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Depression Screening and Early Intervention on the Post-Stroke Patient

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Abstract

Statistics in the United States (US) have shown an increase in the prevalence of Cardiovascular Disease (CVD) or risk for developing CVD. Approximately 78 million American adults, 20 years and older, have hypertension, 31.9 million have elevated serum cholesterol levels, and 68.2 million use tobacco products. Within California, San Francisco (SF) was ranked 8th among counties with adult residents that have CVD. It is estimated that approximately 1.02% of these individuals will have a stroke each year and 16.25% will die from stroke. Of those that survive, it is estimated that at least half will develop neurologic deficits, and at least a third will develop post-stroke depression (PSD). The high prevalence of post-stroke depression (PSD) greatly influences stroke survivor mortality, hospital length of stay (LOS), and Quality of Life (QOL) further fueling the projected rise of indirect annual costs associated to the loss of productivity of stroke survivors and ongoing healthcare costs. Despite best practice recommendations and guidelines from health agencies, current stroke care processes of stroke care facilities deviate from these recommendations and lack the inclusion of a post-stroke neuropsychiatric sequelae protocol or screening measure that leaves PSD undetected and untreated. This project aimed to implement the inclusion of a depression screening measure and (pharmacologic and non-pharmacologic) intervention in the current stroke care processes of a 395-licensed bed, urban, general acute care hospital (GACH) located in the downtown Tenderloin area of San Francisco, California. Despite the low volume of stroke patients admitted during the 3-month period, the project was moderately successful on multiple levels. The project produced the intended outcomes of cost-effective staff training and education on the timely administration of PSD screening measures and intended pharmacological interventions. It was able to moderately raise nurses' comfort levels in the administration of BH screening questions and answering questions

related to its use. Nurses reported moderate increase in confidence on the overall clinical utility of PSD screening as part of stroke care processes. The project's success on improving stroke outcomes as it relates to timely screening and intervention of PSD was considered low. However, there appears to be a strong link between good communication, good training, and staff compliance to small tests of change aimed towards improving patient care. Ultimately, depression screening and early intervention on post-stroke patients has the potential to provide cost savings or cost avoidance equal to $29159.95 over a 3-month period.

Keywords: Post-stroke depression, Patient Health Questionnaire, Patient Health Questionnaire-2, Patient Health Questionnaire-9, National Institutes of Health Stroke Scale, cardiovascular disease, neuropsychiatric sequelae, selective serotonin-reuptake inhibitors, cognitive behavior therapy

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Section I: Background Knowledge

Recent statistics of cardiovascular health in the United States (US) show an increase in the prevalence of cardiovascular disease (CVD) or risk for developing CVD. Approximately 78 million American adults, 20 years and older, have hypertension, 31.9 million have elevated serum cholesterol levels (>240 mg/dl), and 68.2 million use tobacco products. For children between the ages of 2 to 19 years old, 23.9 million are considered overweight and obese while 12.7 million are obese (Go et al., 2014), putting them at risk of developing CVD later in life. Approximately 800,000 of these individuals will have a stroke episode each year (Go et al., 2014) and 130,000 will die from stroke (Kochanek, Xu, Murphy, Miniño, & Kung, 2011). Of those that survive a stroke episode, at least half will develop neurologic deficits (Phipps, 1991). Neurologic symptoms are the primary cause of disability among stroke survivors. These long-term residual impairments are debilitating and negatively affect the quality of life (QOL) post-stroke. However, the concurrent development of neuropsychiatric symptoms on post-stroke patients can further complicate post-stroke outcomes. Between 33 to 50 percent of stroke survivors will develop clinically significant depressive symptoms at any stages of recovery (Hackett, Yapa, Parag, & Anderson, 2005; Robinson, Starr, Kubos, & Price, 1983).

Stroke is a life changing and debilitating event, but a combination of stroke and depression can be particularly devastating. The high prevalence of PSD greatly influences stroke survivor mortality, hospital length of stay (LOS), and QOL further fueling the projected rise of indirect annual costs associated to the loss of productivity of stroke survivors and ongoing healthcare costs, from $33.65 billion to $56.54 billion within the next 20 years (Ovbiagele et al., 2013).

Overview of Relevant Theories

Numerous epidemiological, clinical, neuroimaging and neuropathology studies have been conducted in an attempt to explain the definite etiology of PSD. The psychological hypothesis for PSD suggests that social and psychological stressors associated with stroke triggers the depressive episode of stroke survivors (Fang & Cheng, 2007). The psychosocial framework views depression as resulting from the interplay of several domains of variables, including personal and environmental resources, environmental stressors, and the individual's appraisal and coping responses to specific stressful events (Billings & Moo, 1982). Similar to primary depression, it is postulated that severity and frequency (i.e. more than one stroke episode) increase the prevalence of PSD. Phipps (1991) suggested that post-stroke neurologic deficits, permanence of loss of function and independence, and the stress of undergoing rehabilitation predisposes, precipitates, and perpetuates depressive symptoms post-stroke.

The biological hypothesis of PSD is the most predominant among all of the theories that attempt to explain the etiology of the disease. Several researches have utilized the biological framework of stroke as means of correlating the following possible mechanisms to the development of PSD: (a) lesion location, (b) neurotransmitters mechanism, (c) inflammatory cytokines mechanism, and (c) gene polymorphism mechanism (Fang & Cheng, 2007). The site of infarct or location of the lesion suggests an organic biological basis for the difference of emotional reactions and development of mood disturbance post-stroke, with left-sided cortical and sub cortical lesions having a high prevalence for PSD (Rajashekaran, Pai, Thunga, & Unnikrishnan, 2013). The ability of the brain to rewire or reorganize itself after injury is also believed to precipitate behavioral changes and post-stroke neuropsychiatric sequelae. It is also postulated that repair activities within the brain post-stroke can cause PSD through alterations in

the microenvironments of the parenchyma that eventually leads to the abnormal release of neurotransmitters. An increase in glutamate and decrease serotonin and norepinephrine were linked to PSD (Sanchez-Mendoza et al., 2014). The release of multiple inflammatory cytokines by the parenchyma such interleukin (IL) 1β, IL-18, and tumor necrosis factor α, were also associated with PSD (Fang & Cheng, 2007). A repeat length of polymorphism of Serotonin Transporter (SERT) variants of 5-HTTLPR, STin2 VNTR, and rs25531, were all linked to depression-susceptibility in people experiencing emotional trauma including PSD (Kohen et al., 2008).

Neurobiological Etiology

There is currently no definite mechanism that defines the etiology of PSD and it appears to be multifactorial in cause. However, several studies have suggested the strong correlation between the changes in the microenvironment of the brain and the risk for developing PSD. The American Psychiatric Association (2013) classifies PSD as Depressive Disorder Due to a General Medical Condition (i.e. stroke). What makes PSD unique from typical depression is the necessity for the diagnosing clinician to establish that the mood disturbance is etiologically related to the medical condition through a physiological mechanism. Two considerations for detecting PSD take its premise from the biological origin of the condition. Diagnosing clinicians must assess the presence of a temporal association between onset, exacerbation, or remission of the general condition. Onset for PSD can occur 1 day to months post-stroke with depression severity strongly correlated with severity of stroke. The second consideration is the presence of clinical features that are atypical of primary mood disorders. Although age can be considered a risk for PSD with older adults being at higher risk for stroke, other features such as absence of family history cannot be factored in to rule out PSD. Majority of the literatures suggest that

neurochemical changes independent or triggered by lesion location can trigger PSD – with left frontal strokes having the greatest risk compared to right frontal strokes (American Psychiatric Association, 2013).

Onset and Course

The physiological changes of stroke are well documented. Ischemic changes in cell structure begin almost as rapidly as ischemic changes in biochemistry (Gupta, Pansari, & Shetty, 2002). Stroke involves the formation of blood clots that blocks an artery or a break in a blood vessel and prevents oxygenated blood from reaching the brain. Brain damage starts immediately when brain cells start to die due to blood deprivation. It is estimated that 2 million brain cells die every minute of a stroke (Go et al., 2014). After a stroke episode, new brain cells start to form to compensate for the injury and form specialized contacts with other cells. It is postulated that these new connections may not always be functional or communicate properly with neighboring cells and other brain structures. The cascade of changes within the brain structure and its' biochemistry post-stroke are associated to both post-stroke recovery and risk for developing PSD and other neuropsychiatric disorders. The actual onset of PSD remains unclear and varies from patient to patient. It is estimated that between 33 to 50 percent of stroke survivors will develop clinically significant depressive symptoms at any stages of recovery (Hackett, Yapa, Parag, & Anderson, 2005; Robinson, Starr, Kubos, & Price, 1983). Most depressive symptoms manifest during the acute phase post-stroke and become more pronounced during acute rehabilitation, days to weeks after stroke, with some experiencing depressive symptoms years post-stroke. However, some patients show very subtle behavioral changes or may even be asymptomatic during hospitalization and rehabilitation, that results in the under-diagnosis of PSD. (Robinson, et al.,1983).

Stroke Severity Measure

Currently, the National Institutes of Health Stroke Scale (NIHSS) is the most widely used clinical assessment tool to evaluate post-stroke neurologic status. The NIHSS is a 15-item assessment tool that evaluates the consequence of acute infarct on the following: (a) levels of consciousness, (b) language, (c) neglect, (d) visual-field loss, (e) extraocular movement, (f) motor strength, (g) ataxia, (h) dysarthria, and (i) sensory loss (National Institutes of Health, n.d.). The following scores of the NIHSS are interpreted as follows: (a) 0 for no stroke symptoms, (b) 1 to 4 for having minor stroke, (c) 5 to 15 for moderate stroke, (d) 16 to 20 for moderate to severe stroke, and (e) 21 to 42 for severe stroke. The NIHSS is a simple and reliable tool that can be administered by clinicians at the bedside regularly, and has been shown as good predictor of both short and long-term stroke outcomes.

Treatment and Care

Currently, there is no treatment specific to PSD. Historically, the main focus of post-stroke recovery and conventional stroke care were geared towards rehabilitation. Post-stroke rehabilitation takes its premise from the principles of neuroplasticity, the ability of the brain to "rewire" to retrain itself to perform everyday functions through repetition of tasks. However, the changes in the brain after a stroke are much more complex than this. Imbalances in brain chemistry can lead to the development of a concurrent psychiatric condition. Studies have shown that there is a negative correlation between severity of depression and 5HT2 receptor binding in the left temporal cortex in left-sided stroke and low levels of CSF 5H1AA, the principle metabolite of 5HT in PSD (Ramasubbu, Flint, Brown, Awad, & Kennedy, 1999). Randomized trials show that antidepressants, particularly selective serotonin uptake inhibitors (SSRI), are effective in the treatment of PSD (Gupta et al., 2002). Citalopram and fluoxetine have proven

efficacy in the treatment and management of depression among stroke survivors. However, since the etiology of PSD is not limited to the biological model and is considered multifactorial, a multidisciplinary approach and the inclusion of several treatment modalities (e.g. cognitive behavioral therapy (CBT), dialectic behavior therapy (DBT), etc.) other than pharmacologic interventions may increase the chances for depression remission.

Guidelines and Recommendations

As the number of stroke cases each year increases and new research studies regarding post-stroke sequelae are published, guidelines to stroke care continually evolve. Several national and international organizations recommend the inclusion of PSD screening with stroke care. In 2011, the Brain Attack Coalition amended its recommendations for the establishment of Primary Stroke Centers (PSC), to include new elements that may improve the care and outcomes of post-stroke patients (Alberts et al., 2011) such as detection and treatment of co-occurring mood disorders. Additionally, The Joint Commission (TJC) supports the inclusion of depression screening and assessment of cognitive decline and other social implications of stroke during its acute phase (Go et al. 2013). Similar recommendations were made by health agencies outside of the US. In the United Kingdom (UK), the National Clinical Institute for Stroke recommended screening for PSD within the first month post-stroke and review of the patient's mood and behavior (Hart & Morris, 2007).

Local problem

In a study Lund and Pheatt (2001), San Francisco (SF) was ranked 8th among California counties with adult residents that have CVD and at risk for having a stroke. There are several General Acute Care Hospitals (GACH) in SF, at least 5 of which are TJC-certified PSCs, which cater to the healthcare needs of SF residents and that of other neighboring counties (Vega, 2014).

Despite best practice recommendations and guidelines from several national and international health agencies, (with the exception of Comprehensive Stroke Centers) current stroke care processes deviate from these recommendations and lack the inclusion of a post-stroke neuropsychiatric sequelae protocol or screening measure that leaves PSD undetected and untreated. Additionally, because of the decline in reimbursements for BH care, majority of the hospitals can no longer afford to offer such services in an inpatient setting.

Stroke remains one of the most common causes of disability among patients with CVD. Designated PSCs and other health facilities caring for stroke patients must explore the prevalence of post-stroke neuropsychiatric sequelae in the population that they are caring for and should consider adopting measures for screening for PSD and providing appropriate interventions. Hart and Morris (2007) examined the compliance of healthcare professionals in screening for PSD. Of the 145 hospitals with stroke services examined, 88% had local protocols in place for post-stroke psychological assessments. Reported compliance among these hospitals was low, with a rate of only 50%. The researchers found it interesting that despite positive attitudes of staff toward screening, the average intention to screen was low. The following barriers to screening were identified: (a) time pressure, (b) feeling uncomfortable using the available tool(s), and (c) concern than screening may trigger the disease or other depressive symptoms. Additionally, many providers still believe that most cases of PSD resolves without any PSD-specific interventions as post-stroke neurologic deficits improve during the rehabilitation phase.

