predictor for specific behaviors during the common tasks of mobility. Ten individuals with moderate to severe TBI were recruited for this study and were compared to ten subjects without TBI. Seven neurological tests including The Trail Making Test and Stroop Test were conducted to measure cognition. Locomotor patterns and reading times were also conducted during obstructed and unobstructed walking tests. Results indicated that subjects with TBI walked slower and required higher clearance margins. The Trail Making B test and the Stroop test for dual task and reading times showed a significant decrease in divided attention in subjects with TBI compared to subjects without TBI. These results indicated that decreased divided attention and behavior might negatively affect locomotion in complex environments (Cantin et al., 2007). Thus, dual-task context of walking puts individuals with TBI at a higher risk for a fall.

Sheridan, Solomont, Kowall, and Hausdorff (2003) conducted a cross-sectional study that looked at the effects of cognitive function and divided attention on gait variables in 28 veteran patients with Alzheimer's disease (AD). Though different in etiologies, individuals with AD and TBI have commonalities in impairment of executive function and decreased attention. Results from this study showed that patients with AD had reduced gait speed and increased gait variability with dual-task activity. Sheridan et al. (2003) concluded that divided attention impaired the ability to coordinate stride in gait timing. Therefore, individuals susceptible to impairment in divided attention may be at a higher risk for falls (Sheridan et al., 2003).

Pettersson, Olsson, and Wahland (2007) investigated the influence of dual task attention during walking. The Talking While Walking dual-task test was used on 12 community-dwelling subjects with cognitive impairment and 25 subjects without cognitive impairment. A significant decline in performance on the dual-task and walking speed measurements were noted in subjects with cognitive impairment. Pettersson et al. (2007) concluded that dual attention was a key factor in walking speed and simultaneous tasks involved in gait. Thus, attention deficits resulting in decreased dual task performance may be a contributing factor to falls in individuals with cognitive impairment including individuals with TBI.

Balance disorders as a fall risk factor. Balance disorders in the TBI population are widely reported in the literature. Balance provides a means for stability, orienting the body with regard to gravity during movement. Proper balance and postural control allows an individual to efficiently execute functional activity. A decrease in balance and postural control can potentially limit aspects of social and personal participation as well

as increase the likelihood of a fall (Campbell & Parry, 2005). An observational study conducted by Campbell and Parry (2005) researched balance disorders as a multi-system dysfunction. The study targeted components of postural control, as researched by Nashner (as cited in Campbell & Parry, 2005) and applied it to the TBI population. These components included range of motion, motor processes, sensory processes, and adaptive processes. Deficits across six domains were observed in 27 subjects with TBI including biomechanical, motor performance, peripheral sensation, vision, vestibular, and integration and adaptability. Results showed that 20 subjects had deficits in all six domains (Campbell & Parry, 2005). With its multi-system nature, this study supports balance disorders as a fall risk in the TBI population.

Dizziness, a common symptom of TBI, occurs when multiple systems contributing to balance fail to function together (Maskell, Chiarelli, & Isles, 2006). A TBI often results in vestibular system damage to the vestibular nerve pathways, the brainstem pathways, or the motor pathways. These damages have a direct connection to the symptoms of dizziness and balance impairment. Eighty percent of the TBI population reported dizziness as early as a few days after the injury (Maskell et al., 2006). Maskell et al. (2006) performed a literature review looking at the functional limitations caused by dizziness in the general population. Results indicated balance difficulties, falls, physical limitations, and a decreased quality of life as outcomes of dizziness. It can be presumed that these results are also prevalent in individuals with TBI, though no research has been conducted on this topic as of late (Maskell et al., 2006).

Visual disorders as a fall risk factor. Visual disorders secondary to TBI are common and impose significant hardships on daily living activities and everyday

functioning (Hellerstein, Freed, & Maples, 1995). Often, the visual system is damaged in more than one way due to its distribution complexity in the central nervous system. As a result, damage to the visual system from a TBI can cause more than one deficit in vision. The most common visual impairments in TBI include visual contrast acuity, depth perception, and visual field loss (Hellerstein et al., 1995). These impairments may lead to or even cause falls in the TBI population.

A prospective cohort study was conducted on 156 community dwelling older adults to obtain information on the deficits in vision that may lead to or cause falls (Lord & Dayhew, 2001). The visual tests focused on visual acuity, contrast sensitivity, depth perception, and stereoacuity. Visual acuity was measured using a letter chart, contrast sensitivity was measured using the Melbourne Edge Test, depth perception was measured using the Howard-Dohlman depth perception apparatus, and stereoacuity was measured using the Frisbee Stereotest. Of the 156 subjects who participated in the study, 64 reported falling one or more times. Results indicated that the participants who experienced multiple falls also had significantly worse scores on each vision test as compared to subjects who did not fall. Researchers further identified that among the participants experiencing multiple falls, depth perception and contrast visual acuity were the strongest risk factors associated with falls. This study concluded that impaired vision, specifically depth perception and contrast visual acuity, were associated with an increased risk for falls (Lord & Dayhew, 2001).

Additionally, research done by Freeman, Munoz, Rubin, and West (2007) looked at data provided by over 2300 individuals who participated in the Salisbury Eye Evaluation (SEE) Project. Falls among these individuals were assessed over a 20-month

period using a monthly calendar that was analyzed each month by the SEE clinic. The data provided by the participants of the SEE was analyzed using a binomial regression analysis. Results indicated that within each year, lower visual field scores on the SEE were associated with fall. Specifically, peripheral field impairment was shown to have a higher ratio of falls. Freeman et al. (2007) concluded that visual field loss increased the risk for falls by 95%. Researchers emphasized the importance of visual field deficits in the risk of falls and decreased mobility (Freeman et al., 2007).

Use of psychotropic medications as a fall risk factor. Pharmacological intervention is common in individuals with TBI. With multiple systems being affected in TBI, polypharmacy, the use of multiple medications for one individual, is common. Psychotropic medication is used frequently to address the multitude of neuropsychological consequences of TBI. Common psychological disorders include depression, mood disorders, anxiety disorders, behavioral disorders, and psychosis (Rao & Lyketsos, 2000). The most common medications to manage these disorders include dopaminergic agents, selective serotonin reuptake inhibitors, typical and atypical anti-psychotics, and anticonvulsants. Side effects of these drugs include dizziness, hallucinations, orthostatic hypotension, blurred vision, and confusion. Thus, these side effects may increase the risk for falls by decreasing functional status of the individual (Rao & Lyketsos, 2000). Additionally, a meta-analysis was conducted in 2007 on the impact of specific medication classes on falls in the elderly (Woolcott et al., 2009). The odd ratio measured the association between the medication and the risk for fall. Over 12,000 articles were reviewed and 22 met the inclusion criteria. Nine drug classes were reviewed including antihypertensive agents, diuretics, beta-blockers, sedatives and

hypnotics, neuroleptics and antipsychotics, antidepressants, benzodiazepines, narcotics, and nonsteroidal anti-inflammatory drugs. The corresponding odd ratios are 1.24, 1.07, 1.01, 1.47, 1.59, 1.68, 1.57, .96, 1.21, respectively. These ratios present high statistical evidence for the elevated risk for falls when using sedatives and hypnotics, neuroleptics and antipsychotics, antidepressants, benzodiazepines, and nonsteriodal anti-inflammatory drugs (Woolcott et al., 2009).

Although there has not been specific research done on psychotropic medications and the fall risk among TBI patients, research has been done on the elderly population. It can be presumed that these specific medications have the same side effects in the TBI population as they do in the elderly population (Rao & Lyketsos, 2000). Within the family of psychotropic medications, antidepressants have a stronger association with falls (Cumming, 2008). A major side effect of most of the antidepressant medications is sedation. Sedation leads to psychomotor retardation, which in turn leads to higher fall risk. Specifically, selective serotonin reuptake inhibitors have a stronger correlation to falls than tricyclic antidepressants. A meta-analysis by Cumming (2008) reviewed 37 studies researching the effect of psychotropic medications on falls. Nearly every study demonstrated a relationship between individuals taking antidepressants and falls (Cumming, 2008).

Individuals with TBI commonly take anticonvulsant agents for symptoms including behavior dyscontrol, mania, seizure disorder, and impulsivity (Lee, Lyketsos, & Rao, 2003; Reifkohl, Bieber, Burlingame, & Lowenthal, 2003). A prospective cohort study carried out by Ensrud et al. (2002) looked at the effect of anticonvulsants on over 8,100 elderly women who participated in the fourth examination of the Study of

Osteoporotic Fractures. The use of central nervous system medications as well as the incidence of falls over a one-year period were reported. Results indicated an increased risk for falls in women taking anticonvulsant medications and those taking antidepressant medication. Thus, it was concluded that individuals taking medications affecting the central nervous system are at an increased risk for falls (Ensrud et al., 2002).