Intended Improvement Project/Purpose of Change

A proposal of change to meet the needs of individuals at risk for developing PSD was identified by the project manager to implement in hopes of providing early detection and

treatment, for patients admitted in the hospital in an effort to improve stroke outcomes and reduce costs associated with stroke care, prolonged rehabilitation, and long-term disability. Despite being one of the few hospitals in the city that offer inpatient services for psychiatric and behavioral health (BH) disorders, inpatient BH services are only limited to patients actually admitted in the Behavioral Health Unit (BHU) while floor consults are reserved only to medical patients with acute psychiatric symptoms (e.g. danger to self, danger to others, etc.). In collaboration with the project sponsor, organizational leaders, physicians, and staff nurses on stroke care areas, the project manager developed a plan to address this gap by introducing a standardized screening measure and early intervention for PSD in the hospital's current stroke care processes. The project was approved by hospital's regional Institutional Review Board (IRB) and classified as a quality improvement (QI) initiative and do not meet the criteria for human subject's research under state and federal regulations (see Appendix B).

Aim Statement

As members of the stroke care team, the role of nurses and physicians was providing accurate and timely screening for PSD and provide treatment for positive screens. Together with nurse volunteers who served as resource nurses, the project manager conducted a small test of change, screening patients for PSD in each stroke care areas for a 30-day period. High yield areas were identified while low-to-no yield areas were excluded from the project which spanned 3 months. The project manager monitored and reported bimonthly to the nurse managers and project sponsor. The project goal is 90% timely screening for PSD on all admitted stroke patients and to provide appropriate intervention(s) for post-stroke sequelae, therefore reducing post-stroke neurologic deficits as evidenced by improved pre-discharge NIHSS scores and reducing the following: (a) falls, (b) hospital LOS, (c) post-stroke depressive symptoms, and (d) hospital

readmission. Additionally, the project aimed to improve nurses' comfort levels in administering BH screening measures on patients that are typically considered non-psychiatric or psychiatrically well.

Objectives

Nurses working in stroke care areas are responsible for assessing the need for psychiatric and behavioral health intervention(s) of patients, utilizing the recommended screening tools (see Appendices H and I). These nurses have the responsibility of ensuring that PSD screening is administered on all admitted stroke patients. Specific objectives identified as part of the stroke-care nurse included: (a) identify if the patient meets the criteria for PSD screening through review of the most current National Institute of Health Stroke Scale (NIHSS) scores on Facial Palsy and Best Language, (b) timely administration of the depression screening tool(s), on the 3rd day or after 72 hours of hospitalization , (c) concise and timely documentation of the patient's Patient Health Questionnaire (PHQ) score in the organization's electronic health record system (EHR), Cerner, using the Situation-Background-Assessment-Recommendation (SBAR) format, and (d) assure that PSD treatment and/or other BH interventions ordered by the physician are carried out on a timely manner.

Physicians attending to the care of stroke patients had the responsibility of assessing the need for psychiatric and/or BH interventions during hospitalization and on the day of discharge. Specific objectives identified as part of the attending physician's responsibilities included: (a) timely review of the patient's PHQ score(s) and nurses' SBAR entry, (b) order appropriate pharmacologic and/or non-pharmacologic intervention, (c) timely request for BH and/or neuropsychiatric consult if necessary, and (d) timely documentation of explanation and justification for not ordering PSD intervention.

These objectives were discussed with all involved organizational leaders, physicians, and staff, to increase compliance to the project and its realization. The success of the PSD screening project relied on the enthusiastic participation of staff. The project leader frequently surveyed the involved units and engaged staff at least once a week, both during the testing, training, and live phases of the project. Since nursing provides the most direct post-stroke care services, it was essential to also gain the support of the organization's Education Department to ensure the continuity of the project and that competencies for the use and interpretation of the PHQ tools are documented.

Review of the Evidence

Several studies have investigated the effects of depression on the stroke patient and it has been found that PSD significantly impacts patient rehabilitation, function, recovery, and quality of life (Chen, Guo, Zhan, & Patel, 2006). Additionally, PSD is also associated with increased use of healthcare resources (Herrman et al., 2011; Williams et al., 2007). A review of the literature was conducted using Fusion and Google Scholar to further support these claims and to identify additional studies on stroke and PSD published between 1980 to the present. Search terms included stroke, PSD, post-stroke, stroke treatment, stroke rehabilitation, stroke care, and depression screening. The search yielded more than 80 articles. Twenty-five articles were selected based on content and relevance to the project, while 6 were appraised using an evidence table (see Appendix S).

Validity of Screening Measures

Lincoln, Nicholl, and Flannaghan (2003) conducted a cross-sectional study on the validity of questionnaires in screening for PSD, mood and other neuropsychiatric sequelae. Twenty stroke patients were recruited from hospital wards while an additional 123 were

recruited from a randomized control trial of cognitive behavioral therapy (CBT). All 143 participants completed the following questionnaires: (a) Beck Depression Inventory (BDI), (b) Wakefield Depression Inventory (WDI), and (c) General Health Questionnaire-28 (GHQ-28). The authors found that patients who met the DSM's criteria for depression scored significantly higher on questionnaires than those patients who were not depressed, with correlational variances ranging between 23 to 34%. BDI had an 83% sensitivity and a 44% specificity in detecting PSD in relation to the DSM criteria for depression, while WDI had an 86% sensitivity and a 50% specificity, and the GHQ-28 had an 81% sensitivity and a 68% specificity. The findings of the study emphasized the limitations of standardized assessment measures and the variations of prevalence rates among these screening tools on the detection of PSD. The researchers concluded that although PSD screening measures are sensitive to PSD, they have low specificity.

A similar study that aimed to determine the validity of screening measures for detecting PSD was contacted by Turner et al. (2011). The researchers aimed to determine internal consistency among the following screening tools: (a) Patient Health Questionnaire-2 (PHQ-2) and Patient Health Questionnaire-9 (PHQ-9), (b) Hospital Anxiety and Depression Scale (HADS), (c) Beck Depression Inventory-II (BDI-II), (d) Distress Thermometer (DT), and (e) Kessler-10. Seventy-two participants were recruited in the study, aged 25 to 91 years; all were three or more weeks post-stroke. Participants either self-completed each of the screening tools using paper or by a touchscreen computer during one appointment. The researchers concluded that, apart from the DT, all screening measures performed considerably well in accurately detecting PSD and support recommendations on the inclusion of depression screening tools in stroke care.

Stroke-specific Geriatric Depression Scale

Clinicians face the challenge of accurately assessing PSD in a population where the disease is complicated by both aging and disability. The elderly population has the highest incidence of CVD and risk for stroke. Screening measures for depression are often too lengthy, confusing for the elderly, and do not assess for the severity of the disease. Cinamon, Finch, Miller, Higgins, and Mayo (2010) conducted a study on the development of a stroke-specific depression screening measures for geriatric patients. A 17-item stroke-specific Geriatric Depression Scale (SS-GDS) was developed that measured the following PSD symptoms: (a) motor, (b) cognitive disability, (c) emotionalism, and (d) depressive symptoms. Ninety-one stroke patients, aged 71 and older, all one-year post-stroke, were interviewed using the SS-GDS over 3 points and yielded 240 interviews. Of those that screened positive for PSD, the following major symptoms for depression were expressed by the participants: (a) worrying about the past, (b) being in good spirits, and (c) being hopeful about the future. The researchers also noted that PSD symptoms different from typical depression wherein symptoms are more pronounced 3 months after stroke.

The researchers concluded that SS-GDs has a 79% reliability in detecting and quantifying the severity of PSD, and can have important practical applications for the refinement of stroke care processes for the elderly.

Smiley Diagrams

Lee, Tang, Yu, and Cheung (2007) conducted a cross-sectional study on the clinical utility of emoticons in screening for PSD. The purpose of the study was to determine the efficacy of a simple, non-language-based, culturally neutral, non-verbal, and easy to administer screening measure detecting PSD, particularly on elderly patients who suffer multiple functional losses.

The tool consisted of 3 enlarged diagrams: (a) a happy face, (b) a flat face, and (c) a sad/tearing face. Initially, the emoticon tool consisted of 5 diagrams that included a very happy and a very sad face. All 5 diagrams were matched with a 5-point Likert scale. However, older participants during the pilot found it difficult to differentiate between the very happy with happy and very sad with the sad diagrams. The researchers decided to eliminate the smileys with quantifiers. Meeting 5 of the DSM criteria meant that the participant was depressed. Two hundred fifty-three participants, aged 50 and older, all monolingual Chinese, and all 1-month post-stroke, were recruited from two regional hospitals in Hong Kong.

The researchers reported varying rates of sensitivity for each emoticon in detecting PSD: (a) 75.9% for sad, (b) 98% for flat, and (c) 48.3% for happy. Similarly, varying rates of specificity were reported for each emoticon: (a) 77.4% for sad, (b) 18.2% for flat, and (c) 73% for happy. Because there was a strong negative correlation between the flat and happy emoticon, but there was no such correlation between the flat and sad emoticon, the researchers speculate underreporting of the sad emoticon among mildly depressed participants. The researchers concluded that the positive predictive value for PSD of the emoticon to slightly exceeds 50%. The performance of the visual tool appears promising, not as an alternative to other language-based tools but as an adjunct tool for screening PSD in patients with low literacy and limited linguistic capabilities.

Single-item Screening Tool

Screening tools are often lengthy, redundant, and confusing for patients for which the tools are being administered on. With the competing demands in direct patient care areas, clinicians often don’t have the time to properly explain the purpose of the screening measure and go through each items listed at the pace of the patient is comfortable with. Watkins et al. (2007)

conducted a study on the accuracy of a single-item screening tool for detecting PSD. The researchers administered the Yale, a screening tool for PSD that only requires a simple "yes" or "no" answer to one question, on 540 admitted stroke patients. Screening was administered at two points post-stroke: (a) 2 weeks and (b) 3 months. The study found that the Yale had 85% sensitivity and 84% specificity in detecting PSD at 2 weeks post-stroke. After 3 months, the Yale had 95% sensitivity and 89% specificity, with an overall efficiency of 92% in detecting PSD. The researchers also noted that the tool is promising when compared to other multi-item screening measures such as the Geriatric Depression Scale (GDS), Hospital Anxiety and Depression Scale (GHDS), and the General Health Questionnaire (GHQ). The researchers concluded that a single-item tool can satisfactorily detect PSD and recommended the use of the Yale when considering the need for further psychiatric and behavioral health interventions. However, the researchers also cautioned clinicians in using the Yale on stroke patients with moderate to severe cognitive and language deficits, as the tool may produce false results.

Zung Self-Rating Depression Scale

Identification of PSD risk factors is essential to develop specific post-stroke neuropsychiatric interventions and preventative strategies during stroke recovery and rahbilitation. A cross-sectional study was conducted by Bose and Shah (2012) to determine whether depression levels are related to the following: (a) location of stroke, (b) gender, (c) cause of stroke, (d) number of arteries involved, and (e) presence of other medical co-morbidities. Participants in the study were recruited from various hospitals in Mumbai and Navi Mumbai. The researchers administered the Zung Self-Rating Depression Scale (ZSRDS) on 100 stroke patients, all at least two-weeks post-stroke. The ZSRDS is a 20-item depression screening tool that has a 93% predictive value of detecting depression when compared other commonly

used screening measures. The researchers found that severity of depression is higher in right-sided stroke patients. Additionally, the researchers reported that there is no significant relationship for stroke severity on gender, cause of stroke, number of arteries involved, and presence of other medical co-morbidities. The researchers also support the active screening for PSD beyond the acute phase post-stroke and extend out in rehabilitation.

Conceptual/Theoretical Framework

The theoretical framework for this project is based on Betty Neuman's Systems Theory. Neuman's theory postulates that wellness is the condition in which all system parts and subparts are in harmony with the whole system of an individual. The following basic assumptions of Neuman's Systems Theory (Neuman & Fawcett, 2010) were utilized:

- Each patient system is a unique composite of factors and characteristics within a range of responses contained in a basic structure.
- Many known, unknown, and universal stressors exist. Each differ in their potential for upsetting a client's usual stability level.
- Each patient has evolved a normal range of responses to the environment referred to as the normal line of defense. It can be used as a standard by which to measure health deviation.
- The particular inter-relationships of patient variables can, at any point in time, affect the degree to which a client is protected by the flexible line of defense against possible reaction to stressors.
- When the flexible line of defense is incapable of protecting the patient against an environmental stressor, that stressor breaks through the line of defense.

- The client is a dynamic composite of the inter-relationships of the variables, whether in a state of illness or wellness. Wellness is on a continuum of available energy to support the system in a state of stability.
- Each patient has implicit internal resistance factors known as LOR, which function to stabilize and realign the patient to the usual state of wellness.
- Primary prevention is applied in patient assessment and intervention, in identification and reduction of possible or actual risk factors.
- Secondary prevention relates to symptomatology following a reaction to stressors, appropriate ranking of intervention priorities, and treatment to reduce their noxious effects.
- Tertiary prevention relates to adjustive processes taking place as reconstitution begins, and maintenance factors move them back in a cycle toward primary prevention.
- The patient is in dynamic, constant energy exchange with the environment.