Environmental factors for falling. Research has shown that people with TBI have reported lighting, noise, and crowds as environmental factors affecting mobility (Cantin et al., 2007). Symptoms of impulsivity and risk-taking behaviors, as seen in the TBI population, may have a negative interaction with the environment, consequently leading to falls (Lee et al., 2003). Clemson, Manor, and Fitzgerald (2003) performed qualitative research on environmental and behavioral perspectives surrounding falls in 15 community dwelling older adults. Results found that the ten common risk-taking behaviors among fallers were not attending to the route ahead, lack of familiarity, pace, mobility behaviors, eyesight problems, physical disabilities, environmental influences, decreased confidence, overexertion, and unnoticed environmental hazards.

Some of the factors seen in the Clemson et al. (2003) study do relate specifically to the TBI population including eyesight problems such as visual dysfunction and unnoticed hazards. Maneuvering in an environment with uneven surfaces may be difficult for an individual with depth perception problems. Furthermore, individuals with attention problems and decreased dual-task functioning may not notice environmental hazards, and are therefore at an increased risk for falling. While not all of these ten common risk factors associate with the TBI population, it is important to note that these

results substantiate evidence that behavior and environment interact together to contribute to falls (Clemson et al., 2003).

Fall Risk Assessments

The assessment tools included in this literature review were chosen with consideration given to the needs of CareMeridian, the risk factors for falls in the TBI population, time and the material requirements, and the research available in the peer-reviewed journals. Two types of fall risk assessments are included: multi-factorial and functional assessments. Multi-factorial assessments quickly assess a wide variety of factors; whereas, functional assessments have a narrower focus and evaluate specific physiological domains (Scott et al., 2007). Assessments that evaluate balance, gait, cognition, and vision were chosen because they address specific fall risk factors in the TBI population.

An important factor to consider when using any assessment tool is its sensitivity and specificity. High scores in both categories are ideal; however, high scores do not necessarily mean an assessment is superior to others. The consequences of false positive and false negative results need to be considered. Considering the consequences of falls, a low sensitivity relative to high specificity may be acceptable in order to ensure identification of individuals at risk for falls. The specificity and sensitivity of each of the following assessments are provided, where appropriate.

Multi-factorial assessments. The Morse Fall Scale (MFS) and Heindrich II Fall Risk Model (HFRM) are nursing assessments that are widely used in a variety of acute and long-term care settings. They both can be completed in about two minutes with little specialized training. Both assessments examine multiple variables associated with falls

in admitted hospital patients (e.g. history of falls, mental status, dizziness, medication use). Each assessment assigns scores that are weighted differently. For the MFS, total scores are categorized into three categories: low (< 25), medium (25-50), or high (> 51) risk of falling (National Center for Patient Safety, 2009). For the HFRM, a total score of five or above indicates a person is at a high fall risk (Hendrich, Bender, & Nyhuis, 2003). For the MFS, various studies have placed its specificity between 72% and 83% and its sensitivity between 29% and 83% for predicting fall risk in older adults (Ang et al., 2007.) A study conducted in an acute care facility on elderly adults by Hendrich et al. (2003) found the sensitivity of the HFRM to be 74.9% and specificity to be 73.9%.

Falls are caused by complex interactions between multiple risk factors. An advantage of multi-factorial assessments is that they provide clinicians the ability to assess a wide spectrum of variables in order to determine fall risk. Because multiple factors have the ability to increase a individual's risk of fall, multi-factorial assessments have an advantage over functional assessments that only assess one component. Consequently, multi-factorial assessments provide clinicians a more comprehensive assessment of fall risks to assist in the clinical decision making process.

Balance and gait assessments. The Berg Balance Scale (BBS) and Dynamic Gait Index (DGI) are assessments designed to measure balance in elderly adults through functional movements (Jonsdottir & Catteneo, 2007; Medley et al., 2006). They consist of multiple static and dynamic tasks that are scored with point systems. A lower score indicates an increased fall risk. They each take 15-20 minutes to administer and there are equipment and space requirements. A study conducted by Medley, Thompson, and French (2006) found the BBS to have a sensitivity and specificity of 85% for predicting

fall risk in community dwelling individuals with brain injury. The study was limited by only including individuals functioning at level V or greater on the Level of Cognitive Functioning Scale (LCFS). Newstead, Hinman, and Tomberlin (2005) found the test-retest reliability of the BBS to be excellent in individuals with brain injury functioning at LCFS level VI or more. A prospective study by Feld, Rabadi, Blau, and Jordan (2001) studied the relationship of BBS scores with functional independence measure scores on 40 brain injury patients at admission and discharge from a rehabilitation hospital. Their results suggested that the BBS, when used with other assessments, may be useful in predicting functional outcomes. Additionally, there were three patients that fell during the study, and each had low BBS scores at the time of admission.

Although the DGI was designed for use with older adults, research indicated that it might be reliable for use with people that have vestibular dysfunction or a history of stroke (Jonsdottir & Catteneo, 2007). Medley et al. (2006) conducted a study involving 26 individuals with brain injury functioning at LCFS level VI or more living in a community setting. The participants were interviewed to determine if they had fallen in the last six months and were classified into faller and non-faller categories. Each participant was assessed using the BBS and DGI. Logistic regression analysis suggested that the DGI was a more accurate predictor of falls for this population than the BBS in this study.

The Timed Up and Go (TUG) is a functional assessment of lower extremity function, mobility, and fall risk. It was designed to assess fall risk in the elderly population. Subjects are asked to stand up from a chair, walk 3 m, turn around, and walk back and sit down. Scoring for the test is based on the amount of time it takes to

complete it. An alternate dual task version, the TUG cognitive, incorporates attention and cognition into the test by requiring the subject to count backward while walking. There is also a TUG manual version that requires the participant to carry a cup of water during the test, which provides a functional component.

An advantage of the TUG test over other balance assessments is that it requires participants to actually walk, rather than perform static or dynamic tasks. Additionally, it has standardized times for dual task conditions. However, research found that TUG dual task conditions were no more accurate in predicting fall risk than the standard test (Shumway-Cook, Brauer, & Woollcott, 2000). It should be noted that no participants with known neurological deficits were included in the study. Overall, all versions of the TUG were shown to have a predictive value of 87% for assessing fall risk in older adults in the study (Shumway-Cook et al., 2000).

Research indicates that performance on the TUG may be a more reliable indicator of executive functioning ability than other commonly used balance tests. Herman, Giladi, and Hausdorff (2010) studied the relationship between cognitive function and performance on the TUG, BBS, and DGI in 265 healthy older adults. Cognitive function was assessed using the mini-mental status exam, digit span, and verbal fluency tests. TUG was found to be mildly positively correlated with the executive function tests; whereas, the BBS and DGI were not. Although the correlation was small in this healthy group, these findings may be significant in relation to populations with deficits in cognitive functioning such as TBI.

Cognitive assessments. Deficits in executive functioning and divided attention, as seen in individuals with TBI, may increase fall risk (Cantin et al., 2007; Sheridan et

al., 2003). Verghese et al. (2002) tested the validity of using divided attention tasks to predict falls in the elderly using a walking while talking task (WWT). Participants walked 40 feet while reciting the letters of the alphabet aloud. In a more complex version, participants recited alternate letters of the alphabet while walking the same distance. Both WWT test results were compared to the Tinetti Balance and Mobility Scale, and a non-standardized timed gait test. The WWT simple was able to predict 55% of fallers over the next year, while the WWT complex predicted 71%. The Tinetti was able to identify 36% of fallers and the timed gait identified 42% of fallers (Verghese et al., 2002).

Some tests of cognitive ability may be more reliable predictors of the severity of brain injury than others. This is important because a more severe injury is likely to lead to greater impairments in cognitive functioning than a milder injury. Demery, Larson, Dixit, Bauer, and Perlstein (2010) studied how patients with mild, moderate, and severe TBI performed on a variety of commonly used executive function tests. Tests included the Wisconsin Card Sorting Test, Paced Auditory Serial Addition Test, Stroop Interference Test, Digit Span Test, Trail Making Test A and B, and Digit Symbol test. The performance of the patients with TBI on each test was compared to a control group with patients without a TBI. In between-group comparisons, the only test that was able to differentiate between the control and mild TBI group was Trail Making Test B. However, when compared to the control group, scores that were 1.5 standard deviations below the mean on the Digit Span Backward were most predictive of a mild TBI. In the moderate and severe TBI groups, the Digit Span Backward and Trail Marking Test B were shown to have the best predictive value when compared to the control group.