Similar to the concepts of the life cycle of project management, Neuman developed a sequential nursing process for problem solving. The 6 steps in Neuman's Systems Model nursing process was also used as the framework project development and implementation: (a) assessment, (b) diagnosis through data collection, (c) goal setting, (d) planning the intervention, (e) implementation of the plan, and (d) evaluation (Neuman & Fawcett, 2010).

Section III: Methods

Ethical Issues

The project manager considered the following ethical principles throughout the course of this project: (a) beneficence and non-maleficence, (b) patient autonomy, and (c) social justice. A project statement of determination was submitted to the USF DNP department and the project site's IRB for review. The project was determined as a QI project and did not meet the criteria for human subjects' research under state and federal regulations.

Byars and Jorge (2015) conducted a study to review the ethical issues and implications for healthcare providers on the detection of PSD. The neuropsychiatric sequelae of stroke may include symptoms (e.g. apathy, anxiety, irritability, and impulsivity, etc.) that overlap with a major depressive episode, mood disorder, post-traumatic stress disorder (PTSD), or even minor depression. Post-stroke neuropsychiatric disorders such as PSD do not occur exclusively as an impaired adjustment reaction to loss of functioning and increased responsiveness of one's mortality. The researchers found that patients with PSD are at risk of committing suicide up to 5 years after a stroke episode and approximately 7% will die of suicide. Healthcare providers involved in the care of stroke patients need to identify and differentiate symptoms of PSD from other neuropsychiatric disorders. The research provided several aspects of ethical dilemma that healthcare providers encounter when caring for post-stroke individuals: (a) beneficence and non-maleficence, (b) patient autonomy, and (c) equity.

Healthcare providers who introduce and administer health screening measures and interventions to patients who have not requested them (nor have prior knowledge of their availability) have the added responsibility of making sure that the benefits outweigh any possible harm. PSD screening is not part of conventional stroke care. Acutely ill patients are already at an emotionally vulnerable state due to numerous variables related to their hospitalization (e.g. possible loss of independence, change in environment, etc.). Additionally, the societal stigma

associated with mental illness further complicates patient engagement. Family members may became defensive or dismissive during the initiation of the screening process and opt for the patient to not be screened for PSD during hospitalization. The increase awareness on the risk of developing or having post-stroke neuropsychiatric disorder, such as PSD, may prove distressful to both patients and family members. Additionally, there is also the possibility that patients may minimize symptoms to avoid being stigmatized or complicating their post-stroke care. Healthcare providers unfamiliar or have limited experience in the use of behavioral health screening measures may fear inducing unwarranted emotional distress to patients and family members, or furthering post-stroke apathy and irritability. However, screening typically has no impact on the patient's risk of developing the disorder that is being screened for (Association of Faculties of Medicine of Canada, n.d.).

The role of the project manager and staff nurses is to introduce PSD screening that emphasize on expected improvement in stroke outcomes and not coerce participation. Explaining the purpose of administering the screening measure in a therapeutic manner assures that informed consent is properly obtained. Rather than overtly campaigning for population results and evidence, emphasizing individual benefits of early screening and intervention for PSD allows for the patient to have realistic expectations on the risk, intervention, and outcomes. Healthcare providers must balance the duty of doing no harm and respecting the patient's choice. To avoid unintentionally dissuading patients, screening nurses are instructed to disclose the following prior to screening: (a) PSD screening is currently only a recommendation and not a mandate for PSCs, and (b) the PSD measure is a pilot project.

Non-native English speakers are less likely to be able to participate in the screening process in the absence of an English-speaking family member or certified language interpreter.

The project site cares for a large percentage of monolingual Chinese and Russians. Because of this disadvantage, non-English speakers are at risk of not being afforded accurate and timely screening and intervention for PSD. Hospitals and other healthcare organizations must make sure that they have resources in place such as certified language interpreters (onsite or via phone) to help in translating the screening questions. Using non-certified staff may lead to mistranslation while using friends and family members may result in the patient under-reporting depressive symptoms.

Setting

The setting for this project is a 395-licensed bed, urban, GACH located in the downtown Tenderloin area of San Francisco, California. The hospital is certified by The Joint Commission (TJC) as a Primary Stroke Center (PSC), and is committed to providing the most up-to-date and evidenced-based stroke care. An average of 10 stroke patients per month are admitted through the Emergency Department (ED), while the hospital's Acute Rehabilitation Unit (ARU) also receives an average of 10 post-stroke patients from other facilities.

Along with conventional stroke care, patients are routinely screened for stroke-related neurologic deficits using the NIHSS (see Appendices I to K). The NIHSS is a 15-item, clinical assessment tool used by trained clinicians to quantify the severity, determine intervention, and predict outcomes of stroke patients. Impairments concerning several aspects of brain functioning such as consciousness, vision, sensation, movement, speech, and language are given a score. A baseline NIHSS score of 21 or more is classified as a severe stroke (National Institute of Neurologic Disorders & Stroke, n.d.). With the exception of the BHU, all nurses in the project setting are "stroke-certified", with training and validated competencies in rendering evidence-based care to stroke patients, including the use of the NIHSS. Stroke severity is assessed on

admission and discharge, in the ED, Medical-Surgical Unit (MSU), and ARU. NIHSS is completed on admission, discharge, and every shift (8 hours) for all stroke patients in the Intensive Care Unit (ICU). NIHSS scores are documented in the hospital's electronic healthcare record (EHR) system, using the Situation-Background-Assessment-Recommendation (SBAR) format.

The progression of inpatient stay is dependent on the severity of stroke. From the ED, a patient may be admitted to the ICU and transferred to the MSU when more stable, or may also be admitted directly from the ED to the MSU. The stroke patient progresses from the MSU to ARU, with an average length-of-stay (LOS) of 10 to 14 days. Post-stroke patients requiring long-term care and rehabilitation are transferred to a Skilled Nursing Facility (SNF) while those with little to no apparent neurologic deficits are discharged home. The ARU also receives an average of 10 post-stroke patients from other facilities with an average LOS of 7 to 14 days.

Planning the Intervention

The inclusion of a depression screening measure in the project site's current stroke care processes required extensive literature review from various online databases necessary to increase the project manager's knowledge on stroke and post-stroke neuropsychiatric sequelae. A strength-weakness-opportunities-threats (SWOT) analysis was conducted to gauge whether project objectives were attainable by identifying favorable and unfavorable internal and external variables (see Appendix M). Based on the reviewed literature, SWOT analysis, and the project's theoretical framework, the project manager had 2 underlying assumptions: (a) at least one-third of admitted stroke patients will screen positive for PSD, and (b) any meaningful change is often met with resistance.

The project manager also developed a Gantt chart (see Appendix E) to create a timeline for project milestones and develop realistic and achievable deadlines for deliverables. This Gantt chart was used to help monitor whether the project was moving as projected. Due to several unforeseen events (e.g. loss of project sponsor, etc.), the timeline was revised and adjusted accordingly to ensure that the project moved forward. Additionally, the sequence project of deliverables was determined by developing a Work Breakdown Structure table (see Appendix D).

Narrative of Responsibilities and Work Breakdown Structure

A formal diagram for the decomposition of the project's deliverables was developed (see Appendix C). Breaking down the project into small manageable components was necessary to identify each component's hierarchy and ensure prioritization of resources. The precursors and mutually exclusive and co-dependent elements of each components were identified by developing a project resource requirements table (see Appendix D). The work breakdown structure is summarized as follows:

- Review PSD literature: guidelines, etiology, and screening measures
- Identify of validated depression screening measure
- Map the current stroke care workflow
- Perform a gap analysis
- Map the proposed PSD screening workflow
- Pre and post-live survey and review results
- Create tool kit
- Train resource nurses
- Identify high volume units

- Pilot in stroke care areas: ED, ICU, MSU, and ARU
- Train stroke care nurses (end-users)
- Print screening tool and assemble resource binder
- Go-live on stroke care units
- Data Mining and project Evaluation
- Present findings to organizational leadership
- Integrate findings into DNP paper
- Submit DNP with revisions and present project to committee

Description of Project Resource Requirements

The project manager identified a designated PSC to serve as the site for project implementation. The project manager contacted the hospital's Nursing Education Director and submitted the following documents required from student interns: (a) criminal background check, (b) health clearance and immunization records, (c) student's resume, and (d) preceptor's (DNP chairperson) resume. Additionally, a project prospectus was submitted for review and cleared by the hospitals' IRB.

This project required a project sponsor to serve as a liaison between the project manager and organizational stakeholders. The project sponsor also served as an advisor/consultant by helping the project manager navigate around encountered and potential barriers, identifying stakeholders, and reviewing hospital policies and processes related to stroke care. The project volunteered thirty minutes to an hour of his/her time with biweekly meetings or email correspondence with the project manager. Throughout its course, the project had a total of three different project sponsors.

A significant portion of the project's resource requirements included a dedicated number of hours spent in all key phases of the project: (a) research, (b) testing, (c) staff training, (d) go-live, and (e) evaluation. The project manager participated in the new hire orientation on the use of the hospital's EHR system and was given student access for conducting chart reviews and audits. The project manager spent a combined 535 hours in all stages of the project.

This project required one physician champion that supports the inclusion of a PSD screening measure on stroke care. The project manager and the ARU nurse manager met with the lead stroke care physician who agreed to support the project. Additionally, the physician champion directed the project manager to research articles relevant to PSD screening.

This project required at least one resource nurse to administer the PHQ tools for a month on each identified stroke care areas: (a) ED, (b) ICU, (c) MSU, and (d) ARU. Resource nurses were trained by the project manager on the use of the screening measures. Screening was conducted during the resource nurses' regular shift concurrent with routine patient care. No additional compensation was provided and resource nurses were considered volunteers. However, these nurses received "project hours" as part of their staff nurse III/IV portfolio.

In addition to the resource nurses, unit clerks were also tasked in making sure that new stroke patients are logged into the project's resource manual, and collected and filed all completed screening forms in the patient's paper chart.

All of the involved staff have been HIPPA trained and are compliant prior to the start of related project activities.

Communication Responsibilities

The success of this project involved regular and effective communication between the project manager and organizational stakeholders. The project manager had responsibilities in

communicating with members the essential elements of successful PSD screening and intervention. The project manager met with nurse managers and the project sponsor bi-weekly and corresponded with them via email as needed to give status updates on each phases of the project. Similarly, the project manager met with resource nurses bi-weekly.

Since the screening tool is not available in the organization's EHR system, a strong emphasis was placed on the timely screening for PSD of all admitted stroke patients by putting up informational flyers on the nurses' stations and staff break rooms on all stroke care areas. The project manager's contact information was made available for staff if questions regarding the project arise.

Baseline data on staff's comfort levels and perceptions on the use of BH screening tools were collected via a self-administered survey form handed-out during nurses' huddles and were also available in each of the stroke care areas project resource binder. Nurses were also asked to complete a similar, but slightly modified, post-live survey form. Nurses were provided training and education on the administration of the PHQ tools via a "read and sign" project resource binder. The project manager and the resource nurses conducted the staff in-service and signed-off nurses who completed the in-service from the unit roster. Feedback from staff were collected and reviewed by the project manager. Survey results and feedback were also communicated to the nurse managers and project sponsor for review and further feedback.

Nurses refer to the unit's census to identify stroke patients and refer to the EHR system for admission dates and most current NIHSS scores. Charge nurses and resource nurses also remind staff of patients which are due depression screening. The results of the screen are communicated to the attending provider verbally and by charting in the EHR.

Upon completion of the data analysis, the project manager will present the outcomes of this QI improvement project to his Doctor of Nursing Practice (DNP) chairperson and committee members.

Implementation

The implementation of the project was supported by the elements and timeline established in project's work breakdown structure, resource requirements and Gantt chart (see Appendices C to E). Based on these documents, 8 distinct phases were identified for the successful completion of the project. These phases included: (a) review of evidence, (b) workflow mapping and gap analysis, (c) identification and training of resource nurses, (d) pilot testing, (e) training of staff nurses, (f) assembly of project live materials, (g) project go-live, and (h) post-live and evaluation.

The project manager conducted a comprehensive literature review which was used in identifying articles related to PSD. The author synthesized current PSD screening and intervention guidelines, studies on the etiology of typical depression and PSD, PSD screening studies and validated tools, intervention and treatment modalities. A study of the current stroke care workflow was also conducted in consultation with the project sponsor, the stroke coordinator, and nurse managers of stroke care units. From this, a gap analysis was completed and it was identified that there is no standardized process to screen for and document PSD. A new workflow was proposed that highlighted the inclusion of the PHQ-2 and PHQ-9 depression screening tools (see Appendix G). PSD screening is due after 3 days or 72 hours post-hospital admission. With input from the stroke coordinator, items 4 (Facial Palsy) and 9 (Best Language) of the NIHSS were used to determine the exclusion criteria for PSD screening. Stroke patients with complete facial paralysis and/or severe to global aphasia were excluded until an

improvement in the said NIHSS items are observed. Additionally, patients with pre-existing depression and other mood disorders who were already on an antidepressant regimen were also excluded. Nurses administered the PHQ-2 (see Appendix H). If the patient scored 3 or higher on the PHQ-2, nurses proceed in administering the PHQ-9 (see appendix I). If the patient scored 10 or higher on the PHQ-9, then this was indicative of a "positive" screen for depression. Nurses documented their findings in the patient's EHR using the SBAR format. The attending provider reviewed the clinical note and decided on an appropriate intervention (e.g. BH consult, to start on an antidepressant, outpatient BH follow-up, psychotherapy, etc.). Providers documented their clinical impression in patient's EHR. The completed depression screening tools were filed in the patient's paper chart and are electronically scanned by medical records after the patient had been discharged.