Vision assessments. Research suggests that three components of vision may contribute to fall risk in the TBI population: visual field loss, depth perception, and visual contrast sensitivity (Hellerstein et al., 1995). According to Warren (2011), visual field loss is assessed through a process called perimetry. It can be simple, by means of confrontation testing, or complex using specialized software and materials. All forms of testing require an individual to focus on a fixed target while a second target is presented in the visual field. Confrontation testing has been studied extensively in the field of neurology with mixed results (Kerr, Chew, Eady, Gamble, & Danesh-Meyer, 2010). It is shown to have limited sensitivity when compared to specialized perimetry equipment. However, confrontation testing is commonly used in neurological settings as a practical method for assessing visual field loss when automated perimetry equipment is unavailable. Additionally, the confrontation testing becomes more accurate when assessing subjects with more pronounced deficits (Kerr et al., 2010).

According to Phipps (2006), depth perception can be effectively assessed in a functional manner. Plates, cups, silverware, or other common items may be placed on a countertop or stool. The client is then asked to identify what object is closer or further away than the rest. Depth perception can also be assessed by asking the individual to judge distances between objects in the environment.

Assessing visual contrast acuity involves evaluating both high and low contrast acuity (Warren, 1998). High contrast acuity is commonly tested with a Snellen eye chart or with a card with bold typeface on it. Low contrast acuity, also referred to as contrast sensitivity function (CSF), is the ability to detect the borders of objects as they fade into a background. According to Warren (1998), the visual environment consists mostly of low

contrasting items, such as curbs or steps, rather than high contrasting items. Therefore, CSF may contribute more to the ability to adapt to one's environment. There are a variety of charts available individually or as part of the assessment batteries that assess for CSF.

Statement of Purpose

The purpose of this project was to develop an evidence-based and multi-factorial fall risk evaluation tool for individuals with TBI. This project will contribute to the knowledge base of the occupational therapy profession by developing an evaluation tool that is evidence-based. Abreu and Chang (2002) stated that evidence-based practice is the integration of clinical reasoning and clinical research. Thus, best practices within the occupational therapy profession involve the use of appropriate, current, and relevant researches that can be integrated into clinical practice. Additionally, evidence-based practice involves using interventions and assessment tools that have evidence to support their effectiveness in measuring specific characteristics. The development of an evaluation tool that appropriately measures the fall risks for individuals with TBI provides a means for occupational therapy professionals to ensure best clinical practice within the context of intervention with the TBI population.

Theoretical Framework

The theoretical framework guiding the development of this project is the Person-Environment-Occupation (PEO) model. This model, developed by Mary Law and associates in 1996, is used in occupational therapy to describe how the interactions between the person, their environment, and their occupations affect performances. This model states that these three factors form a transactional relationship that constantly

changes over time. According to Law and Dunbar (2007), “when these components fit closely together, occupational performance is optimized” (p. 31). Therefore, the goal of therapy is to optimize the fit between these three components.

According to Law et al. (1996) the PEO model assumes that people are dynamic beings that change over time in response to constant interactions with their environments. The model allows for the evaluation of client factors and performance skills such as visual perception, balance, gait, and cognitive abilities. An individual’s unique characteristics and life experiences determine how he or she interacts with the environment, which in turn influences the occupational performances. Some characteristics, such as strength and range of motion, have the capacity to be changed via interventions. Others, such as age or past experiences, cannot be changed but still must be taken into account during the therapy process.

Specific to this project, the person element represents individuals with TBI. Emphasis is placed on the unique set of skills and abilities, such as balance and cognition, which an individual with TBI brings forth. As a result of TBI, there may be a disruption in the individual’s unique set of skills and abilities. TBI can be thought of as a disruption in the individual’s performance skills. The disruption puts an individual at an increased risk for a fall, which further leads to a decline in engagement with meaningful occupations. A fall risk evaluation tool will help to understand how the individual’s specific performance in occupations, such as functional mobility, is being affected.

In the PEO model, environment is the context in which individuals engage in occupations. Specifically, Law et al. (1996) defines the environment as “those contexts and situations that occur outside the individual and elicit responses from them” (p. 16). It

is described broadly to include cultural, social, psychological, organizational, and physical components (Law & Dunbar, 2007). The environment has the potential to be either enabling or constraining, but it is considered to be more adaptable than the person (Law et al., 1996). In assessing fall risks in individuals with TBI, importance is placed on how behaviors and responses to environmental stimuli may elicit an increased risk for falling. For example, assessing dual-task function within the scope of the fall risk assessment will help to understand the individual's ability to attend to their environment. If the individual has decreased attention to their environment, this creates a safety hazard and increases the likelihood of falls.

Occupations are purposeful tasks and activities that a person chooses to engage in over a lifetime. They are guided by intrinsic desires for self-maintenance, expression, and fulfillment within the context of roles and environments (Law et al., 1996). Occupations may change over time and can vary greatly in complexity. Assessing fall risk in individuals with TBI will help to determine if they can safely meet the demands of their desired occupational activities.

Within the PEO model, occupational performance is the result of the preceding components interacting together (Law & Dunbar, 2007). When these components overlap and fit together, function and performance is enhanced. If there is a poor fit in one or more areas, dysfunction is likely to occur. The strength of the PEO model is that it allows multiple perspectives from which to observe influences on occupational performance (Law & Dunbar, 2007). From the person viewpoint, client factors and performance skills can be assessed and improved upon through therapy. From an environmental perspective, the physical or social settings, once identified, can be

modified or changed to enable function. Finally, occupations themselves can be graded or adapted to fit the person's factors.

Each component of the fall risk evaluation tool involves testing factors that may have decreased an individual's performance in meaningful occupations within a context. Together, these components will help the clinicians understand the areas in which there is a less optimal fit. Once this less optimal fit is determined, these individuals can start the process of recovery toward optimal function and performance. Thus, the fall risk evaluation tool can enhance and augment the optimal fit on the person, their environment, and their occupations.

Methodology

Project Design

FRETT is comprised of seven individual tests that each specifically evaluate the fall risk factors associated with individuals with TBI. Portions of the evaluation tool are from currently published assessments that include TUG Cognitive, Trail Making Test Part B, and Hamilton-Veale Contrast Sensitivity Test. FRETT also includes functional tests that were developed using the developers' clinical reasoning to assess the client's depth perception and visual field. The client's history of falls in the past 30 days since sustaining a TBI and use of medications that elevate fall risk are components of the evaluation of fall risk as well.

A scoring sheet (see Appendix A) was created to record the results of the assessment and obtain an overall measure of fall risk. A manual (see appendix B) was also developed with detailed instruction on how to accurately score the assessment. For each assessment the manual includes a description of what the test measures, a list of

materials needed to perform the test, and the estimated length of time to complete the test. The manual provides setup instructions for the administrator and instructions to the client, which are italicized and in red. The developers also compiled a short video to demonstrate how to implement FRETT and provide a visual image of the tool for their in-service presentations.

Target Population and Agency Description

CareMeridian is a congregate care facility that provides specialized sub-acute and rehabilitation care for individuals with life-altering injuries and medically complex illnesses (CareMeridian, 2010). With 26 facilities located throughout California, Arizona, and Nevada, CareMeridian provides services to over 500 clients. The Fairfax location, where this project was implemented, has a maximum occupancy of 12 residents. Residents of CareMeridian include individuals with TBI, spinal cord injuries, neuromuscular disorders, and other medically complex issues. The average resident age is 42 years old, however, services are available for all ages. The average length of stay for residents at CareMeridian is 40 to 60 days (CareMeridian, 2010).

CareMeridian offers individualized care plans in a non-institutional-like environment (CareMeridian, 2010). The multi-disciplinary team of professionals offers personalized attention and collaboration to develop individualized plans, ensuring each resident has the best opportunity to improve function and quality of life. The health care team includes attending physicians, directors of nursing and case managers, nurses, certified nursing assistants, physical therapists, occupational therapists, speech and language pathologists, registered dietitians, respiratory therapists, social workers, neuropsychologists, and activities directors (CareMeridian, 2010).

The target clinicians/practitioners for this project include the occupational therapists, physical therapists, and nurses at the CareMeridian facility located in Fairfax, California. The evaluation tool was provided to the rehabilitation staff to evaluate the fall risks of individuals with TBI who reside at CareMeridian.

Project Development

The Regional Vice President of CareMeridian, Dr. Mohammad Khalifa, requested the help of the project developers in the development of an evidence-based multifactorial fall risk evaluation tool. After accepting the request, the developers visited the Fairfax CareMeridian facility on September 20, 2011 in order to observe the facility and meet with Dr. Khalifa. At this time, the developers conducted an informal interview with Dr. Khalifa to develop an understanding of his intentions for the assessment. Dr. Khalifa gave the project developers written and verbal consent to implement our thesis project at CareMeridian of Fairfax.

From the information provided to us by Dr. Khalifa, as well as knowledge of risk factors for falls for individuals with TBI, the project developers created a multi-factorial fall risk evaluation tool based on the latest evidence available. FRETT focuses on the following seven areas: History of falls in the last 30 days since sustaining a TBI, the medications the client is taking, and the client's balance, which is assessed through the TUG Cognitive. The client's cognition is assessed through the Trail Making Test Part B and visual field is tested through confrontation testing. Depth perception is tested through the Functional Test of Depth Perception, and the client's contrast sensitivity is tested using The Hamilton-Veale Contrast Sensitivity Test. A manual was developed for the clinicians at CareMeridian comprised of the previous seven tests with detailed

instructions on how to administer FRETT. The project developers also created a short film on how to administer FRETT.

A scoring sheet was developed to illustrate fall risk. The development of the scoring for each test was based on the evidence of fall risk factors for individuals with TBI as well as the project developers' clinical reasoning. Since there is not an appropriate fall-risk model for TBI at this time, the project developers applied the current evidence-based geriatric model and modified it for the TBI population. Using the "Risk Factor and Odd Ratio of Falls" from the American Geriatrics Society, British Geriatrics Society, and American Academy of Orthopaedic Surgeons Panel on Falls Prevention (2001), the project developers converted the odd ratios to percentages, and rounded to the nearest 5%. The project developers then took these percentages and converted them into proportioned number scores. A number score was assigned to each assessment item in FRETT based on the developer's clinical reasoning and evidence of fall risk factors. A total score for FRETT can be obtained by adding up the scores for each individual assessment. The total score places the individual into one of three fall risk categories: low, medium, or high. The total score categories were developed using current evidence and the project developers' clinical reasoning as well.

Project Implementation

An in-service meeting with the clinicians was arranged with Dr. Khalifa for March 31, 2012. The meeting took place at the Fairfax CareMeridian facility from 1:00 pm to 1:45 pm. Participants included the occupational therapist, physical therapist, speech therapist, and nursing staff of the facility. Learning objectives for the forty-five minute in-service meeting included the following: the clinicians will be familiarized with

the specific fall risk factors in the TBI population; the clinicians will have an understanding for the need of an evaluation tool to objectively measure fall risk in individuals with high functioning TBI; the clinicians will understand the purpose of such an evaluation tool; the clinicians will have a gross understanding of how to administer and score FRETT. The in-service included a detailed description of how to administer, score, and interpret FRETT. The FRETT assessment forms and a manual were handed out for reference during the presentation, and also left with the clinicians. A feedback survey was used to obtain feedback and recommendations from clinicians in order to further develop FRETT.

There were a few challenges to the in-service. The first was not having a projector screen available for the PowerPoint presentation and the video portions of the in-service. We had to present by just speaking to the clinicians without visuals for the clinicians to reference to. Also, because the meeting was held during business hours, the facility had a difficult time rounding up clinicians to attend to the presentation. As a group, we received positive feedback about FRETT, as well as constructive feedback on how to improve FRETT.

Changes to our original implementation plan include presenting FRETT to two additional facilities, Kentfield Rehabilitation and Specialty Hospital in Kentfield, California, and California Pacific Medical Center (CPMC) Davies Campus in San Francisco, California. The in-service presentations took place on April 3rd, 2012 and April 6th, 2012, respectively. Both of these presentations followed the same format as the CareMeridian in-service presentation. However, we were able to use a PowerPoint for these presentations and play our video for the clinicians.

We received constructive and positive feedback from the Kentfield clinicians, so much as one of the physical therapists offered to administer FRETT with a high level functioning TBI patient on her caseload. The CPMC clinicians did not have any feedback to offer for FRETT. Specific feedback for all the in-service presentations will be discussed in the project evaluation section.

Project Evaluation

A feedback survey (see Appendix C) was given to the clinicians immediately following the in-service presentations in order to provide feedback on the assessment and the manual. The survey assessed the clinicians' evaluation of the presentations and the evaluation tool, including the clarity of the presentations, feasibility to administer FRETT, and applicability in the TBI population. The survey also assessed whether the clinicians would consider using FRETT at their facility and any additional comments or recommendations.

Overall, based on the survey results and feedback from the clinicians, the in-service presentations and FRETT received positive reviews. The results showed that eleven of the twenty-three clinicians rated the presentations as somewhat clear, with the remaining twelve clinicians rating the material presented on FRETT as very clear. Concerning the feasibility to administer FRETT in their current clinical practices, eight of the clinicians rated FRETT as somewhat feasible and seven as very feasible. Three clinicians rated FRETT as somewhat unfeasible, one neutral, and one clinician rated FRETT as both somewhat unfeasible and neutral. Therefore, over 50% of the clinicians rated FRETT as somewhat feasible or very feasible.

When asked if this assessment would be applicable in evaluating fall risk for the TBI population, twenty of the clinicians marked yes, two clinicians stated they were not sure, and one clinician marked no. These results indicated that 87% of the clinicians surveyed felt that FRETT would be applicable in evaluating fall risk in individuals with TBI. In describing why or why not the clinicians felt the assessment would be applicable, five clinicians stated it would be most applicable for higher-level functioning clients and three suggested to add a judgment component to the tool. Overall, there was a general consensus that FRETT would be applicable for client's who are functioning at a higher level, since clinical reasoning alone may not be adequate to determine the appropriateness for discharge.

Other pertinent responses stated that having a standardized assessment (such as FRETT) would be an appropriate clinical tool in identifying problem areas/risk factors associated with falls. Another clinician expressed that FRETT would help ascertain if a patient was able to live independently or if they needed supervision. Another clinician stated that with some modification to FRETT, she could see the value in using it. Alternatively, the clinician who suggested that FRETT would not be applicable also proposed that FRETT needed to address both poor judgment and vestibular components.

When evaluating whether the clinicians would consider using FRETT at their facility, 83% of the clinicians responded yes. Some of the comments as to why FRETT would be considered to be used at their facility included, "It would be a great resource for our facility," "It seems easy to administer, pretty quick and doesn't require specific tools," "A way to show patients progress, and useful for a portion of population for justifying continued therapy and discharge location."

In general, the presentation evaluations demonstrated that FRETT does have potential for application, specifically for the population of higher-level functioning clients. Based on clinician feedback, two alterations were made to the FRETT project. Special modifications for clients who have expressive aphasia were developed for applicable tests within FRETT. Additionally, we suggest FRETT be used with clients that are considered to be high functioning. No standard definition of high functioning exists for the TBI population, so criteria was created using the developer's clinical reasoning. For the purpose of using FRETT, high functioning clients are defined by the following characteristics: ambulatory at a minimum of supervisory assistance with or without an assistive device; not globally confused; and functioning at a cognitive level of at least VI on the Rancho Los Amigos Scale.

Ethical and Legal Considerations

Given that no direct contact with clients occurred, ethical issues such as informed consent and vulnerable populations do not apply to this project. However, the entire set of ethical principles as described in *The Occupational Therapy Code of Ethics and Standards* was used to guide the development of the evaluation tool. The ethical principles of beneficence, and autonomy and confidentiality were central in the decision-making process.

For occupational therapists, beneficence is demonstrating concern for the safety and the well being for the recipients of services (AOTA, 2010). The project developers strived to ensure that only appropriate and current evidence were used in the decision-making process of creating FRETT. Every effort was made to include criteria and assessment components that are supported by evidences and within the scope of

occupational therapy practice. The project coordinators also exercised careful judgment to ensure that the potential harm for residents would be minimized with the use of the FRETT.

In the profession of occupational therapy, the principle of autonomy and confidentially dictates that practitioners will provide services according to clients' desires (AOTA, 2010). Informed consent was obtained via the site selection form as required by Dominican University of California standards. An interview with Dr. Mohammed Khalifa, Regional Vice President of CareMeridian, was conducted to determine the facility's desired outcomes at the beginning of the project. Collaborative dialogues were maintained between the project developers and CareMerdian staff via direct communication, and through the thesis advisor on an as needed basis. An instructional session was conducted to ensure that participants understood how to correctly administer FRETT, and its benefits and risks in administration.

Another ethical consideration of this project was the inclusion of proper references and materials as part of the FRETT. Credit was given in the references and manual as appropriate.

Discussion, Summary, and Recommendations

The goal of this project was to develop an evidence-based multi-factorial evaluation tool that can accurately predict fall risk in the TBI population. After an initial meeting with the staff of CareMeridian to determine their needs, we reviewed the literature to identify available evidence for the development of FRETT. Our initial intention was to create an occupation-based assessment. However, we were unable to locate any research during the development of this project that we felt would support an

occupation-focused fall risk assessment. Additionally, we found little research that examined fall risk in the TBI population. The research that was obtained focuses primarily on assessments that were developed to assess fall risk and factors leading to falls in the elderly population. We utilized this information, in conjunction with clinical reasoning as applicable, to create an evaluation tool that targets specific risk factors for falling in the TBI population. The result is an evidence-based evaluation tool, made up of multiple assessment components, that is named FRETT.