The project manager capitalized on the hospital's clinical nurse ladder program and consulted with nurse managers in identifying potential resource nurses (staff nurse III/IVs) for the project. These nurses served as volunteers and were trained by the project manager in the administration of the PHQ-2 and PHQ-9. Pilot testing on high-volume stroke care units was conducted for 4 weeks. Together with the resource nurses, the project manager was able identify additional barriers and made appropriate changes to the proposed workflow. Both the ICU and ED were removed the project because of low-yield results (see Appendix P). The project officially went live in June 2015. Data mining for the first 3-months after implementation was conducted. Staff was again asked to complete a survey. Project evaluation began on month 2 and extended to 8 more weeks after the project go-live.

Results and findings were incorporated in the project manager's paper and submitted to his DNP committee for review. Revisions will be made on this paper based on the committee's

feedback and will be re-submitted after 2 weeks. A formal presentation of the project will follow contingent upon approval of the DNP committee.

Barriers to Implementation

The project had several set-backs since inception. After a review of the hospital's EHR system, the project manager identified the lack of a validated depression screening tool for clinicians. One of the initial objectives of this project was to have the PHQ-2 and PHQ-9 to be built into the EHR system prior to going live with the project. The project manager intended to have an automated clinical alert for positive screens. Unfortunately, the project site is part of a larger hospital network and any "build requests" will be system-wide and will have to go through the corporate office. Approval for build requests take at least 6 months to a year, with an additional 3 months for building and testing. After consultation with the project sponsor and the hospital's clinical informatics educator, the project manager decided to abandon the electronic format and instead opted to have the screening tools on a paper. The proposed workflow was revised to reflect this change. Additionally, a Strength-Weakness-Opportunity-Threat (SWOT) analysis (see Appendix M) was developed based on the following identified barriers for project implementation:

- **Changes in Organizational Leadership**

  Two weeks after starting the program, the hospital's Stroke Coordinator left the organization. The project manager was able to meet and consult with her only once prior to her departure. The Stroke Coordinator position remains vacant to date. Half way through the project's testing phase, the Director of Critical Care, who served as the project sponsor and clinical liaison, and the Chief Nursing Officer (CNO) were unexpectedly terminated by the hospital's executive leadership. The project was on hold

for approximately 2 months until a new sponsor was identified. The former project sponsor suggested that the project manager contact the hospital's Director of Nursing Education to discuss the future of the project. Fortunately, The Director of Nursing Education agreed to be the new project sponsor. Two months after, the new project sponsor also left the organization. Again, the project was on hold for approximately 2-3 weeks until a new sponsor was identified. This dilemma was communicated to the DNP committee as the project's progress was again in jeopardy. One of the committee members suggested that the project manager contact the hospital's Director of Clinical Informatics in hopes of gaining new sponsorship. The Director of Clinical Informatics agreed to be the new (3rd) project sponsor. Two months later, the Director of Rehabilitation Services also left the organization.

- **Low Patient Volume**

  Being a small-sized hospital in an area with several bigger PSCs, the hospital only receives an average of 10 stroke cases per month. Convincing internal stakeholders, particularly providers, to accept a change in current stroke care workflow will be difficult. Additionally, the medical units rely on BH providers for BH consults. Often times, BH consults are not completed in a timely manner since the hospital only has two psychiatrists, who also serve as attending providers for the inpatient BHU.

- **Low Yield**

  After discussion with the hospital's stroke coordinator, it was determined that pre-existing depressive and other mood disorders, complete facial paralysis, and severe aphasia will serve as the exclusion criteria for post-stroke depression screening, lowering potential number of depression screening candidates.

- **Change Fatigue and Staff Compliance**

  On July 2014, the hospital had its PSC re-certification survey from TJC. It was found that nurses were non-compliant in routine completion of the NIHSS on stroke patients. As part of the hospital's corrective plan of action, all nurses were re-educated on the use of NIHSS. According to one of the nurse resources, "It will be difficult to expect nurses to do something new when compliance is already low in something that they should be doing in the first place".

Methods of Evaluation

Time and Cost Summary

The project manager had a time-limited role in implementing the project. A Gannt chart (see Appendix E) was developed to map out a timeline for project milestones. This helped the project manager to navigate around time constraints and monitor whether deadlines for deliverables were being met as projected. Due to several unforeseen events (e.g. loss of project sponsor, etc.), several components of the chart was revised and adjusted accordingly to reflect changes in deadlines. Approximately 36 weeks was spent conducting review of literature related to stroke and PSD. The project manager spent 4 weeks in identifying an implementation site and project sponsorship, and obtaining clearance from the site's IRB. An additional 8 weeks was spent meeting with key stakeholders. Training and testing took a combined 12 weeks to complete. The project went live on June 2015 and was supported by the project manager and resource nurses for 8 weeks. Staff surveys were conducted pre and post-live for 2 weeks each. Review of data and project evaluation took 12 weeks. The project was completed at the end of October 2015.

Cost-Benefit Analysis / Financial Outcomes

The project manager developed a formal budget with estimated breakdown of expenses (see Appendix F). Estimates were compared with actual costs to determine variances. The budget for direct costs was $1,080.00 while actual direct costs were $978.50. Variance for direct costs was 9.39%. The budget for indirect costs was $500.00 while actual indirect costs were $536.75. Variance for indirect costs was -7.35%. An estimate of the opportunity costs for those involved in the project was also included in the budget, merely as a reference. Opportunity cost for 535 project hours was $46,909.60 .

Financial outcomes were to be demonstrated by total project (direct and indirect) expenses versus improved outcomes such fall episodes, LOS, and hospital readmission rate. However, the process of measuring financial outcomes was more difficult than originally expected due to accounting structures and billing processes. The sudden departure of the hospital's Stroke Coordinator and Director of Rehabilitation Services, individuals who had access to the necessary data, further complicated analysis of patient outcomes and translating them into financial outcomes. A summary table was developed to present estimated cost savings and cost avoidance related to decrease in LOS and episodes of fall, for stroke patients who screened positive for PSD and started on an SSRI (see Appendix T). According to Medi-Cal's Diagnostic Related Group (DRG) pricing calculator, base payment for stroke care is $17,415.00 for an average LOS 7.65 (California Department of Healthcare Services, 2015). The estimated savings over a 3-month period for decrease in LOS was $6,140.11 for the MSU and $6,032.64 for the ARU. According to a study conducted by Exel et al. (2003), a single fall episode of a stroke patient during hospitalization increases LOS by 71%. Based on this information, it is estimated that savings over a 3-month period for 0 episodes of fall was $8.079.80 for the MSU

and $10,422.65 for the ARU. The total estimated cost savings produced by the project over a 3 month period was $30,376.20.

Evaluation Criteria

This project was intended to involve all stroke care areas in the hospital in screening for PSD on all admitted stroke patients. The evidence surrounding depression screening and positive outcomes of early PSD intervention is strong but relied heavily on the involvement of a larger population group to prove its short-term and long-term efficacy. In order for the project manager to successfully implement this project, certain elements had to be removed (i.e. electronic version of the tool in the EHR) and reduction in scope had to be initiated (i.e. exclusion of ICU and ED after testing). Full evaluation of the project through staff surveys and patients' chart review was based on the following: (a) proficiency of resource nurses in educating other nurses on the use of the PHQ depression screening tools, (b) accurate and timely administration of PHQ tool(s) on stroke patient meeting the criteria for PSD screening, (c) nurses' perception on the clinical utility of BH screening measures and their comfort levels in administering such tools, (d) clinical utility of BH screening measures for post-stroke patients as it relates to LOS, hospital readmission, falls, and pre-discharge NIHSS scores. Because this program is in its beginning stages, it will require ongoing evaluation and refinement in processes.

Analysis

Evidence of the successful implementation of the project towards the goal of early screening and intervention for PSD on stroke patients was measured in 3 different stages: (a) pre-live, (b) live, and (c) post-live. Results of pre and post-live staff surveys (see Appendices N and O) and the screening and intervention results (see Appendix P) were reviewed and analyzed.

A total of 76 nurses completed the pre-live survey. A high number of nurses expressed moderate to high comfort levels in administering BH screening tools on patients, with a rate of 39.47% and 28.94% respectively. A few nurses reported no to low comfort levels, with a rate of 6.57% and 10.52% respectively, while 14.47% reported feeling neither comfortable nor uncomfortable in administering BH screening tools to stroke patients. A high number of nurses also reported moderate to high comfort levels in answering questions from patients and family members as to why BH screening tools are being administered, with a rate of 36.84% and 32.89% respectively. A few nurses reported no to low comfort levels, with a rate of 5.26% and 9.21% respectively, while 15.78% reported feeling neither comfortable nor uncomfortable in answering questions from patients and family members as to why BH screening tools are being administered. Nurses who responded to the pre-live survey reported moderate to high confidence in the value of BH screening tools on patients as it relates to stroke patient outcomes, with a rate of 43.42% and 56.57% respectively. A high number of nurses reported that they either somewhat agree or agree on recommending the use of BH screening tools on stroke patients, with a rate of 51.31% and 48.68% respectively, while 6.57% reported being unsure whether to recommend or not. Additionally, 30.3% of nurses admitted that they have reported to a provider that a stroke patient may require a BH consult or intervention at one point. Majority of the nurses reported observing behavioral changes from stroke patients 2 to 3 days, post-hospital admission.

At month 1 of project go-live, a total of 10 stroke patients (4 in the MSU and 6 in the ARU) who did not have moderate to severe aphasia or facial palsy were administered the PHQ-2. The average LOS for the MSU and ARU were 5.2 and 10.2 days respectively. Only 1 patient met the criteria for PHQ-9 screening. The patient scored less than 10 in the PHQ-9 and was considered not depressed at the time of screening.

At month 2 of project go-live, a total of 10 stroke patients (5 in the MSU and 5 in the ARU) who did not have moderate to severe aphasia or facial palsy were administered the PHQ-2. The average LOS for the MSU and ARU were 5.0 and 10.6 days respectively. Two patients met the criteria for PHQ-9 screening and scored 10 or more, and were considered as depressed at the time of screening. Both patients were started on a low-dose SSRI.

At month 3 of project go-live, a total of 7 stroke patients (4 in the MSU and 3 in the ARU) who did not have moderate to severe aphasia or facial palsy were administered the PHQ-2. The average LOS for the MSU and ARUU were 6.2 and 10.2 days respectively. Only 1 patient met the criteria for PHQ-9 screening and scored 10 or more. The patient was considered as depressed at the time of screening. The patient was started on a low-dose SSRI.

A total number of 82 nurses completed the post-live survey. A high number of nurses expressed moderate to high comfort levels in administering BH screening tools on stroke patients, with a rate of 36.58% and 47.56% respectively. A few nurses reported no to low comfort levels, with a rate of 3.65% and 2.43% respectively, while 9.75% reported feeling neither comfortable nor uncomfortable in administering BH screening tools to stroke patients. A high number of nurses also reported moderate to high comfort levels in answering questions from patients and family members as to why BH screening tools are being administered, with a rate of 34.14% and 47.56% respectively. A few nurses reported no to low comfort levels, both with a rate of 2.43%, while 13.41% reported feeling neither comfortable nor uncomfortable in answering questions from patients and family members as to why BH screening tools are being administered. Nurses who responded to the post-live survey reported moderate to high confidence in the value of BH screening tools on patients as it relates to stroke patient outcomes, with a rate of 47.56% and 52.43% respectively. A high number of nurses reported that they

either somewhat agree or agree on recommending the use of BH screening tools on stroke patients, with a rate of 46.34% and 53.65% respectively, while 3.65% reported being unsure whether to recommend or not. Additionally, 30.48% of nurses admitted that they have reported to a provider that a stroke patient may require a BH consult or intervention at one point. Majority of the nurses reported observing behavioral changes from stroke patients 2 to 3 days, post-hospital admission.

Section IV: Results

Program Evaluation and Outcomes

Several numerical changes were noted after comparing the results of the pre-live with the post-live staff surveys. For the reported comfort levels in administering BH screening tools on stroke patients: (a) there was a decrease of 2.92% in nurses feeling uncomfortable, (b) there was a decrease of 9.08% in nurses feeling somewhat uncomfortable, (c) there was a decrease of 4.72% in nurses neither feeling comfortable nor uncomfortable, (d) there was a decrease of 2.89% in nurses feeling somewhat comfortable, while (e) there was an increase 18.52% in nurses feeling comfortable. For the reported comfort levels in answering questions from patients and family members as to why the BH screening tool was being administered: (a) there was a decrease of 2.85% in nurses feeling uncomfortable, (b) there was a decrease 6.78% in nurses feeling somewhat uncomfortable, (c) there was a decrease of 2.37% in nurses feeling neither comfortable nor uncomfortable, (d) there is a decrease of 2.7% in nurses feeling somewhat comfortable, while (e) there was an increase of 14.67% in nurses feeling comfortable. For the reported confidence in the value of administering BH screening tools on stroke patients: (a) there was an increase of 4.14% in nurses reporting some confidence, and (b) there was a decrease of 4.14% in nurses reporting confidence. For recommending the use of BH screening tools on stroke patients: (a) there was a decrease of 2.92% in nurses who would neither recommend nor not recommended, (b) there was an increase of 4.97% in nurses who would recommend, while (c) there was an increase of 21.02% in nurses who would recommend. Additionally, BH changes are still observed by nurses 2 to 3 days post-hospital admission. There was no significant change in reporting rate by nurses for PSD interventions to providers.