During the creation of our project, we learned that there was a significant lack of information that directly addressed fall risk in the TBI population. We also discovered there were some main issues that were overlooked in the development of FRETT. During all three presentations, it was brought to our attention that many individuals with TBI may have expressive aphasia. In retrospect, this seemed obvious; this detail may have been overlooked because we, the developers, had limited clinical experience to draw upon. Adjustments were made in the final version of FRETT to include modifications for tests requiring verbalization from the client. Additionally, clinicians suggested that FRETT contain a section that evaluates judgment. At this time, we feel that a judgment component would be best incorporated through clinical observations of the client by a clinician. These observations are to be incorporated in addition to FRETT scores when making a final decision regarding a client's fall risk.

The project underwent some changes from the original plan. The major change involved presenting at three facilities instead of just CareMeridian. Also, additional materials were developed, including the making of a video to demonstrate how to administer FRETT. Furthermore, modifications were added to the FRETT manual based

on the clinicians' feedback, such as adding components to accommodate for expressive aphasia.

It is difficult at this time to ascertain how FRETT benefitted the three facilities where an in-service was presented, although feedback was generally positive. Surveys from all of the sites indicated that FRETT could be a valuable tool with high functioning individuals with TBI. However, only Kentfield Rehabilitation and Specialty Hospital indicated that they had clients appropriate for its use. The other two sites indicated that FRETT would most likely not be an effective tool for evaluating their client populations. Reflecting on the presentation process, we feel we did not make the point clear that FRETT was likely to be more applicable with the higher functioning individuals, especially those being considered for discharge. We suggest any future research projects utilizing FRETT explicitly indicate this early in the implementation process.

Reflection on the presentation process also brought up a surprising realization of the varying thoughts and feelings among the clinicians towards evidence-based practice. Presenting at three different facilities illustrated the difference in opinions with regards to the need and utilization for evidence-based practice. At one facility, there was an overwhelming hesitation toward evidence-based practice. Moving forward, FRETT will have to overcome the resistance to evidence-based practice in our current clinical atmosphere. The aim of FRETT is contribute to the occupational therapy profession's centennial vision in utilizing evidence to solidify the profession's future, as well as other disciplines. The value of both evidence and clinical expertise is what makes FRETT unique and fundamentally usable in our profession.

This project solidifies implications for occupational therapy practice. First and foremost, FRETT addresses a void in the literature with regards to the TBI population. Prior to the development of FRETT, no assessment existed that specifically evaluated fall risk in this population. Although a variety of fall risk functional assessments are currently available, they are generally designed for use with the elderly population or too limited in scope and may not accurately evaluate the multiple factors of fall risk in the TBI population. Additionally, there is no current fall risk assessment that is geared toward higher-level functioning individuals with TBI. We have determined that the fall risk in this subpopulation may have been overlooked, especially in a non-controlled environment such as a home. Thus, the use of FRETT on this subpopulation of TBI is important in order to justify further remediation and prevent further injury.

Limitations to this project include the lack of research on the internal and external validity of FRETT. Without testing the validity of FRETT, there is no way to tell if the developed evaluation tool is effective in predicting fall risk in individuals with TBI and accurately measuring if individuals are not at an increased risk for falling. This gives further implication for a research study to assess the validity of FRETT, specifically its specificity and sensitivity, in order determine its application in measuring fall risk in individuals with TBI. We suggest a future thesis group research FRETT's use on high functioning individuals with TBI, in hopes to receive adequate data about its validity in measuring fall risk in this population.

Conclusion

Individuals with TBI are at an increased risk for falling; thus, affecting optimal functions in their occupational performance. Currently, there is a lack of an evidence-

based multi-factorial fall risk evaluation tool to aid in measuring the fall risk for individuals with TBI. Additionally, CareMeridian did not have an appropriate tool to measure the potential fall risk for individuals with TBI to determine appropriateness for discharge. The development of FRETT will ensure that individuals with TBI are being assessed for fall risk. By developing FRETT, the project developers aimed to add to the scope of occupational therapy and related disciplines evidence-based practice knowledge by ensuring the assessment is based on the latest evidence available.

This project presents an important direction in regards to occupational therapy's role in addressing fall risk for individuals with TBI. It also helps to aid in our occupational therapy mission, as well as other disciplines involved with the TBI rehabilitation, for best clinical practice with support from latest evidence. However, further research validity and reliability of FRETT will be needed in order to ensure its applicability in predicting fall risk in individuals with TBI.

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APPENDIX A

FRETT

Fall Risk Evaluation Tool for Traumatic Brain Injury

Client Name:
Date:

1. Has client fallen during the past 30 days since onset of TBI?
   ☐No (score as 0) .... ______
   ☐Yes (score as 10) .... ______

---

2. Is client taking any fall risk medications?
   ☐No (score as 0) .... ______
   ☐Yes (score as 15) .... ______

---

3. Balance & Gait
   ☐ < 15 sec *(<14.5) (score as 0) .... ______
   a. TUG cog/*(man) time ______
   ☐ ≥15 sec *(≥14.5) (score as 25) .... ______
   b. Walking aid used ____________________

---

4. Cognition
   ☐ < 180 sec (score as 0) .... ______
   a. TMT B time ______
   ☐ ≥ 180 sec (score as 25) .... ______

---

5. Vision
   WNL
   a. Visual Field
   ☐Yes (score as 0) .... ______
   ☐No (score as 5) .... ______

   b. Depth Perception
   ☐Yes (score as 0) .... ______
   ☐No (score as 10) .... ______

   c. Contrast sensitivity
   ☐Yes (score as 0) .... ______
   ☐No (score as 10) .... ______

   R eye open: Level ____
   L eye open: Level ____
   Both eyes open: Level ____
   *Level ≤ 8 in 1 eye is not WNL – mark "No"
   *Level ≤ 12 in both eyes is not WNL – mark "No"

Low Risk = 0-25 **Mod Risk =** 30-45 **High Risk =** 50 or higher

TOTAL SCORE: ________

APPENDIX B

FRETT

Fall Risk Evaluation Tool for Traumatic Brain Injury

Heidi Mertle, OTS
Kiley Richter, OTS
Louis Scirica, OTS

Dominican University of California, Department of Occupational Therapy

Table of Contents

***Disclaimer*:** *FRETT is an evaluation tool that can be used to determine fall risk in individuals with high functioning TBI. FRETT was developed using evidence-based research. The developers' clinical reasoning was also utilized in order to determine the risk factors of falls that were deemed most significant to assess based on the literature findings. The risk factors included in the evaluation tool have all been shown in the literature to increase an individual's risk for falling. It is advised that FRETT is not used as a single tool to determine an individual's risk for falling, but as a collaborative tool along with the clinician's clinical reasoning.*

Special Considerations

Portions of FRETT require that the client verbalize a response to an assessment. Because sustaining a TBI often encompasses speech difficulties such as expressive aphasia, the following assessments include a brief section on ways to accommodate for speech difficulties:

- **TUG Cognitive (pg. 7-9)**
- **Gross Test of Peripheral Visual Fields (pg. 13-14)**
- **Functional Depth Perception Test (pg. 15-16)**
- **The Hamilton-Veale Contrast Sensitivity Test (pg. 17-19)**

* ***Denotes assessments that have accommodations for speech difficulties***

Additionally, it is recommended that FRETT be used with clients that are considered high functioning. High functioning clients are defined by the following characteristics:

- **Ambulatory at a minimum of supervision assistance, with or without an assistive device**
- **Not globally confused**
- **Functioning at a cognitive level of at least VI on the Rancho Los Amigos Scale.**

Fall History

Fall history can be obtained in a few different ways:

- Medical history or transfer summary in the client's chart
- Information from a family member and/or caregiver
- Nursing notes
- Incident reports, if the chart and/or facility has this

A fall history is important for the administrator to be aware of in terms of the client's safety and current level of function.

Scoring:

- Mark **"Yes"** on FRETT if client has fallen during the last 30 days since onset of TBI. Score as 10.
- Mark **"No"** on FRETT if client has not fallen during the last 30 days since onset of TBI. Score as 0.
- If client has fallen during the last 30 days, but before sustaining TBI injury, mark **"No."** Score as 0.

Fall Risk Medications in TBI

This chart is a ***general*** informational guide to the medications that could be considered a fall risk in clients with TBI. When consulting with client about the current medications he/she is taking, consider this chart. If you do not see a medication on this chart or are unsure of a particular medication's side effects, it is recommended to research the medication. When a client is taking fall risk medications, close monitoring during functional activities is advised.

Classification	Common Names	Type
Psychotropic		
• Dopaminergic agents	• Amantidine • Bromocriptine • Levodpa	Cognitive deficits
• Selective serotonin reuptake inhibitors	• Fluoxetine • Sertaline • Paroxetine • Fluvoxamine • Citalopram	Anti-depressant
• Tricylcic agents	• Desipramine • Amytriptyline	Anti-depressant
• Typical anti-psychotics	• Haloperidol • Fluphenazine	Psychosis
• Atypical anti-psychotics	• Clozapine • Risperdone • Olanzapine • Quetiapine • Ziprasidone • Aripiprazole	Psychosis
Anticonvulsants	• Sodium Valprotate • Neurontin • Topirimate • Carbamazepine	

General fall risk side effects from these medications include:

- Dizziness
- Hallucinations
- Orthostatic hypotension
- Blurred vision
- Confusion
- Sedation

Scoring:

- Mark **"Yes"** on FRETT if client is taking any fall risk medications. Score as 15.
- Mark **"No"** on FRETT if client is not taking fall risk medications. Score as 0.

TBI Medication Chart. (n.d.) In *Trauamtic brain injury: The journey home online*. Retreived from http://www.traumaticbraininjuryatoz.org/Moderate-to-Severe-TBI/Treament-Stages-of-Moderate-to-Severe-TBI/TBI-Medication-Chart.aspx.

Rao, V., & Lyketsos, C. (2000). Neuropsychiatric sequelae of traumatic brain injury. *Psychosomatics, 41*(2), 95-103. doi:10.1176/appi.psy.41.2.95

* Timed Up and Go "TUG" Cognitive

What test measures:

- The time (in seconds) it takes an individual to stand up from a standard arm chair and walk a measured distance while counting backwards from a randomly selected number between 20 and 100.
- Measures dual-task performance with a focus on cognition while maintaining dynamic balance in walking, transferring, and making turns.

Materials needed:

- Arm chair (seat height ~18 in, arm height ~26.5 in)
- Timer (stop watch measuring seconds)
- Measuring tape to measure 10 feet
- Tape to mark 10 feet
- Walking aids, if applicable

Time to complete test:

- Varied; less than 5 minutes.

Instructions for Administrator:

- **See page 7 for diagram of setup**
- Procedure to assess: sit → stand from arm chair, walk 10 feet, turn around, walk back 10 feet to the chair, sit down ***while counting backwards from a randomly selected number between 20 and 100.***
- Details:
  - Make sure client is wearing regular footwear and using customary walking aid during assessment (cane, walker, etc.).
  - No physical assistance is to be given.
  - Client starts with their back against the chair and their arms resting on the armrests.
  - The client is to walk through the test once before being timed in order to become familiar with the test.

Instructions for Client:

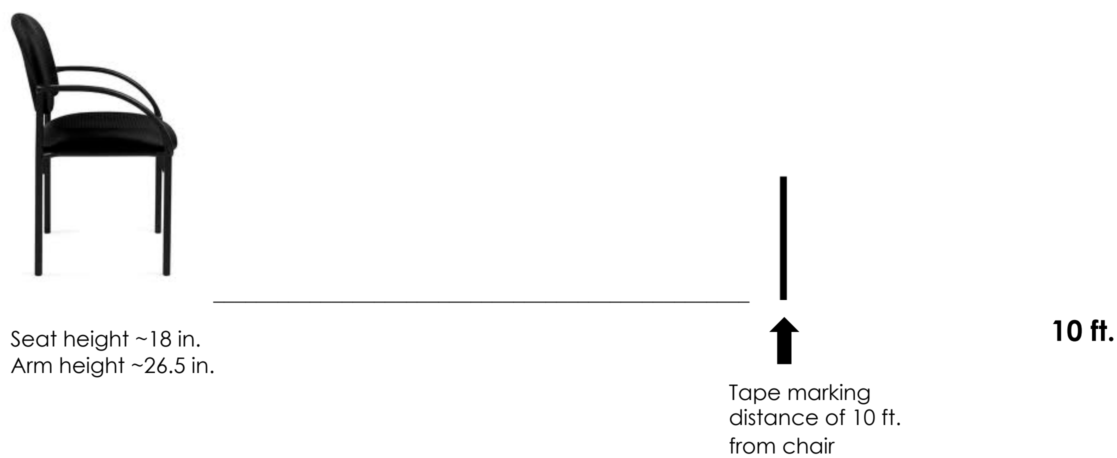
- *"When I say 'go' I want you to stand up and walk to the line, turn, and then walk back to the chair and sit down again.* ***While walking, please count backwards from the number I will give you, starting from number*** ______ (assign a number 20-100). *Walk at your normal pace."*
- *"Go."*

Scoring:

- Time for 'Up and Go' test _________sec.
- Walking aid used?
  - Type of aid: ____________________

- Mark the "< 15 sec" box on FRETT if client's time is less than 15 seconds. Score as 0.
- Mark the "≥ 15 sec" box on FRETT if client's time is greater than15 seconds. Score as 25.

TUG Cognitive Setup



*** Speech Considerations:**

- If client is having a hard time verbalizing the counting of numbers, substitute the **TUG Manual**.
- The directions are primarily the same, except the administrator will instruct the client to hold a glass filled with water, walk 10 feet, turn around, and walk back to the chair and sit down.
- **Scoring**:
  - Time for 'Up and Go' test _________sec.
  - Walking aid used?
  - Type of aid: ____________________

  - Mark the " $<$ 14.5 sec " box on FRETT if client's time is less than 14.5 seconds. Score as 0.
  - Mark the " $\geq$ 14.5 sec " box on FRETT if client's time is greater than 14.5 seconds. Score as 25.

Podsiadlo D, Richardson S. The timed "up and go": a test of basic functional mobility for frail elderly persons. *JAGS* 1991; 39: 142-148.

Trail Making Test Part B

What test measures:

- This assessment measures cognitive function.
- More specifically, this assessment looks at visual processing, visuospatial skills, visual search, divided attention, working memory, and psychomotor coordination.

Materials needed:

- Pen or pencil
- Timer (stop watch measuring seconds)
- Sample Trail Making Test Part B (see handout)
- Trail Making Test Part B (see handout)
- Table, desk, or any smooth surface to write on
- Chair to sit in while taking test

Time to complete test:

- Varied; less than 5 minutes.

Instructions for Administrator:

- Trail Making Test B consists of 25 circles distributed over a sheet of paper. The circles include both numbers (1 – 13) and letters (A – L).
- Instruct the client to draw lines to connect the circles in an ascending pattern, by alternating between the numbers and letters (i.e., 1 – A, then 2 – B, then 3 - C, etc.)
- The client should be instructed to connect the circles as quickly as possible, ***without lifting the pen or pencil from the paper***.
- Time the client as he or she connects the "trail." ***If the client makes an error, point it out immediately and have them return the pen or pencil to the place from which he/she began drawing an incorrect line and continue while the clock remains running.***
- Errors affect the patient's score only in that the correction of errors is included in the completion time for the task.
- It is unnecessary to continue the test if the client has not completed the task after five minutes has elapsed.
- If client lifts the pen off the paper, instruct him/her to lower pen back down to the paper at the last correct number/letter and continue.

Instructions for Client:

- *"I am going to give you a test that measures your attention and ability to think. I am going to demonstrate how to complete this test using this sample sheet."* (Demonstrate using Trail Making Part B SAMPLE).
- *"Now I will give you a paper and pencil* (or pen).