After reviewing the total number of admitted stroke patients for the 3 month period of project go-live, a total of 27 patients were identified as not having moderate to severe aphasia of facial palsy and were administered the PHQ-2 screening tool. Five out of these 27 patients scored 3 or more on the PHQ-2 and were administered the PHQ-9 screening tool. Only 3 of these 5 patients scored 10 or more on the PHQ-9 and considered depressed. The number of positive PSD screens for post-stroke patients is significantly below the expected rate of 33%, with the actual rate being at 11%. All patients with positive PSD screens were afforded early intervention and were started on a low-dose SSRI. Additionally, all admitted stroke patients, regardless of their PHQ scores were provided informal CBT sessions by stroke nurses, through the hospitals stroke education session held during the weekends, which involved topics like “how to cope with changes in feelings after having a stroke”.

Section V: Discussion

Summary

Despite the low volume of stroke patients admitted in the hospital during the 3-month period, the project was moderately successful on multiple levels. The project produced the intended outcomes of cost-effective staff training and education on the timely administration of PSD screening measures and intended pharmacological interventions. It was able to moderately raise nurses' comfort levels in the administration of BH screening questions and answering questions related to its use. Additionally, nurses reported moderate increase in confidence the overall clinical utility of PSD screening as part of the stroke care process. As a disruptive innovation, it also exposed organizational stakeholders to the benefits of considering small tests of change. The project was implemented during a period of high leadership turnover and when the organization had just recently undergone its PSC re-certification, the project exemplified a no-risk, low-key, and moderate-paced implementation. Overall success was dependent on the widespread acceptance and support of all involved stroke care areas and enthusiastic participation of resources and stroke care nurses. And although the project's success on proving improvement of stroke outcomes as it relates to timely screening and intervention of PSD was considered low, due to several factors and limitations of the project, there appears to be a strong link between good communication, good training, and staff compliance to small tests of change aimed at improving patient care.

Relation to Other Evidence

Experimental Research

Kronenberg, Gertz, Heinz, and Endres (2014) conducted a translational research on experiments conducted in modeling PSD in rodents via a variety of approaches. The researchers

aimed to investigate short-term end points of acute stroke lesions and its relevance to the development of PSD. The potential use of 5-hydroxytryptaminergic antidepressants as a pharmacologic intervention for PSD was also explores. Four neurobiological changes in the brain that contribute to behavioral changes and depressive-like symptoms post-stroke among rodents (and other mammals) were identified: (a) the ability of the brain to capacity in building new glia (neuroplasticity), (b) impaired neutropin signaling with decrease brain-derived neurotropic factors (BDNF) concentrations seen post-mortem in suicide victims and patients with mood disorders,(c) an increase in pro-inflammatory cytokines which is associated with decrease reactivity from the social and physical environment, and (d) the rupturing of critical neural pathways (neurodegeneration). The corrective actions of antidepressants and other mood stabilizing agents after a stroke at the brain's cellular and molecular levels were also validated. The researchers concluded that outcomes in rodent stroke research may be of great value for bridging the gap between clinical and other experimental perspectives in human stroke research.

Research outside the United States

Stroke and post-stroke complications are a growing public health concern worldwide. It is estimated that frequency of reported PSD cases around the world range from 20% to 60% (Ojagbemi, Akinyemi, & Baiyewu, 2014). Outside the US, several studies have been conducted to determine the frequency and predictors of PSD. Ojagbemi et al. (2014), conducted a study on 130 stroke survivors in Nigeria undergoing rehabilitation over a 6-month period matched with a control group of 130 healthy subjects, 60 males and 70 females. Most of the participants had medical co-morbidities, such as systemic hypertension, and nearly one-quarter were either had a history of alcohol abuse. Literacy was low, with 104 participants only having up to 6 years of formal education while, while the remaining had none. Participants were referred by their

primary care physicians (PCP). The aim of the study is to determine the frequency and predictors of a Major Depressive Disorder (MDD) according to the DSM IV criteria using standardized assessments in developing countries, such as Nigeria.

The Schedules for Clinical Assessment in Neuropsychiatry (SCAN) was used in the diagnosis of a depressive disorder. At least 5 symptoms lasting 2 weeks or more meant that the patient was depressed. The researchers reported that 41.5% of the participants met the criteria for MDD post-stroke. The researchers believe that the morbidity in reported PSD may be associated with the following factors: (a) mild stroke patients may not undergo rehabilitation or follow through with referrals, (b) inefficient treatment of stroke at its acute phase, (c) a large proportion of patients may present with traditional or sociocultural beliefs about stroke (e.g. faith healers, etc.), and (d) limited access to health care services. The researchers concluded that although the association between socio-economic risk factors for PSD were not directly studied, the social economic changes in developing countries may also contribute the bi-directional relationship between disability and depression.

Non-Pharmacologic Treatments

The most prevalent intervention for post-stroke neuropsychiatric disorders are pharmacological agents. Currently, there is no universally accepted non-pharmacological treatment for PSD. The reactive aspect of stroke such as functional impairment and PSD has been subject to much debate. However, it has been suggested that PSD arise from the patient's inadequate adjustment to the consequences of the stroke and significance to loss of functioning. Behavior change potential for stroke patients is limited. The traditional CBT approach of modifying irrational, self-defeating and other negative thoughts do not typically work for stroke patients who have sensory, motor, and cognitive impairments. Kootker et al. (2015) proposed a

new psychological treatment protocol in the form of a stroke-specific cognitive behavioral therapy (CBT). The intervention supports the inclusion of occupational and movement during therapy sessions by modifying existing CBT intervention for chronic disease to be stroke-specific.

The researchers conducted a pilot study on 5 patients and integrated 5 psychological approaches to CBT: (a) enhancement of motivation for behavioral change through motivational interviewing, (b) promotion of grief resolution, (c) explanation of the relationship between thought, feelings, and actions (Cognitive deficits adaptation), (d) selective optimization with compensation through occupational and movement therapy, and (e) executive skills training through relaxation techniques. The aim of the intervention is to improve self-efficacy by providing cognitive tools to effect positive behavioral change. Participants attended 15-16 individual CBT sessions, jointly facilitated by a psychologist and an occupational therapist. Although the outcome of the study was not clearly defined, the researchers agree that the proposed intervention is innovative through its inclusion of occupational and movement therapy and concurrently addressing post-stroke anxiety complaints.

Limitations

Because of the scope and constraints of the project, the project manager acknowledges several short-comings. The project limitations identified are the following:

- The number of admitted stroke patient who met criteria for PSD screening was low. A large population is required to sufficiently measure the clinical utility of revising current stroke care processes to include PSD screening.

- The heterogeneous entry of stroke patients in to the hospital, either through the ED or via inter-facility transfer and directly in to the ARU, also meant that stroke patients screened for PSD are at varying stages post-stroke.
- The chosen screening tools, the PHQ-2 and PHQ-9, are language-based measures necessitating the exclusion of patients with moderate to severe aphasia and facial palsy - patients that may also screen positive for depression had a non-language based tool was administered.
- Only two treatment modalities / interventions were administered for positive screens: (a) SSRIs and (b) pseudo-CBT.
- SSRIs, the first-line agent for PSD and other mood disorders typically take 4 or more weeks to take effect. The scope of the project did not involve measuring the efficacy of pharmacologic interventions for PSD after hospitalization.
- Cognitive decline and other post-stroke deficits are continuously monitored at each shift through the use of the NIHSS. However, PSD screening was done only at one point (72 hours after admission) and not at multiple points during the patient's hospitalization.

Conflict of Interest

The project manager acknowledges that there are no financial or personal relationships between him and others involved that might bias this project.

Interpretation

Although this project was ideally suited for implementation on a much larger scale that would encompass all 4 identified stroke care areas (ED, MSU, ICU, and ARU), it was successful implemented in only the two high volume units, the MSU and ARU. Despite the lack of a clinical alert (in the EHR) for nurses to screen, and varying levels of reported comfort in

administering BH screening tools and answering questions from patients and family members as to why the BH tool is being administered, compliance with PSD screening was high. The project manager assumes that high compliance was affected by the following: (a) stroke is a hospital core measure and is already a closely monitored condition, (b) effective teaching in the use of the screening tool, and (c) easy administration / use of the chosen screening measure.

Conclusions

The biological and psychosocial theories of PSD can be an excellent guide in determining higher risk populations and providing a timeline on when to observe for depressive symptoms. The neurochemical changes in the brain provide an excellent framework for pharmacologic management of depressive symptoms and the efficacy of SSRIs in treating PSD are well documented. Although, tests to determine lesion location are part of conventional stroke care, the inclusion of additional invasive procedures and tests to assess for neurochemical and other microenvironment changes in the brain can prove too costly and may add to the stroke patient's distress. Rather than inflating the cost of hospitalization and exposing the patient to several invasive procedures, the administration of a simple clinical tool for PSD screening is more cost-effective and ethical.

Nurses play an important role in all the phases of stroke care and stages of stroke recovery. They are at key position in detecting depressive symptoms and advocating for BH interventions for stroke patients. Although PSD screening is only recommended for PSCs, the inclusion of validated depression screening measure with conventional stroke care processes should be integrated in all levels of stroke care to enable early detection, treatment, and improving overall stroke outcomes.

Section VI: Other Information

Funding

Funding for this project and any future publication was directly provided by the project manager. Incidental support activities such as staff education and training by resource nurses are not included in the project budget and were provided by the project site volunteers and organizational leaders.

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Appendix A

Evidence-Based Change of Practice Project Checklist

EVIDENCE-BASED CHANGE OF PRACTICE PROJECT CHECKLIST *

Instructions: Answer YES or NO to each of the following statements:

Project Title:	**YES**	**NO**
The aim of the project is to improve the process or delivery of care with established/ accepted standards, or to implement evidence-based change. There is no intention of using the data for research purposes.	X	
The specific aim is to improve performance on a specific service or program and **is a part of usual care**. ALL participants will receive standard of care.	X	
The project is **NOT** designed to follow a research design, e.g., hypothesis testing or group comparison, randomization, control groups, prospective comparison groups, cross-sectional, case control). The project does **NOT** follow a protocol that overrides clinical decision-making.	X	
The project involves implementation of established and tested quality standards and/or systematic monitoring, assessment or evaluation of the organization to ensure that existing quality standards are being met. The project does **NOT** develop paradigms or untested methods or new untested standards.	X	
The project involves implementation of care practices and interventions that are consensus-based or evidence-based. The project does **NOT** seek to test an intervention that is beyond current science and experience.	X	
The project is conducted by staff where the project will take place and involves staff who are working at an agency that has an agreement with USF SONHP.	X	
The project has **NO** funding from federal agencies or research-focused organizations and is not receiving funding for implementation research.	X	
The agency or clinical practice unit agrees that this is a project that will be implemented to improve the process or delivery of care, i.e., **not** a personal research project that is dependent upon the voluntary participation of colleagues, students and/ or patients.	X	
If there is an intent to, or possibility of publishing your work, you and supervising faculty and the agency oversight committee are comfortable with the following statement in your methods section: *"This project was undertaken as an Evidence-based change of practice project at X hospital or agency and as such was not formally supervised by the Institutional Review Board."*	X	

ANSWER KEY: If the answer to **ALL** of these items is yes, the project can be considered an Evidence-based activity that does NOT meet the definition of research. **IRB review is not required. Keep a copy of this checklist in your files.** If the answer to ANY of these questions is **NO**, you must submit for IRB approval.

*Adapted with permission of Elizabeth L. Hohmann, MD, Director and Chair, Partners Human Research Committee, Partners Health System, Boston, MA.

STUDENT NAME (Please print): Marco Oliver D. Lopez

Appendix B

Letter of Support / Institutional Review Board Clearance

Dignity Health

IRB:	Bay Area Regional Institutional Review Board (IRB) Federal Wide Assurance (FWA) # 00001499
Date:	May 28, 2014
To:	Marco Oliver D. Lopez
Protocol Name:	"Depression Screening & Early Intervention on the Post-Stroke Patient"
Hospital:	Saint Francis Memorial Hospital (SFMH)
IRB Review Type:	Process Administratively - Chair's Review
IRB Decision:	**Acknowledged – Quality Improvement – IRB oversight not required**

On May 27, 2014, the Chair of the Bay Area Regional IRB reviewed your submission and determined that the above referenced project is a quality improvement project and thus does not meet the criteria for human subject's research under state and federal regulations.

If you intend to alter or significantly change the processes or data collection, please notify the Institutional Review Board prior to implementation.

If you have any questions or need further assistance, please contact the Bay Area Regional IRB, IRB Manager, Leigh Pruneau at (415) 750-5654.

Sincerely,

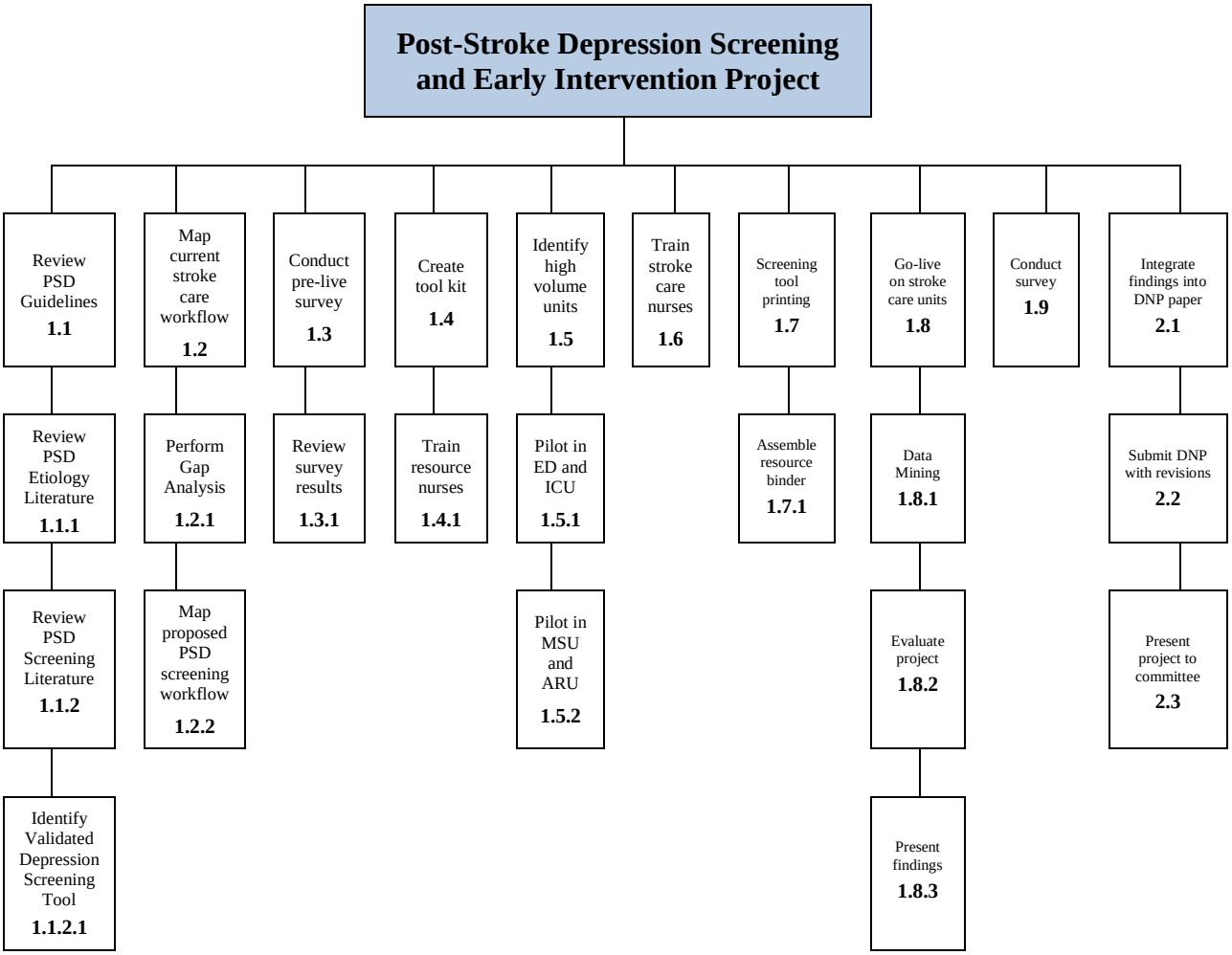
Jeffrey Braff, DrPH
Chair, Bay Area Regional Institutional Review Board

cc: Dennis Kneeppel, Accountable Executive, SFMH
Beth Willy, RN, MSN, Director of Education Services, SFMH
Mary Rydman, MPA, CIP, CHC, Director Dignity Health HRPO

Dignity Health is organized and operates according to its Federal Wide Assurance with the Department of Health and Human Services (DHHS) Office of Human Research Protections (OHRP). Dignity Health IRBs operate in compliance with the Code of Federal Regulations (CFR) including 45 CFR 46, 21 CFR 56 and 21 CFR 11.

Appendix C

Work Breakdown Structure



Appendix D

Project Resource Requirements Table

Work Package	WBS ID	Activity	Predecessor	Duration in Weeks
Review of Evidence	1.1	Review PSD Guidelines	N/A	4
Review of Evidence	1.1.1	Review PSD Etiology Literature	1.1	6
Review of Evidence	1.1.2	Review PSD Screening Literature	1.1	6
Review of Evidence	1.1.2.1	Identify Validated Depression Screening Tool	1.1.2	2
Workflow Mapping	1.2	Map current stroke care workflow	1.1	2
Gap Analysis	1.2.1	Perform Gap Analysis	1.2	1
Workflow Mapping	1.2.2	Map proposed PSD screening workflow	1.2.1	2
Pre Go-live Survey	1.3	Conduct pre-live survey	1.2.1	2
Pre Go-live Survey	1.3.1	Review survey results	1.3	1
Training	1.4	Create tool kit	1.3.1	1
Training	1.4.1	Train resource nurses	1.4	1
Testing	1.5	Identify high volume units	1.4	1
Testing	1.5.1	Pilot in ED and ICU	1.5	4
Testing	1.5.2	Pilot in MSU and ARU	1.5	4
Training	1.6	Train stroke care nurses	1.4	4
Screening Tool	1.7	Screening tool printing	1.1.2.1	1
Screening Tool	1.7.1	Assemble resource binder	1.7	1
Project Go-live	1.8	Go-live on stroke care units	1.6	12
Project Go-live	1.8.1	Data Mining	1.8	8
Project Go-live	1.8.2	Project Evaluation	1.8.1	8
Project Go-live	1.8.3	Present findings to organizational leadership	1.8.2	1
Post Go-live Survey	1.9	Conduct post-live survey	1.8	2
Write-up	2.1	Integrate findings into DNP paper	1.9	6
Write-up	2.2	Submit DNP with revisions	2.1	2
Write-up	2.3	Present project to committee	2.2	1

Appendix E

Gantt Chart

Activity	Apr. 2014	May 2014	June 2014	July 2014	Aug. 2014	Sept. 2014	Oct. 2014	Nov. 204	Dec. 2014	Jan. 2015	Feb. 2015	Mar. 2015	Apr. 2015	May 2015	June 2015	July 2015	Aug. 2015	Sept. 2015	Oct. 2015	Nov. 2015	Dec. 2015
Literature review.																					
Identification of Project Site.																					
Identification of project sponsor.																					
IRB Clearance.																					
Meet with MSU Nurse Manager.																					
Meet with ARU Nurse Manager.																					
Meet with Stroke Coordinator.																					
Identification of resource nurses.																					
Pre-live survey.																					
Testing (ED & ICU)																					
Identification of new project sponsor.																					
Testing (MSU & ARU)																					
Staff training.																					
Submission of project prospectus.																					
Identification of new project sponsor.																					
Project go-Live.																					
Data mining.																					
Post-live survey.																					
Present findings to hospital leadership.																					
Submission of DNP paper.																					
Submission of DNP paper with revisions.																					
Present project to committee.																					

Appendix F

Financial Report

Expenses			Budget	Actual	Var.
Direct Expenses					
Printing / Copying Services *		$300.00			
Transportation Expense					
Gas	$150.00				
Parking *(Student rate at $8 per day)*	$320.00	$470.00			
Volunteer Meals		$100.00			
Catering Costs *(Day of project go-live)*		$300.00	$1080.00	$978.50	9.39%
Indirect Expense					
Office Supplies Expense **		$50.00			
Other (Unforeseen) Expenses		$300.00			
Token of Appreciation *(for project sponsor and resource nurses)*		$150.00	$500.00	$536.75	-7.35%
Total Direct & Indirect Expenses			**$1580.00**	**$1515.25**	**4.09%**
Estimated Opportunity Costs ***					
Project hours of project manager *(535 hours at $62.56 per hour)*			$33469.60		
Project hours of resource nurses *($56 per hour)*					
Resource nurse A (80 hours)		$4480.00			
Resource nurse B *(80 hours)*		$4480.00			
Resource nurse C *(40 hours)*		$2240.00			
Resource nurse D *(40 hours)*		$2240.00	$13440.00		
Total Opportunity Costs			**$46909.60**		

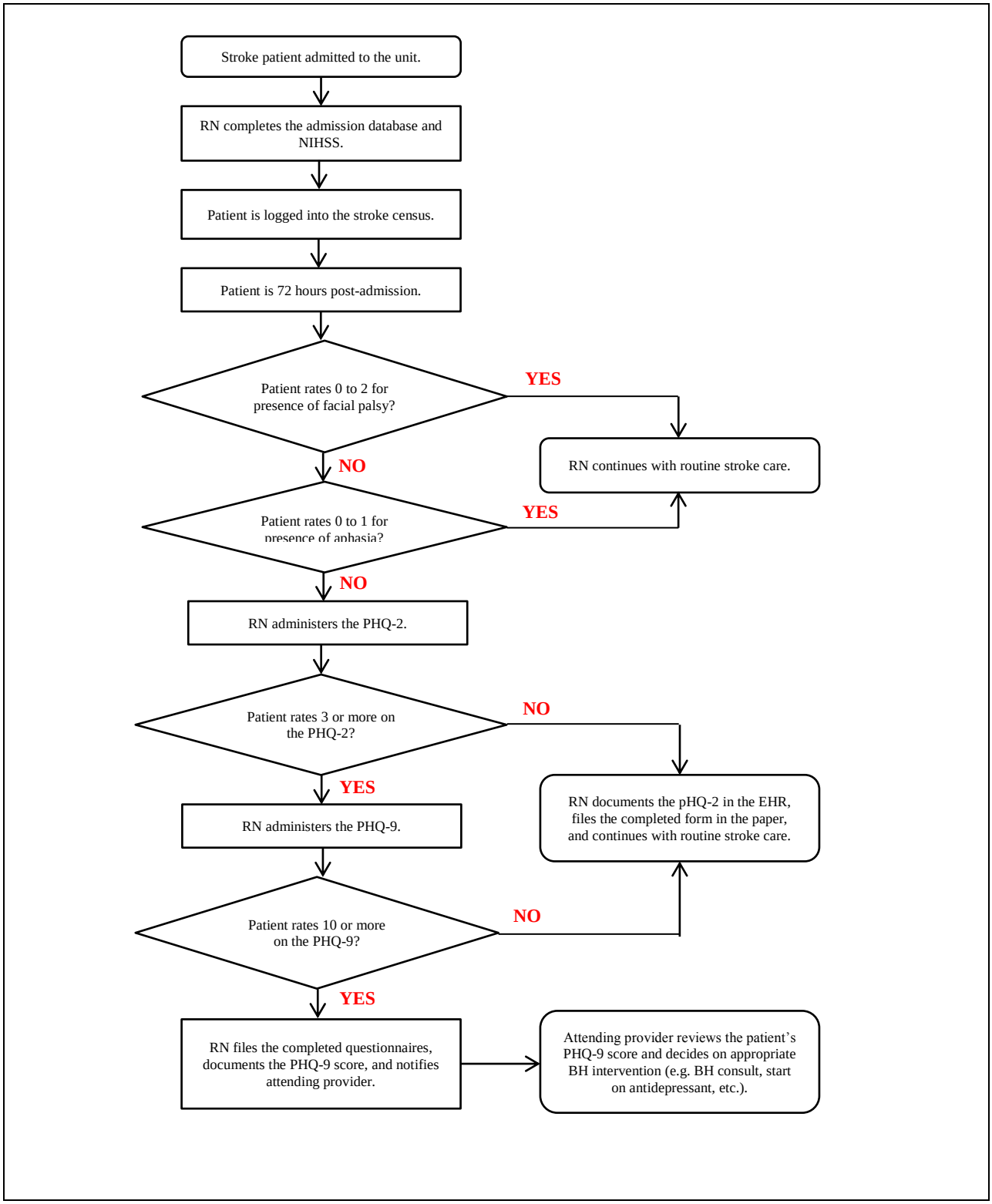
** Include binding costs for resource manuals.*

*** Include papers, folders, and other office supplies.*

**** For reference only. Not part of the budget.*

Appendix G

Workflow Map



Appendix H

Patient Health Questionnaire-2

STABLE RESOURCE TOOLKIT

The Patient Health Questionnaire-2 (PHQ-2)

Patient Name _____ Date of Visit _____

Over the past 2 weeks, how often have you been bothered by any of the following problems?	Not At all	Several Days	More Than Half the Days	Nearly Every Day
1. Little interest or pleasure in doing things	0	1	2	3
2. Feeling down, depressed or hopeless	0	1	2	3

Appendix I

Patient Health Questionnaire-9

STABLE RESOURCE TOOLKIT

The Patient Health Questionnaire (PHQ-9)

Patient Name _____ Date of Visit _____

Over the past 2 weeks, how often have you been bothered by any of the following problems?	Not At all	Several Days	More Than Half the Days	Nearly Every Day
1. Little interest or pleasure in doing things	0	1	2	3
2. Feeling down, depressed or hopeless	0	1	2	3
3. Trouble falling asleep, staying asleep, or sleeping too much	0	1	2	3
4. Feeling tired or having little energy	0	1	2	3
5. Poor appetite or overeating	0	1	2	3
6. Feeling bad about yourself - or that you're a failure or have let yourself or your family down	0	1	2	3
7. Trouble concentrating on things, such as reading the newspaper or watching television	0	1	2	3
8. Moving or speaking so slowly that other people could have noticed. Or, the opposite - being so fidgety or restless that you have been moving around a lot more than usual	0	1	2	3
9. Thoughts that you would be better off dead or of hurting yourself in some way	0	1	2	3
Column Totals		_____ +	_____ +	_____
Add Totals Together		_____		

10. If you checked off any problems, how difficult have those problems made it for you to Do your work, take care of things at home, or get along with other people?

☐ Not difficult at all ☐ Somewhat difficult ☐ Very difficult ☐ Extremely difficult

Appendix J

National Institutes for Health Stroke Scale (Items 1a-3)

Appendix K

National Institutes for Health Stroke Scale (Items 4-9)

Appendix L

National Institutes for Health Stroke Scale (Items 10-11)

Dysarthria

Instructions

Dysarthria:
If patient is thought to be normal, an adequate sample of speech must be obtained by asking patient to read or repeat words from the attached list. If the patient has severe aphasia, the clarity of articulation of spontaneous speech can be rated. Only if the patient is intubated or has other physical barriers to producing speech, the examiner should record the score as untestable (UN) and clearly write the explanation for this choice. Do not tell the patient why he/she is being tested.

10

Scale Definition

0 **Normal.**

1 **Mild-to-moderate dysarthria;** patient slurs at least some words and, at worst, can be understood with some difficulty.

2 **Severe dysarthria;** patient's speech is so slurred as to be unintelligible in the absence of or out of proportion to any dysphasia, or is mute/anarthric.

UN **Intubated** or other physical barrier, explain:

Score

11

Instructions

Extinction and Inattention (formerly Neglect): Sufficient information to identify neglect may be obtained during the prior testing. If the patient has a severe visual loss preventing visual double simultaneous stimulation, and the cutaneous stimuli are normal, the score is normal. If the patient has aphasia but does appear to attend to both sides, the score is normal. The presence of visual spatial neglect or anosagnosia may also be taken as evidence of abnormality. Since the abnormality is scored only if present, the item is never untestable.

Extinction and Inattention

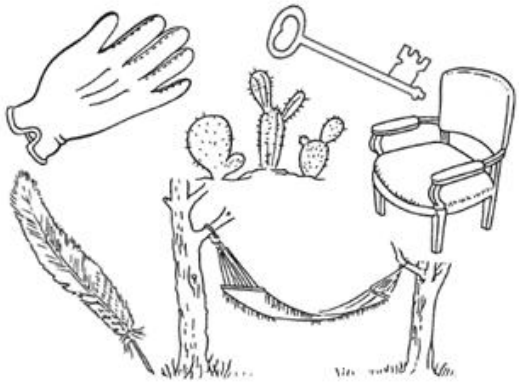
Scale Definition

0 **No abnormality.**

1 **Visual, tactile, auditory, spatial, or personal inattention,** or extinction to bilateral simultaneous stimulation in one of the sensory modalities.

2 **Profound hemi-inattention or extinction to more than one modality;** does not recognize own hand or orients to only one side of space.

Score



You know how.

Down to earth.

I got home from work.

Near the table in the dining room.

They heard him speak on the radio last night.

MAMA

TIP – TOP

FIFTY – FIFTY

THANKS

HUCKLEBERRY

BASEBALL PLAYER

Appendix M

SWOT Analysis

Strengths	Weaknesses
• TJC-certified PSC. • Stroke certified nurses. • Clinical nurse ladder program. • One of the few hospitals with an inpatient BHU and onsite BH providers. • One of the few hospitals with an inpatient ARU.	• Small urban hospital with several neighboring GACHs. • Poor NIHSS compliance by staff. • Lack of a stroke coordinator. • Location (Tenderloin area). • Lengthy process for approval of EHR build requests. • Lack of BH screening measures in the current EHR system.

Opportunities	Threats
• Utilization of BH consults on depressed stroke patients. • Staff nurse III/IVs involvement in QI projects. • Quality improvement on current stroke care processes through the inclusion of PSD screening and intervention(s). • Staff education on PSD etiology, onset, signs and symptoms, treatment, and recovery. • Standardization of depression screening documentation.	• Changes in organizational leadership. • Other designated PSCs and CSCs in the area. • Change fatigue and change resistance at the staff level. • Concurrent Q! projects competing for resources.

`

Appendix N

Pre-live Project Survey Questionnaire

Survey Questions	Disagree	Somewhat Disagree	Neither Agree nor Disagree	Somewhat Agree	Agree	Total	%
Rating Scale	**1**	**2**	**3**	**4**	**5**		
I am comfortable in administering behavioral health screening tools on stroke patients.							
I am comfortable in answering questions from patients and family members as to why behavioral health screening tools are being administered.							
I believe in the value of administering behavioral health screening tools on patients as it relates to stroke patient outcomes.							
I would recommend the use of behavioral health screening tools on stroke patients.							
Total							
At what day after admission do you typically observe behavioral changes (*e.g. irritable, crying spells, socially withdrawn, etc.)* from stroke patients? Please select one.	□ Did not observe any behavioral changes. □ Same day after admission. □ 1 day after admission. □ 2 days after admission.				□ 3 days after admission. □ 4 days after admission. □ 5 days or more after admission. Please specify: ___		
Have you ever reported to a provider that a post-stroke patient may require a behavioral health consult or intervention?	□ Yes □ No						
Comments:							

Appendix O

Post-live Project Survey Questionnaire

Survey Questions	Disagree	Somewhat Disagree	Neither Agree nor Disagree	Somewhat Agree	Agree	Total	%
Rating Scale	**1**	**2**	**3**	**4**	**5**		
I am comfortable in administering behavioral health screening tools on stroke patients.							
I am comfortable in answering questions from patients and family members as to why behavioral health screening tools are being administered.							
I believe in the value of administering behavioral health screening tools on patients as it relates to stroke patient outcomes.							
I would recommend the use of behavioral health screening tools on stroke patients.							
Total							

Have you ever reported to a provider that a post-stroke patient may require a behavioral health consult or intervention?	□ Yes □ No	
At what day after an intervention (e.g. antidepressants, brief psychotherapy, etc.) had been initiated did you observe improvement in the patient's behavior? Please select one.	□ Did not observe any improvement in behavior. □ Same day. □ After 1 day. □ After 2 days	□ After 3 days. □ After 4 days. □ 5 days or more after intervention has been started. Please specify: ___
Comments:		

Appendix O

Staff Survey Results

Pre-Live Survey Results
Duration: 4 weeks **Number of Respondents:** 76

	1	%	2	%	3	%	4	%	5	%
I am comfortable in administering behavioral health screening tools on stroke patients.	5	6.57	8	10.52	11	14.47	30	39.47	22	28.94
I am comfortable in answering questions from patients and family members as to why behavioral health screening tools are being administered.	4	5.26	7	9.21	12	15.78	28	36.84	25	32.89
I believe in the value of administering behavioral health screening tools on patients as it relates to stroke patient outcomes.	0	0	0	0	0	0	33	43.42	43	56.57
I would recommend the use of behavioral health screening tools on stroke patients.	0	0	0	0	5	6.57	39	51.31	37	48.68
Have you ever reported to a provider that a post-stroke patient may require a behavioral health consult or intervention?	**Yes**	23	**%**	30.3			**No**	53	**%**	69.7
At what day after admission do you typically observe behavioral changes (*e.g. irritable, crying spells, socially withdrawn, etc.)* from stroke patients? Please select one.										

Never	%	Same day	%	After 1 day	%	After 2 days	%	After 3 days	%	After 4 days	%	After 5 days or >	%
0	0	4	5.26	5	6.57	17	22.36	36	47.36	10	13.15	4	5.26

Post-Live Survey Results
Duration: 4 weeks **Number of Respondents:** 82

	1	%	2	%	3	%	4	%	5	%
I am comfortable in administering behavioral health screening tools on stroke patients.	3	3.65	2	2.43	8	9.75	30	36.58	39	47.56
I am comfortable in answering questions from patients and family members as to why behavioral health screening tools are being administered.	2	2.43	2	2.43	11	13.41	28	34.14	39	47.56
I believe in the value of administering behavioral health screening tools on patients as it relates to stroke patient outcomes.	0	0	0	0	0	0	39	47.56	43	52.43
I would recommend the use of behavioral health screening tools on stroke patients.	0	0	0	0	3	3.65	38	46.34	44	53.65
Have you ever reported to a provider that a post-stroke patient may require a behavioral health consult or intervention?	**Yes**	25	**%**	30.48			**No**	57	**%**	69.51
At what day after an intervention (e.g. antidepressants, brief psychotherapy, etc.) had been initiated did you observe improvement in the patient's behavior? Please select one.										

Never	%	Same day	%	After 1 day	%	After 2 days	%	After 3 days	%	After 4 days	%	After 5 days or >	%
0	0	8	9.75	6	7.31	19	23.17	34	41.46	12	14.63	3	3.65

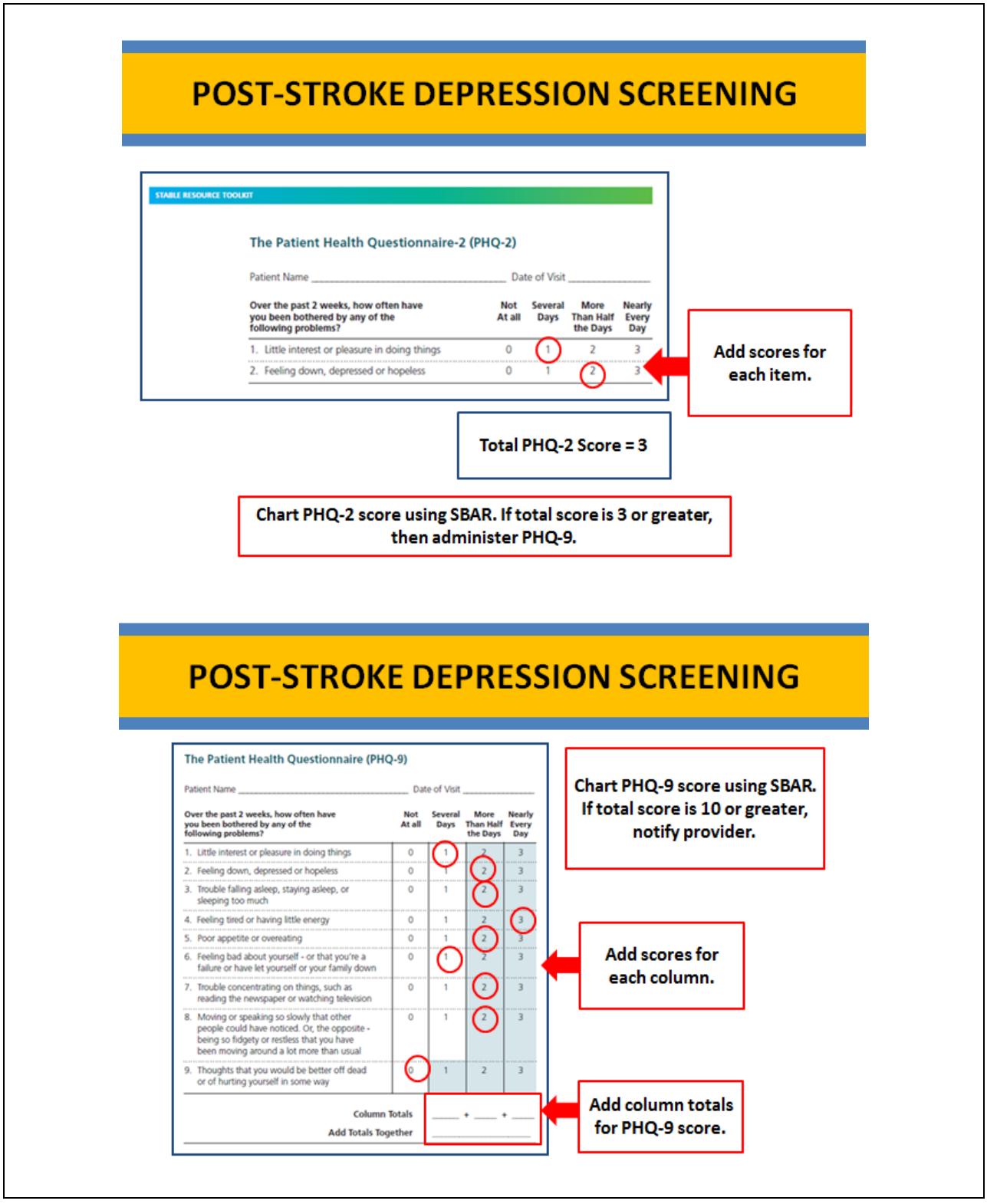
Appendix P

Screening and Intervention Results

Testing (1 Month)									
Stroke Care Unit	**# of Stroke Patients**	**Pre-PSD Screening NIHSS**	**# of PHQ-2 Score > 3**	**# of PHQ-9 Score > 10**	**# of (+) PSD Intervention**	**# of FALL**	**Average LOS**	**Pre-DC NIHSS**	**# of Readmits**
ED	3	N/A	0	0	0	0	No data	N/A	0
ICU	3	N/A	0	0	0	0	6.2	N/A	0
MSU	5	N/A	0	0	0	0	4.9	N/A	0
ARU	4	16	1	0	0	0	10.1	12	0
Project Live Month 1									
Stroke Care Unit	**# of Stroke Patients**	**Pre-PSD Screening NIHSS**	**# of PHQ-2 Score > 3**	**# of PHQ-9 Score > 10**	**# of (+) PSD Intervention**	**# of FALL**	**Average LOS**	**Pre-DC NIHSS**	**# of Readmits**
MSU	4	N/A	0	0	0	0	5.2	N/A	0
ARU	6	14	1	0	0	0	10.2	12	0
Project Live Month 2									
Stroke Care Unit	**# of Stroke Patients**	**Pre-PSD Screening NIHSS**	**# of PHQ-2 Score > 3**	**# of PHQ-9 Score > 10**	**# of (+) PSD Intervention**	**# of FALL**	**Average LOS**	**Pre-DC NIHSS**	**# of Readmits**
MSU	5	18	1	1	1	0	5.0	13	0
ARU	5	15	1	1	1	0	10.6	12	0
Project Live Month 3									
Stroke Care Unit	**# of Stroke Patients**	**Pre-PSD Screening NIHSS**	**# of PHQ-2 Score > 3**	**# of PHQ-9 Score > 10**	**# of (+) PSD Intervention**	**# of FALL**	**Average LOS**	**Pre-DC NIHSS**	**# of Readmits**
MSU	4	N/A	2	0	0	0	6.2	N/A	0
ARU	3	15	1	1	1	0	10.2	10	0
MSU Results Summary									
Stages	**# of Stroke Patients**	**Pre-PSD Screening NIHSS**	**# of PHQ-2 Score > 3**	**# of PHQ-9 Score > 10**	**# of (+) PSD Intervention**	**# of FALL**	**Average LOS**	**Pre-DC NIHSS**	**# of Readmits**
Test	5	N/A	0	0	0	0	4.9	N/A	0
Month 1	4	N/A	0	0	0	0	5.2	N/A	0
Month 2	5	18	1	1	1	0	5.0	13	0
Month 2	4	N/A	2	0	0	0	6.2	N/A	0
ARU Results Summary									
Stages	**# of Stroke Patients**	**Pre-PSD Screening NIHSS**	**# of PHQ-2 Score > 3**	**# of PHQ-9 Score > 10**	**# of (+) PSD Intervention**	**# of FALL**	**Average LOS**	**Pre-DC NIHSS**	**# of Readmits**
Test	4	16	1	0	0	0	10.1	12	0
Month 1	6	14	1	0	0	0	10.2	12	0
Month 2	5	15	1	1	1	0	10.6	12	0
Month 2	3	15	1	1	1	0	10.2	10	0

Appendix Q

Training Handouts



Appendix R

Betty Neuman's System Model

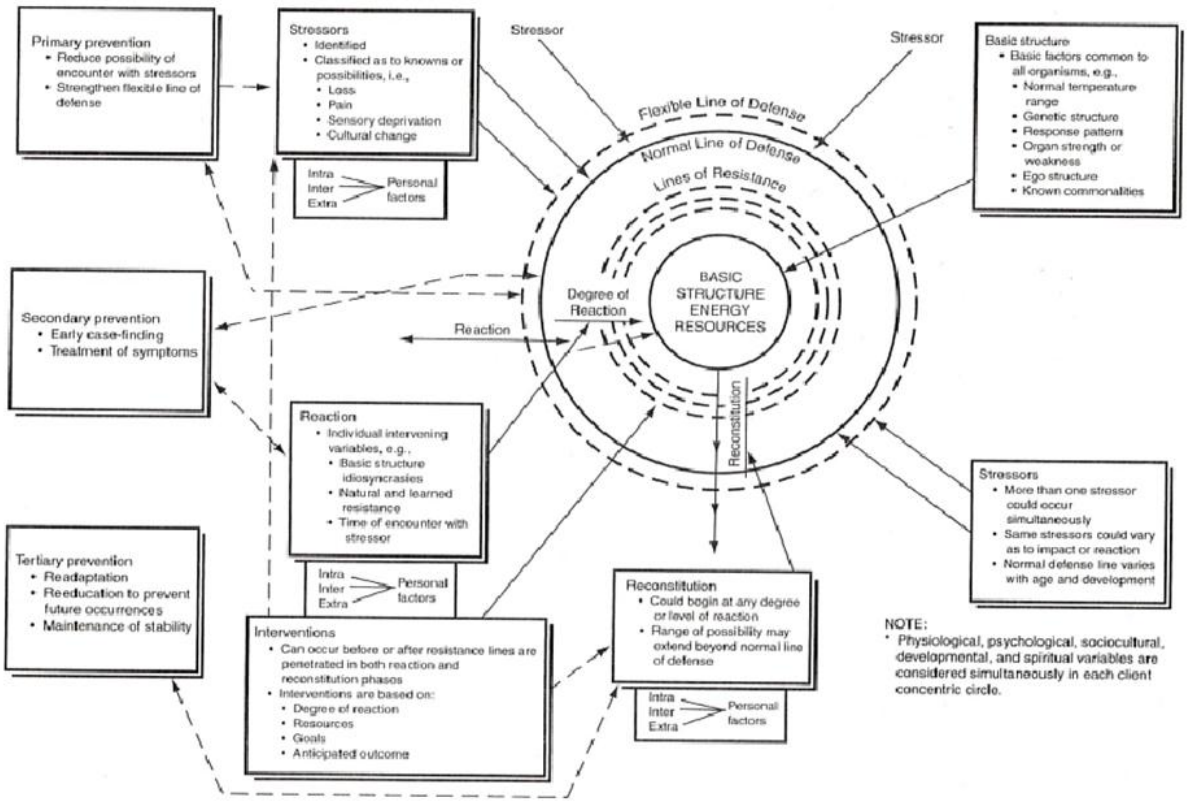


FIGURE 1-3. The Neuman Systems Model. *(Original diagram copyright © 1970 by Betty Neuman.)*

Appendix S

Evidence Table

Citation	Conceptual Framework	Design / Method	Sample / Setting	Major Variables	Measurement	Data Analysis	Findings	Appraisal: Worth to Practice
Lincoln et al. (2003) The validity of questionnaire measures for assessing depression after stroke	Consistency of psychiatric diagnosis in stroke patients.	Pre and post intervention survey design.	123 recruited stroke patients from hospital wards and community.	SCAN = Schedules for Clinical Assessment in Neuropsychology	Self-assessment scores using the Beck Depression Inventory (BDI), Wakefield Depression Inventory (WDI), and General Health Questionnaire 28 (GHQ-28).	Cross-sectional correlational study between questionnaire measures of mood and psychiatric interview; Likert scales.	ICD-10 criteria resulted in poor agreement between classifications (kappa=0.39). Questionnaires were highly significant to each other (r_s=0.48-0.58, all p≤0.001).	Further assessment is necessary before it is assumed that a person is diagnosed as suffering from depression as need to be developed with higher specificity to facilitate for depression after stroke.
Bose et al. (2012) Analyzing Post Stroke Depression Levels in Stroke Patients Using Zung Self-Rating Depression Scale	Identification of post-stroke depression at an early stage to enhance outcomes.	Pre and post intervention survey design.	100 participants who first had first ever stroke attack and completed at least 2 weeks after the attack. Age range between 55-75 years old.	GCS=Glascow Coma Scale MCA=Middle Cerebral Artery	Self-assessment score using the Zung Self Rating Depression Scale.	Cross-sectional analysis, Likert scales, Chi square test with Pearson's correlation.	Depression levels were found to be significantly higher in right sided stroke patients ($p<0.05$).	Findings provided valuable information regarding the importance of identifying depression levels in stroke pstients before resuming any kind of therapy of rehabilitation process.
Cinamon et al. (2010) Preliminary evidence for the development of a stroke specific geriatric depression scale	Importance of using a tool with a mathematically valid index to screen for post-stroke depression.	Pre and post intervention survey design.	91 participants interviewed over three time points or 240 interviews.	GDS=Geriatric Depression Scale MHS=Mental Health Scale	Self-assessment score using the Geriatric Depression Scale (SS-GDS) through Rasch Methodology.	Secondary analysis of a randomized control trial post-stroke. T-test	GDS data misfit (DF:90; x^2: 225.59; p<0.001). Model resulted with the deletion of three item fit intervals.	Findings provided a mathematically valid index to screen for depression and important practical applications for the care of stroke survivors.
Lee et al. (2007) The smiley as a simple screening tool for depression after stroke: A preliminary study	Clinical utility of smiley picture in detecting depression after stroke (DAS)	Cross-sectional study, personal interview at 1 month during post-stroke follow-up.	235 stroke patients at one-month follow-up after first-ever ischemic stroke at a rehabilitation unit or outpatient clinic.	DSM I=Diagnostic and Statistical Manual IV GDS=Geriatric Depression Scale	Staff interview and self-assessment	Descriptive analysis	Kappa's value was highly significant between DSM groups and GDS (Kappa=0.597) and the emoticon (Kappa=0.531).	Supports the use of a simple visual aid language independent tool to facilitate early detection of DAS.
Hart et al. (2008) Screening for depression after stroke: an exploration of professional's compliance with guidelines	Theory of planned behavior as applied to health care.	Pre and post intervention survey design.	75 health care professional in 16 stroke units.	Intenders=those who intended to use screening Non-intenders=those who did not intend to use screening	Self-assessment, postal questionnaire with closed and open questions.	Qualitative data analysis, Kendsull's tau correlations set between 0.50 and 0.78 (moderate stability).	Responses were low, but the 75 returns demonstrated poor compliance for screening, despite positive attitude towards it.	Findings suggested the inclusion of individual and organizational factors associated with screening in enhancing compliance.
Lewin et al. (2013) The influence of self-efficacy, pre-stroke depression and perceived social support symptoms during stroke rehabilitation	Predictive value of psychological factors for the emergence of depressive symptoms in the acute phase of stroke.	Pre and post intervention survey design.	96 participants who have had ischemic stroke, inclusion criteria include 1) at least 4 weeks after stroke onset, 2) sufficient verbal comprehension, 3) no severe comorbidities, and 4) at least 8 years of education.	ADL=Activities of Daily Living GDS=Geriatric Depression Scale GSES=Generalized Self Efficacy Scale MMSE=Mini Mental Status Examination SSEQ=Stroke Self Efficacy Questionnaire	Self-assessment score using the GDS, GSES, and SSEQ	Correlational analysis, Durbin-Watson test	Low levels of depressive symptoms were associated with high levels of general self-efficacy (r=-.64, p=.00). Cognitive function and depressive symptoms disappeared (β=-.13, p=.13) when general self-efficacy was entered into the equation (β=-.59, p=.00).	Findings suggest considering psychological factors in assessing depressive disorders for prevention of PSD.

Appendix T

Cost Savings Table

PSD PATIENTS IN THE MSU WHO RECEIVED PHARMACOLOGIC INTERVENTION							
	MEDI-CAL DRG			PROJECT SITE			
	LOS	DRG BASE	RATE/DAY	# (+) CASES	MSU LOS	Δ LOS	SAVINGS
MONTH 1	7.65	$17415	$2276.47	0	N/A	N/A	N/A
MONTH 2	7.65	$17415	$2276.47	1	5.0	2.65	$6032.64
MONTH 3	7.65	$17415	$2276.47	0	N/A	N/A	N/A
PSD PATIENTS IN THE ARU WHO RECEIVED PHARMACOLOGIC INTERVENTION							
	MEDI-CAL DRG			PROJECT SITE			
	LOS	DRG BASE	RATE/DAY	# (+) CASES	MSU LOS	Δ LOS	SAVINGS
MONTH 1	14.75	$10410	$705.76	0	N/A	N/A	N/a
MONTH 2	14.75	$10410	$705.76	1	10.6	4.15	$2928.90
MONTH 3	14.75	$10410	$705.76	1	10.2	4.55	$3211.21
PSD PATIENTS IN THE MSU WHO RECEIVED PHARMACOLOGIC INTERVENTION							
	MEDI-CAL DRG			PROJECT SITE		(MSU LOS X 1.71) – MSU LOS	
	LOS	DRG BASE	RATE/DAY	# (+) CASES	MSU LOS		SAVINGS
MONTH 1	7.65	$17415	$2276.47	0	N/A	N/A	N/A
MONTH 2	7.65	$17415	$2276.47	1	5.0	3.55	$8079.8
MONTH 3	7.65	$17415	$2276.47	0	N/A	N/A	N/A
PSD PATIENTS IN THE ARU WHO RECEIVED PHARMACOLOGIC INTERVENTION							
	MEDI-CAL DRG			PROJECT SITE		(ARU LOS X 1.71) – ARU LOS	
	LOS	DRG BASE	RATE/DAY	# (+) CASES	MSU LOS		SAVINGS
MONTH 1	14.75	$10410	$705.76	0	N/A	N/A	N/A
MONTH 2	14.75	$10410	$705.76	1	10.6	7.526	$5311.54
MONTH 3	14.75	$10410	$705.76	1	10.2	7.242	$5111.11
COST SAVINGS							$30675.2
LESS: ACTUAL DIRECT AND INDIRECT EXPENSES							$1515.25
NET SAVINGS OVER A 3-MONTH PERIOD							$29159.95