- *On the paper are the numbers 1 through 12 and the letters A through L, scattered across the page. Starting with 1, draw a line to A, then to 2, then to B, and so on, alternating back and forth between numbers and letters until you finish with the letter L. I'll time how fast you can do this. Are you ready?"*
- *"Go."*

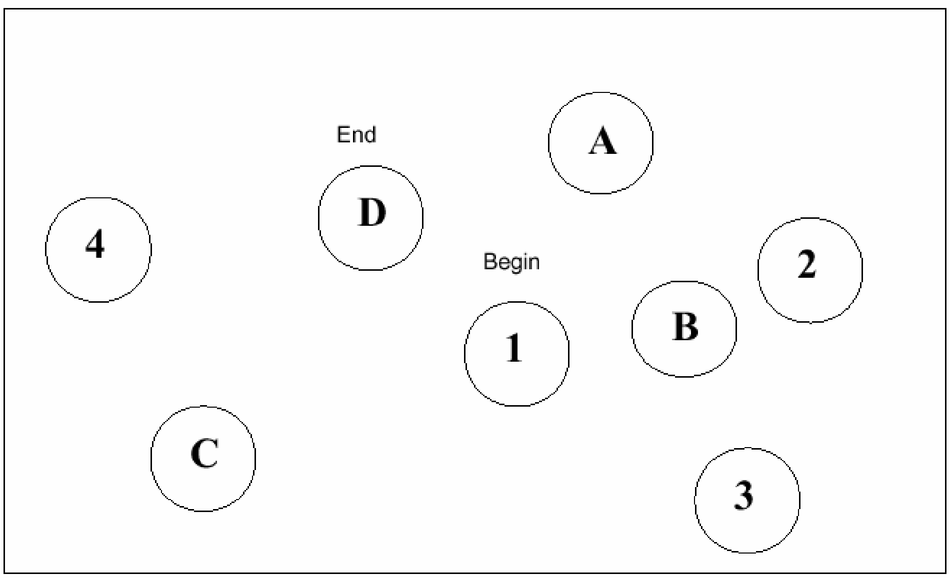
Scoring:

- Results are reported as the number of seconds required to complete the task. Higher scores reveal greater impairment.

- Time to complete test: ________________ seconds.

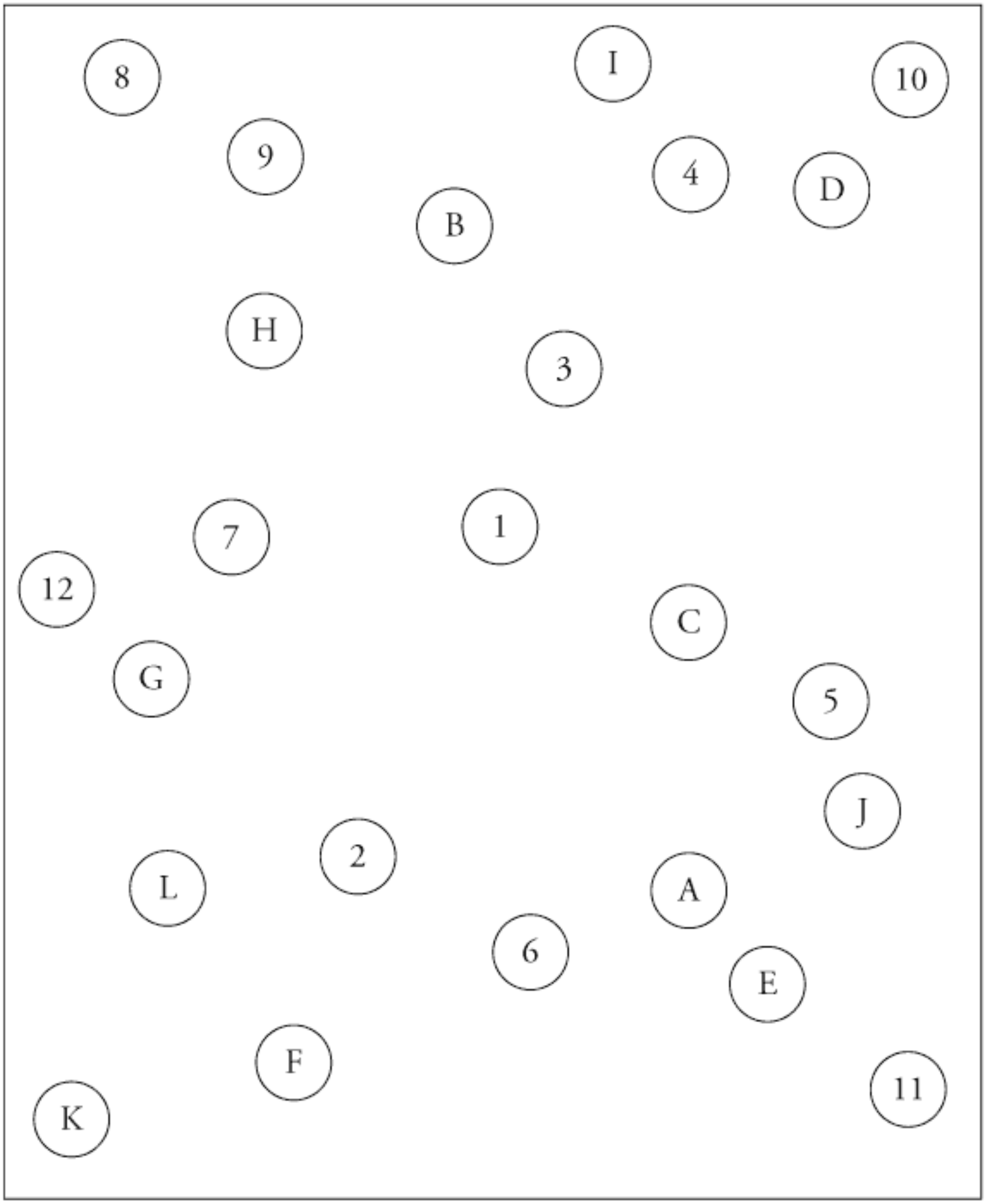
- Mark the " 0 – 180 sec " box on FRETT if client's time is in this range. Score as 0
- Mark the " > 180 sec " box on FRETT if client's time is greater than 180 seconds. Score as 25.

Trail Making Test Part B – *SAMPLE*



Trail Making Test Part B

Patient's Name: ___________________________ Date: __________________



Bowie, C.R. & Harvey, P.D. (2006). Administration and interpretation of the trail making test. *Nature Protocols 1*(5): 2277-2281.

* Gross Test of Peripheral Visual Fields

What test measures:

- Assesses or detects if a gross deficit in the peripheral visual field is present.

Materials needed:

- Popsicle stick with black tape on end
- Stable chair (or wheelchair with brake on)
- One pirate eye patch
    - An eye patch can be purchased at (http://www.eyepatchstore.com/id2.html) or a local drug store.
- Adhesive putty for attachment of target (large black circle) to back of the Hamilton-Veale Contrast Sensitivity Chart

Time to complete test:

- Varied; 1- 5 minutes

Instructions for Administrator:

- Perform test in a well-lit room.
- Have the client sit in a chair and remove eyeglasses if worn.
- The administrator stands (or sits) to the side of, and slightly behind the client. The side that the administrator stands on is the same side as the eye being tested.
    - For example, the administrator stands at the 8 o'clock position relative to the client if the L eye is being tested. For the R eye, administrator stands at the 4 o'clock position relative to the client.
- Instruct the client to occlude one eye with the pirate eye patch.
- Instruct the client to fixate on a target at eye level 40 inches in front of them.
- As the client fixates on the target, the administrator brings the stick from behind the client to the front of the client moving slowly in an arc. (Note: if the stick is moved too fast, the client will not be able to respond quickly enough to obtain an accurate field measurement).
- The client is instructed to indicate as soon as he/she sees the object move into his/her field either by saying "now" or raising a hand.
- The administrator observes the client's eye during the assessment to ensure that the client maintains fixation on the target and does not look for the stick being presented.

The examiner moves the stick forward/up/down in an arc (depending on the field being tested) across the client's visual field using the positions of the clock as a guide. Mix the positions up and perform them randomly to

- prevent the client from predicting the direction of the stick. Do not touch the client or give any cues as to the direction of the stick. The test positions are as follows:
  - 3 o'clock 12 o'clock 9 o'clock 6 o'clock
- Repeat steps for the other eye.

Instructions for Client:

- *"I am going to give you a test that evaluates your peripheral vision. I want you to look at this target in front of you* (point to target). *Can you clearly see the target?"* (Make sure the client confirms they know where the target is).
- *"While you look at the target, I am going to stand behind you and move this stick with the black tape on it from behind towards the front of you."* (Show the client the popsicle stick that you are going to use).
- *"As soon as you see any part of the stick please raise your hand or say 'now'."* (Put the stick close to the middle of the visual field and close to client, make sure client provides appropriate response by raising hand or saying "now")
- *"It is **VERY IMPORTANT** that you keep your eye focused on the target at all times during the test and that you do not try to look for the stick. I will be watching your eye to make sure that you do not move your eye to look for the stick. Are you ready?"*

Scoring:

- The normal visual field for each eye is 60° superior, 75° inferior, 65° nasal, 100° temporal. This method of testing cannot provide an exact degree measurement of the peripheral visual field. It is up to the administrator to determine if the client has a gross deficit in peripheral vision based on their performance during the exam.

- Mark **"Yes" (WNL)** on FRETT is no peripheral vision deficit is detected. Score as 0.
- Mark **"No" (not WNL)** on FRETT if any peripheral vision field deficit is detected. Score as 5.

*** Speech Considerations:**

- If client is having a hard time verbalizing "now", instruct the client to raise their hand when they can first see the popsicle stick enter their visual field.
- **Scoring is the same.**

Warren, M. (1998). *Brain injury visual assessment battery for adults test manual.* Birmingham, AL: visAbilities Rehab Services.

* Functional Depth Perception Test

What test measures:

- This test assesses a client's ability to perceive their surroundings in three dimensions.
- This test is important in determining if clients can safely navigate objects in their environment (e.g. curbs).

Materials needed:

- Stable chairs (or wheelchair with brake on)
- 2 Popsicle sticks, each 6 inches long
    - 1 stick with black tape on top 2 inches of stick
    - 1 stick with silver/grey tape on top 2 inches of stick

Time to complete test:

- Varied, expected time about 1 min or less.

Instructions for Administrator:

- Perform test in a well-lit room.
- Client will wear glasses/contacts, if applicable.
- Have client sit in a chair for the test.
- Administrator sits five feet away from client.
- Administrator holds sticks up side-by-side so the sides of each stick are touching, but not overlapping. Administrator holds the bottom 1 inch of each stick (non-tape end).
    - 4 trials are performed.
    - During each trial, the administrator randomly moves one stick forward or backward about 6 inches, the length of 1 popsicle stick.
    - Client is instructed to close eyes between trials so administrator can position sticks 6 inches apart.
    - Client is asked to open eyes once administrator has sticks spaced 6 inches apart.
    - Client identifies which stick, black or silver/grey, is closest to him or her.
    - All 4 trials must be completed regardless of the number of mistakes being made.

Instructions for Client:

- *"I am going to assess your ability to perceive depth. Can you identify what color tape is on the end of each of the sticks I am holding?"* (Administrator holds sticks up individually and asks client to identify color of tape on ends).

- *"I want you to close your eyes and only open them when I tell you to. When I tell you to open them, I would like you to tell me which color stick I'm holding is closest to you. Please close your eyes now."* (Administrator adjusts distance between the two sticks).
- *"Open your eyes. Which stick is closest to you?"* (Client states his/her answer)
- *"Please close your eyes again."* (Administrator adjusts distance between sticks again) *"Open your eyes. Which stick is closest to you?*
- Repeat for a total of four trials

Scoring:

- Mark **"Yes" (WNL)** on FRETT if client makes correct identification in each trial. Score as 0.
- Mark **"No" (not WNL)** on FRETT if client makes an incorrect identification during any trial. Score as 10.

*** Speech Considerations:**

- If client is having a hard time verbalizing the color corresponding to the popsicle stick closest to them, simply hand them a pair of popsicle sticks that match the administrator's pair (one stick with grey on the end, one stick with black on the end). Instruct the client to raise the color stick that corresponds with the color they feel is closest to them.
- **Scoring is the same.**

* The Hamilton-Veale Contrast Sensitivity Test

What test measures:

- This test measures an individual's contrast sensitivity by varying the contrast of the letters against a white surface. It ultimately measures the peak contrast sensitivity of an individual and gives an idea of the individuals' overall visual acuity in various contrast environments.

Materials needed:

- The Hamilton-Veale contrast sensitivity chart
    - The chart can be purchased from (http://www.contrast-sensitivity-test.com/)
- One pirate eye patch
    - An eye patch can be purchased at (http://www.eyepatchstore.com/id2.html) or local drug store.
- Stable chair (or wheelchair with brake on)
- Adhesive putty, for attachment of chart to the wall

Time to complete test:

- Varied; less than 3 minutes.

Instructions for Administrator:

- The chart has 8 lines, with 4 letters in each line. The 2 letters on the left of each line have a greater contrast than the 2 letters on the right of the same line.
- Test should be performed in a well-lit room.
- Hang the chart on a wall at the eye level, 40 inches in front of the client.
- Sit the client 40 inches away from the chart. (If client is seated, the chair will be stable. Remember to lock the wheelchair if the client is sitting on a wheelchair).
- Instruct the client to occlude the L eye using the pirate eye patch, using the R eye to read chart.
- Instruct client to read the letters across each line, starting from line 1, and reading letters from L to R.
- If needed, the administrator may point to the line that the client is to read from. If the client skips a line, instruct him/her back to the appropriate line and continue testing.
- ***Threshold: the last group of 2 letters (at the same level/line, that are both correctly identified).*** Record level achieved.
- Repeat with the R eye occluded. Record level achieved.
- Repeat with two eyes open. Record level achieved.

Instructions for Client:

- *"I am going to give you a visual test that will evaluate your ability to differentiate between light and dark in each of your eyes. I want you to look at this chart in front of you. Please cover your L eye with the eye patch. Starting at line 1 and reading left to right, please read each letter out loud as you come to it. I will tell you when to stop. Are you ready?"*
- Administer R eye reading. Record score.
- *"Now we will do the same thing, but using your L eye. Please cover your R eye with the eye patch."*
- Administer L eye reading. Record score.
- *"Now we will do the same thing, but using both eyes."*

Scoring

- **Right eye open: Level __________**
- **Left eye open: Level __________**
- **Both eyes open: Level __________**

- Mark **"Yes" (WNL)** on FRETT if client can see Level 13 or above in 1 or both eyes. Score as 0
- Mark **"No" (not WNL)** on FRETT if client cannot see Level 8 or below in 1 eye. Score as 10.
- Mark **"No" (not WNL)** on FRETT if client cannot see Level 12 or below in both eyes. Score as 10.

Those that cannot see to:

Level 4	**Level 5 to 8**	**Level 9 to 12**	**Level 13 to 16**
Severe loss of contrast sensitivity function and/or blindness	Significant loss of contrast sensitivity function	Noticeable loss of contrast sensitivity function	Near normal to normal contrast sensitivity function

* **Speech Considerations:**

- If client is having a hard time verbalizing each letter on the contrast chart, provide client with a chart of the alphabet and instruct them to keep it on their lap (see example of alphabet chart below). Instruct the client to point out the letter on the alphabet chart that corresponds to the letter they see on the contrast chart. ***See below.***
- **Scoring is the same.**
- Warning: the time for this accommodation may take longer than stated under the directions.

A	**B**	**C**	**D**
E	**F**	**G**	**H**
I	**J**	**K**	**L**
M	**N**	**O**	**P**
Q	**R**	**S**	**T**
U	**V**	**W**	**X**
Y	**Z**		

Hamilton Veale, J. (n.d.) The Hamilton Veale contrast sensitivity test. Published instrument. Retrieved from http://www.contrast-sensitivity-test.com/.

FRETT

Fall Risk Evaluation Tool for Traumatic Brain Injury

Client Name:
Date:

1. Has client fallen during the past 30 days since onset of TBI?
   ☐No (score as 0) .... _______
   ☐Yes (score as 10) .... _______

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2. Is client taking any fall risk medications?
   ☐No (score as 0) .... _______
   ☐Yes (score as 15) .... _______

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3. Balance & Gait
   ☐ < 15 sec *(<14.5) (score as 0) .... _______
   ☐ ≥15 sec *(≥14.5) (score as 25) .... _______
   a. TUG cog/*(man) time _____
   b. Walking aid used ____________________

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4. Cognition
   ☐ < 180 sec (score as 0) .... _______
   ☐ ≥ 180 sec (score as 25) .... _______
   a. TMT B time ______

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5. Vision

   WNL

   a. Visual Field
      ☐Yes (score as 0) .... _______
      ☐No (score as 5) .... _______

   b. Depth Perception
      ☐Yes (score as 0) .... _______
      ☐No (score as 10) .... _______

   c. Contrast sensitivity
      ☐Yes (score as 0) .... _______
      ☐No (score as 10) .... _______

   R eye open: Level ____
   L eye open: Level ____
   Both eyes open: Level ____
   *Level ≤ 8 in 1 eye is not WNL – mark "No"
   *Level ≤ 12 in both eyes is not WNL – mark "No"

Low Risk = 0-25 **Mod Risk =** 30-45 **High Risk =** 50 or higher

TOTAL SCORE: ________

APPENDIX C

FRETT Survey

Facility: ____________________________________

1. On the scale below, please rate the *clarity* of the material presented on the Fall Risk Evaluation Tool for individuals with TBI?

1 Very unclear	2 Somewhat unclear	3 Neutral	4 Somewhat clear	5 Very clear

2. What is the *feasibility* to administer FRETT in your current clinical practice?

1 Very unfeasible	2 Somewhat unfeasible	3 Neutral	4 Somewhat feasible	5 Very feasible

3. Based on your experiences with individuals with TBI, do you agree that this assessment would be applicable in evaluating fall risk for this population?

   a.

Yes	No

   b. Why or why not?

4. Would you consider using FRETT at your facility?

   a.

Yes	No

   b. Why or why not?

5. Any additional comments/recommendations: