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National Institute of Health Stroke Scale (NIHSS) Inter-rater Reliability and Confidence Among NIHSS Certified Nurses: Implementation of a Standardized Patient Simulation

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NATIONAL INSTITUTE OF HEALTH STROKE SCALE (NIHSS) INTER-RATER RELIABILILTY AND CONFIDENCE AMONG NIHSS CERTIFIED NURSES: IMPLEMENTATION OF A STANDARDIZED PATIENT SIMULATION

by

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DEDICATION

This project is dedicated to my husband, Shawn Patrick Boylan, and all my friends, family, and work colleagues who have been supportive throughout the entire project providing encouragement, forgiveness, and enduring love.

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PREFACE

Every year about 800,000 people in the United States have a stroke (CDC, 2015). The NIHSS is the most common acute stroke assessment used by healthcare professionals to assess stroke patients (Andre, 2006). The NIHSS is a 15-item stroke specific tool that is used to evaluate and document neurological status. The score obtained contributes to decision making about treatment, and quantatively tracks neurological changes and outcomes (Dancer, 2002), Today, healthcare professionals learn how to use the NIHSS on a website sponsored by the American Stroke Association or National Institute of Health. This is a 4-hour certification program. This certification program has shown high inter-rater reliability immediately following certification and training, but with limited use in practice and as the passage of time increases, accuracy of NIHSS scores decreases. Thus, as accuracy of the NIHSS scores decrease then inter-rater reliability also decreases (Chiu et al., 2009, Hinkle et al., 2014, Goldstein et al., 1997).

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ABSTRACT

The National Institute of Health Stroke Scale (NIHSS) is the most common stroke assessment used by nurses. Nurses certified on the NIHSS do not consistently demonstrate inter-rater reliability nor are they confident when assessing stroke patients using the tool (Josephson, Hills, Johnston, 2006). This EBP project evaluated a standardized patient simulation for maintaining inter-rater reliability and confidence in NIHSS certified nurses. A literature review showed that a decrease in inter-rater reliability occurs within four weeks to three months of NIHSS certification. A single cohort of intensive care nurses and emergency department nurses used the NIHSS tool in a standardized patient (SP) simulation during three scenarios. The first scenario was followed by a debriefing session in which the participants were instructed on the correct way to perform each of the 15 items on the NIHSS tool. Immediately following the debriefing session the participants scored another standardized patient simulation scenario. Four weeks following the first session, the participants were asked to perform a NIHSS assessment in a virtual simulation scenario. Then three months from the debriefing session, the participants scored the last standardized stroke patient scenario. In addition, all participants filled out a pre-intervention and post-intervention survey that measured how confident they felt about performing the NIHSS. The two primary outcomes measured (a) nurses' confidence when performing the NIHSS on stroke patients, and (b) accuracy of scoring stroke patients correctly as compared to expert scores. The data were analyzed using Descriptive Statistics, Repeated-Measures ANOVA with protected dependent *t* tests, Paired-Sample *t*-Tests and Pearson Correlation Coefficient with SPSS 22. Nurses showed a significantly higher confidence level in performing the NIHSS post-simulation versus pre-simulation. Plus, there was a higher inter-rater reliability among total correct NIHSS scores and among gaze, visual fields, ataxia, language and extinction/neglect in this project at 3 months. These findings support that standardized patient simulation with debriefing may provide an educational strategy to help maintain inter-rater

reliability and confidence especially in harder to score items of the NIHSS such as visual fields, ataxia, language and extinction/neglect.

CHAPTER 1

INTRODUCTION

Background

Stroke is the leading cause of disability and the fourth leading cause of death in America. Stroke consistently ranks as one of the top admitting diagnosis in hospitals around the world (Fonarow, 2014). Due to the aging population, it is projected that the prevalence of stroke will increase by 3.4 million people or 4% of the population by 2030 (Powers, 2015). Stroke cost more than 10% of the Medicare budget and greater than 1.7% of the health expenditure in the United States. Total stroke-related costs are expected to triple by 2030 from 71.55 billion to 184.13 billion (Fonarow, 2014).

The Joint Commission (JC) is an accreditation and certification organization that is recognized nationwide as a symbol of quality that reflects a hospitals commitment to meeting certain performance standards in stroke and other health related entities. JC holds a very high expectations on how to become a certified center of stroke excellence; most critical is best practices of care for stroke patients in the hyper-acute phase of the stroke. Recent literature defines the hyper-acute phase of stroke as a very time sensitive process in which every minute lost is affecting patient outcomes thus, the stroke team must work as fast as possible to treat the stroke patient (Fonarow, 2011). The hyper-acute phase of stroke care is the process that occurs in the emergency department when the patient first arrives to the hospital exhibiting signs and symptoms associated with a stroke. Many stroke centers have performed their own gap analysis of the acute process (Powers, 2015). They have found the largest area of improvement typically noted is the extended time it takes to treat a stroke patient with tissue plasminogen activator (tPA). TPA is the only FDA approved treatment for acute ischemic stroke. Also, stroke centers have recognized the lack of accurately assessing stroke patients using the National Institute of Health Stroke Scale (NIHSS). The goal for stroke patients coming to the emergency

department is for initial evaluation and assessment, and treatment of tPA to be complete within 60 minutes from the time the patient arrives in the emergency department. Currently, The Joint Commission (JC) recommends less than 60-minute treatment times from door to drug with tissue plasminogen activator (tPA). However, starting in 2016 the requirements for stroke centers' time to tPA will be that at least 50% of all AIS patients need to be treated in less than 45 minutes. Many hospitals take over 75 minutes to treat a stroke patient due to the emergency staff waiting for neurology to do the neurological assessment (Powers, 2015). The neurological bedside assessment that is needed before correct treatment can be decided is the National Institute of Health Stroke Scale (NIHSS). Since the emergency department nurse is the first health care provider that interacts with the stroke patient, it is reasonable that the emergency department nurse would be responsible for obtaining the NIHSS on all patients exhibiting signs and symptoms associated with a stroke. The NIHSS is the standardized stroke assessment that healthcare professionals use to assess stroke patients (Gohan, S & Fisher, 2008). This 15-item stroke specific tool is used to evaluate and document neurological status, contribute to decision-making about treatment and provide a baseline measure of stroke severity. It also ensures accurate communication between all healthcare providers about the patient's neurological status. The NIHSS is an important part of all stroke centers' processes when deciding to treat an acute ischemic stroke patient with the intravenous tissue plasminogen activator (Lyden, et al., 2001) or endovascular therapy (Powers, 2015). Historically, it has been the emergency physician or neurologist that has been responsible for performing the NIHSS when a stroke patient arrives in the emergency department (ED) (Lyden, et al, 2009). The Joint Commission requires that stroke centers obtain the NIHSS score on every stroke patient at arrival to the ED, at 24 hours of admission and before discharge from the acute care hospital. (The Joint Commission, 2015). The NIHSS has shown to be difficult to replicate correctly between different health care providers, which makes accurate assessment of outcomes unreliable. Thus, it is important that every healthcare provider be trained and able to

demonstrate competence when performing the NIHSS. Currently, the goal of many stroke centers is to train emergency department nurses on the NIHSS using a free three-hour on-line certification program sponsored by the American Stroke Association. However, the evidence shows that nurses' lack consistency in using the NIHSS tool so neurological assessments reliability may not be accurate.

Statement of the problem

The problem that this evidence-based practice (EBP) project addressed is the lack of competence and confidence with nurses using the NIHSS tool. Research has demonstrated that individuals certified on the NIHSS do not consistently demonstrate reliability when scoring patients from one health care professional to the next (Kiencke, 1998). Thus, the inter-rater reliability is low, which contributes to inaccurate NIHSS scores, which may affect proper stroke treatment (Kiencke, 1998). The objective of the EBP is to develop an educational process to maintain nurses' inter-rater reliability and confidence when performing the NIHSS.

Data from the literature supporting the need for the project

A thorough neurological assessment of patients experiencing acute stroke is critical for accurate diagnosis, treatment, and care throughout hospitalization. Published guidelines for the early management of patients with ischemic stroke detail the goals associated with early care, including observation for changes in patients' neurological condition that might require prompt treatment and the facilitation of measures aimed at improving outcomes of patients (Jauch, et. al, 2013). Consistent use of a standardized assessment tool designed for stroke patients assists in the achievement of these goals but trained healthcare providers is critical. The National Institute of Health Stroke Scale (NIHSS) is a well-validated, reliable scoring system for use specifically with stroke patients (Lyden, et. al, 1999). It consists of 15 elements that reflect the wakefulness, vision, and motor, sensory, and language function of stroke patients. The NIHSS provides a numerical value for comparisons from one period to the next. Despite evidence that the NIHSS is reliable and valid there is some reluctance to adopt this scale

because users view it as too complicated. (Richardson, Murray, House, & Lowenkopf, 2006). However, the main issue is that healthcare professionals that use the NIHSS have shown significantly poor inter-rater reliability in scoring on several of the items on the scale, particularly the questions for ataxia, dysarthria, and neglect (Lyden, Lu, Levine, Brott, & Broderick, 2001). Other researchers have found that the items rating facial paresis and limb ataxia have consistently found to be the least reliable between raters in one study (Gohan et. al., 2008). A criticism of the tool is that some cite a "hemispheric bias" within the NIHSS, because 7 of the points on the scale are directly related to measurement of language (a left hemisphere function) and only 2 points related to neglect (a right hemisphere function) (Jauch et al, 2103). However, many of the components of the NIHSS are part of the standard neurological assessment and it is the best tool available for stroke care experts today, but training is required for reliable use of the tool (Hinkle, 2014).

The inter-rater variability of users decrease with certification and on-going education (O'Farrell & Yong Zou, 2008), but the effect of some training was short lived if users did not use the tool on a regular basis in their daily work (Richardson et. al. 2006). The reliabilities of the individual items that compose the NIHSS have been studied extensively, both with videotape simulation and with live patients. There have been studies that have examined NIHSS scoring of patients 3 months after certification in which as the magnitude of time increased, the reliability of raters decreased, the so-called "drift effect" (Goldstein & Samsa, 2001, p. 1). Thus, not only adequate training of the raters is important to maintain inter-rater reliability but also regular exposure to performing the scale is necessary. NIHSS discrepancies in inter-rater reliability achieved among untrained and trained raters are alarming. One study demonstrated that even within the same department at the same hospital with raters trained together showed only fair reliability after time had lapsed from initial training when no opportunity to use the NIHSS was given. In fact, a substantial difference of greater than 4 points between raters was observed in

this study (Kiencke, 2008). The difference of just one point on the NIHSS can change a treatment decision for a stroke patient.

As with any nursing skill, practice is important. It is well established that if nurses are able to use a certain skill on a regular basis they can become experts with that skill (Gocan et. al, 2008). However, if that skill is not reinforced after initial training then competency suffers, as well as the nurse's confidence to perform that skill. O'Farrell (2008) found that a nurse's confidence increased immediately after being trained in the NIHSS, and then decreased at 3 months. In addition, it is important for nurses to recognize how often the NIHSS is being used in practice and if regular exposure is not available then a refresher class or more extensive training should be implemented to increase the nurse's confidence and competence with the assessment tool.

Data from the clinical agency supporting the need for the project

This Evidenced Based Practice (EBP) project was implemented at one of the largest telestroke programs in Indiana. The telestroke program's mission is to provide quality stroke health services to all who entrust their care to them and work to improve the health of the communities they serve. As part of their mission and vision, quality is the telestroke programs fundamental values. The telestroke program serves over 15 counties, representing over a half million people. Over 14% of these people are over 65 years of age (Indiana State census, 2015). The risk of stroke is four times more likely over the age of 65 (Powers, et. al, 2015). Based on this percentage, the telestroke network has the potential to care for 70,000 people annually having a stroke or with some other stroke related complication.

The telestroke network's vision encourages innovation in patient care, research activities, and advanced telemedicine applications. The telestroke program offers the expertise of neurologist "virtually" to all stroke patients in "real time" who arrive in participating rural and small community hospitals in the TriState region of Northeastern Indiana, Northwestern Ohio and Southern Michigan. The telestroke network averages 1100 calls a month. There has been

a 400% growth in telestroke calls since 2010. The transfer rate from within the telestroke network has increased 6% from 2013 to 2014 (B. Fey, Personal Interview, May 20, 2015). This number is expected to go up with the new release of research for stroke endovascular treatments. There are two primary stroke certified hub hospitals and 23 spoke hospitals, of which only 4 are primary stroke certified. Both hub hospitals have been certified as a Joint Commission primary stroke center since 2005. The hub hospitals offer comprehensive stroke care including endovascular therapy for acute ischemic stroke (AIS) patients. In 2014, the two hub hospitals of the telestroke program discharged over 1300 patients with the diagnosis of Acute Ischemic Stroke (AIS) from their hospitals.

The telestroke network implemented a new policy for nurses in 2015. Supervisors and other key nurses were required to be certified in the NIHSS by June 30, 2015. The decision was made that these nurses will be responsible for performing the NIHSS within 15 minutes of patient arrival to the ED or within 15 minutes from when a stroke code is called in house. The stroke coordinators, emergency department manager and physicians were concerned that nurses will not have the exposure to stroke patients on a regular basis to keep their NIHSS competency current. In smaller telestroke hospitals, they may only have 2 strokes a month come into the ED, so this limits the opportunity for all nurses to use the NIHSS on a regular basis.

The telestroke network was looking for an NIHSS educational program that would keep nurses confident and competent long term once they become NIHSS certified. At the start of the EBP project implementation, there were 20 nurses certified at each hub hospital and over 50 nurses throughout the 25 telestroke spoke hospitals. Each nurse became “certified” by the AHA/ASA on-line certification examination that took approximately 3 hours to complete. The nurses were paid for their time to become certified. The American Heart Association/American Stroke Association certification program is free and on-line so the initial training on the NIHSS is relatively easy to implement however, putting together a program that will keep the nurses

confident and competent after initial training was the concern of the telestroke network coordinator. That is what this EBP project addressed.

Purpose of the EBP project

The purpose of the EBP project was to develop an educational process for maintaining inter-rater reliability and confidence when performing the NIHSS after initial certification is obtained by nurses. It was anticipated that nurses would demonstrate consistent and reliable NIHSS assessments regardless of the time that has lapsed from initial certification because this project will provide an educational platform that can be easily used as needed.

Identify the compelling clinical question

What is the effect of a NIHSS simulation education plan on the inter-rater reliability and confidence of the NIHSS certified nurse?

PICOT format

In nurses with NIHSS certification, what is the effect of NIHSS standardized patient (SP) simulation education on maintaining competence and inter-raters reliability, compared to expert raters' NIHSS scores within 3 months?

Significance of the project

Nursing neurological assessment practices can vary widely between colleagues on a given unit, or between health care institutions (Gocan, 2008). Utilization of the NIHSS provides a reliable, standardizes approach and has been identified as an important element in evidence-based stroke care (Jauch, 2013). The ability of nurses to accurately and confidently use the NIHSS whenever the opportunity arises is critical. Andre' (2002), found that the NIH stroke scale is unreliable in untrained staff and almost 50% of participants in his study had at least 2 point mistakes in their scoring of stroke patients and 14 of the participants had over a 6 point mistake in their scores. These results are enough to inappropriately exclude patients from treatment. Therefore, it is paramount that nurses be able to identify stroke symptoms. Swift

accurate use of the NIHSS is critical to facilitate possible treatment and measure outcomes of stroke patients.

CHAPTER 2

THEORETICAL FRAMEWORK AND REVIEW OF LITERATURE

In this Chapter, the DNP student will discuss the theoretical framework and EBP model used for the project. In addition the review of literature will be discussed here.

Theoretical Framework

The theoretical framework used for this EBP project is Benner's Stages of Clinical Competence. In the acquisition and development of a skill, a nurse passes through five levels of proficiency: novice, advance beginner, competent, proficient and expert (Benner, 1985). The five stages can be defined as the following:

- Stage 1: The novice or beginner does not have experience in the situations in which he/she is expected to perform. They lack confidence to demonstrate safe practice and requires continual verbal and physical cues. The nurse is unable to use discretionary judgment,
- Stage 2: The advance beginner demonstrates marginally acceptable performance because the nurse has had prior experience in actual situations, there is efficient and skillful parts of their practice area, requiring occasional supportive cues. Knowledge is developing,
- Stage 3: Nurses who have had a specific skill for two or three years demonstrate competence. The nurse is able to demonstrate efficiency, and has confidence in his/her actions. Assessments and tasks are completed within a suitable time frame with supporting cues,
- Stage 4: The proficient nurse perceives situations as a whole. Proficient nurse learns from experiences. The proficient nurse decisions are less labored because he/she now has a perspective on which of existing aspects are the most important.

- Stage 5: The expert nurse has an intuitive grasp on each situation. The expert nurse operates with a deep understanding of total situation and performs highly proficient and has the analytic ability.

Application of the theoretical framework. This EBP project will include a tool that will measure nurses' confidence in performing the NIHSS. The tool is called the National Institute of Health Stroke Scale Self-assessed competency of neurological assessment techniques (Gocan, 2004). The tool categorized different parts of the NIHSS asking a question about each section. The participating nurses will answer each question as it relates to each item of the NIHSS based on Patricia Benner's novice to expert theory. The participants will respond either novice, advanced beginner, competent, proficient or expert. Since certified nurses in this EBP project have either recent certification or minimal recent experience in performing the NIHSS, Benner's five levels of competence can be applied to nurses learning how to perform the NIHSS. The goal was to understand which items of the scale nurses feel less confident in performing before and after the EBP project intervention. The categories and definitions used in this self- assessment are as follows and the nurses will answer accordingly:

- The novice will have marginal understanding and minimal clinical experience. In addition they will seek assistance in performing the particular item of the NIHSS.
- The advance beginner has conceptual understanding, minimal clinical experience, but limited exposure to clinical situations however is able to identify normal findings.
- The nurse will respond to herself as a competent nurse if she has a conceptual understanding and has performed the skill regularly. She is able to prioritize under stable conditions.
- The proficient nurse will have had more exposure to performing the NIHSS item. The nurse is able to anticipate potential assessment changes.

- The nurses will mark “Expert” if they see themselves having extensive exposure with deep understanding of the NIHSS item. They will rapidly change priorities under all conditions.

This EPB project provides a NIHSS simulation education intervention that offers practice and debriefing so that the nurses may move from novice to expert.

Strengths and Limitations of theoretical framework. This EBP project is an educational intervention and Benner’s model has been used in nursing education since 1985 (Benner, 1985). The DNP student believes this theoretical framework is well suited for his EBP project. Nursing schools for many years have used Benner’s stages of clinical competence. It has been used in building clinical ladders for nurses, developing mentorship programs and development of clinical simulation protocols (Benner, 2011), all which have shown to aid in the development of competency and confidence required in nursing practice (Lawel, 2006). The limitations of Benner’s model include unclear definitions in some of the stages. In addition, Benner’s model is often criticized for its simplistic approach to a very complicated aspect such as nursing competence.

Evidence Based Practice model

The EBP model chosen for the EBP project is the Stetler Model of Research Utilization. This is a well-established model with more than 1000 citations noted in the literature since 2001 (Romp & Kiehl, 2013). The model fits well into this EBP project because it provides a framework for utilization of research that can aid and direct education interventions for maintaining competence and confidence in nursing skills.

Description of the EBP model. Stetler defines the model to be a series of critical thinking steps design to buffer the potential barriers to objective, appropriate and effective utilization of research findings (Stetler, 2001). In addition the 2001 version of the model concepts are fully integrated to facilitate EBP according to Stetler (2001). The Stetler Model of Research Utilization is a five-phase process used for organizing a research utilization project: 1)

phase 1: preparation, 2) phase 2: validation, 3) phase 3: comparative evaluation/decision making, 4) phase 4: translation/application, and 5) phase 5: evaluation. The Stetler model helps practitioners and institutions assess how findings and other relevant evidence can be applied to practice. This model examines how to use evidence to create formal change within the organization as well how individuals can use research on an informal basis as part of critical thinking and reflective practice (Stetler, 2001). The Stetler model links research use, as a first step, with evidence practice. The model is based on the following assumptions:

1. The formal organization may or may not be involved in the an individual's use of research or other evidence,
2. Use may be instrumental, conceptual and/or strategic,
3. Other types of evidence and/or non-research related information are likely to be combined with research findings to facilitate decision-making and problem-solving,
4. Internal or external factors can influence an individual's or group's view and use of evidence,
5. Research and evaluation provide probabilistic information, not absolutes,
6. Lack of knowledge and skills pertaining to research use and evidence-informed practice can inhibit appropriate and effective use (Stetler, 2001).

In addition, key organizational elements needed to support evidence practice at the organizational level include leadership's support for an evidence based practice culture, capacity to engage in evidence based practice, including an effective implementation framework, and infrastructure to support and maintain a culture of evidence based practice and related activities. Also, the Stetler model outlines criteria to determine the desirability and feasibility of applying a study or studies to address an issue. The criteria for this include: a) substantiating the evidence, b) current practice as it relates to the need for change, c) fit of the evidence for the institution or setting, and d) feasibility of implementing the research findings

such as risk/benefit assessment, availability of resources, and stakeholder readiness (Stetler, 2001).

The Stetler Model of Research Utilization provides a deliberate, systematic and continuous evaluation process, during which internal evidence is identified, collected, fed back to nurses and used to enhance application of findings. Thus, this model is an ideal framework for an EBP project.

Application of EBP model to EBP project. Each phase of the Stetler Model guides the practitioner in organizing research literature to answer a question (Stetler, 2001). Therefore, before beginning to organize the literature, there must be a question. In phase 1: preparation, the PICOT format was used to identify a specific question for literature review. The PICOT format clarifies and organizes the population, intervention of interest, comparison of interest, outcome of interest and time frame of evaluation (Melnyk & Fineout-Overholt, 2011). In this EBP project the following PICOT was written:

P-What is the population? Nurses with NIHSS certification,

I-What is the intervention of interest? Simulation education for NIHSS certified nurses,

C-What is the comparison of interest? Expert NIHSS raters and nurse's interrater scores,

O-What is the outcome of interest? Nurse's confidence and competence using NIHSS,

T- what is the time frame evaluated? 3 months.

Specifically, nurses certified in the NIHSS more likely to show increase confidence in using the NIHSS tool to assess stroke patients as well as have the same scores as expert raters, and are their scores similar to each other when giving the opportunity to use a simulation education platform? The reason for this EBP project is related to conversations that the DNP student had with the stroke leaders at implementation sites. Physicians were complaining on a regular basis about nurses that perform the NIHSS regularly scoring the stroke patients incorrectly, thus leading to delay in treatment as well frustration among nurses and doctors alike. Due to

the low volume of stroke patients presenting to smaller telestroke facilities this was especially problematic. Nurses were not able to utilize their NIHSS skills on a regular basis; thus, they forget how to perform the assessment. The telestroke programs have limited manpower and resources and were interested in a way to keep the nurses competent in their NIHSS assessment skills, but also wanted something that would be easy for each hospital to implement on their own.

The second phase of the Stetler model involves critiquing the chosen literature with utilization in mind. This phase is called the validation phase. The credibility of the literature is critical in order to implement good evidence into this EBP project. The NIHSS is considered the golden standard for stroke assessment. However, most of the literature discusses how easy it is to use after someone is trained but the research on how to maintain that skills is much more limited. Some department managers in the telestroke hospitals have the belief that once their nurses are certified on the NIHSS there is no more training is needed. Nurse managers are commonly making decisions on what ongoing education is most important to mandate that nurses attend, so validating the literature is critical to get "buy-in" to future NIHSS education. As part of this EBP project a detailed literature search was implemented, which will be discussed in detail under the section entitled *Literature Search*.

Phase three of the model is comparative evaluation/decision making. When synthesizing the literature it is imperative to locally organize and display the summarized finding across all validated sources in terms of their similarities and differences. (Refer to *appraise relevant evidence* section). It is important to determine whether the research on NIHSS training and education is desirable or feasible to apply to practices at hospitals. During the comparative evaluation, the DNP student makes one of four choices: 1) decide to use the research findings, 2) consider use by gathering additional information before deciding to use, 3) delay use since the research may require more research or 4) reject or not use. Phase three of the Stetler model was extremely important because while evaluating which findings were

desirable and feasible to apply to practice, it was essential that the risks involved, the resources necessary and the readiness of the staff be considered. Although implementation of an education program presents very little risk to most stakeholders, there are financial risks to the department budgets. Thus, the administrators at the telestroke hospitals are requiring additional evidence to justify the cost necessary to support and provide more training on the NIHSS.

Phase four of the Stetler model requires the translation/application of the project. The DNP student determines the type, methods and potential use an institution change. The key stakeholders were already in the process implementing several new stroke policies and competencies for their stroke program. The increase in stroke education and other stroke related activities helped create support to the implementation of the EBP project with the nurses.

Within the final phase, the DNP student evaluates the goals and cost of the EBP project. Clarifying expected outcomes relative to the project to key stakeholders is important for this best practice to become part of the expected education for all NIHSS certified nurses. Key stakeholders must understand the results. In addition, there may be value in the institution creating a pilot program to re-evaluate the outcomes of the EBP project. Sometimes, a pilot can provide findings that can be extended to other settings, or whether the techniques should be modified or further piloted, or whether it is not useful at all for the institution. Lastly, formal evaluation of the EBP project adhered to the organizational standards for approval by receiving IRB approval.

Strengths and limitations of the EBP model: Stetler Model

There are several strengths of the Stetler model. It provides a series of steps to assess and use the research to facilitate evidence based nursing practice. The model focuses on critical thinking and guided problem solving. Critical thinking is critical in order not to become task-oriented that can lead to non-evidence based practice. The limitations to the model is

some increase complexity as the model has changed over the years to provide more guidance around critical utilization of concepts, as well as options in applying research to real world.

Literature Search

The literature search on the National Institute of Health Stroke Scale (NIHSS) showed a plethora of research on the validity and reliability of the tool however, research related to when raters start to lose their reliability in scoring stroke patients was not as robust. The most relevant evidence in nursing was found in the Canadian nursing literature using the Canadian Stroke Scale.

Sources Examined for Relevant Evidence. Conducting a literature search must first start with an appropriate formulated question. The PICOT format assists the DNP student in performing a comprehensive, systematic review of the literature in an effort to find the most relevant peer-reviewed evidence.

Search Engines. The search engines used to find relevant evidence included: CINAHL, PubMed, Medline, ProQuest, Joanna Briggs Institute (via JBI COnNECT), ERIC (via EBSCO), and Cochran Library. Searches were completed using a time frame from 1994, in which the NIHSS was first developed to 2015 in all databases. Search results from all databases are depicted in Table 2.1.

Key words. Various combinations of key search words were identified and MeSH headings were used and included: NIHSS, National Institute of Health Stroke Scale, stroke assessment, stroke evaluation, neurological assessment examination, Canadian stroke scale, educate, learn, technique, implement, workshop, competence, self assurance, proficiency, evaluation, inter-rater reliability, nurse, physician, and neurologist.

Inclusion/exclusion criteria. The criteria utilized during the literature search for inclusion and exclusion included: peer-reviewed, English language, all adults and literature published between 1994-2015. Consulting with an expert at VU Christopher Center Library helped the DNP student become further educated in the process of searching literature. This

endeavor provided a more precise list of terms and subject headings to facilitate the comprehensive systematic search necessary to discover relevant evidence for this EBP project. Appropriate keyterms were identified and MeSH headings were utilized.

An initial search on CINAHL yielded 132 results. After adding the keywords “nurse” the results were reduced to 32 and adding “physician” and “neurologist” increased the results to 35. The three added peer-reviewed articles were found to be useful and saved. Out of the 35 articles, 8 were relevant and of those all 8 were synthesized for this EBP project. All other articles were discarded because of their lack of specificity to competence evaluation and no education component. Using the same keywords and limiters in Proquest including nurs*, physician and neurologist in this initial database search had 39 relevant results, but 15 were duplicates. One new article on the Canadian Neurological Scale competency was found to be very helpful so that was saved and used in this EBP project. The remainder of the articles did not offer any components to education or competency of the NIHSS so they were discarded after reading the abstracts. MEDLINE resulted in several duplications and were already reviewed however, there were two articles reviewed from Canadian nursing research that were used for this project. After these two articles were discovered it occurred to the DNP student to add “Canadian neurological scale” to the search of all databases. In CINAHL it yielded another 12 articles to the search but only one was relevant. Proquest and MEDLINE revealed an additional one article that was useful, but others were duplicates. A search in ERIC revealed no results using the keywords. In The Joanna Briggs Institute and Cochrane databases were searched to no avail.

Throughout the literature search, there were duplicates in MEDLINE, Proquest and CINHAL. In addition, many articles did not meet the inclusion criteria. There were many articles on the NIHSS or stroke scales being used in research but most were not relevant to competency or education processes. In total, 11 relevant sources were included for this integrative review.

Level of evidence. Articles chosen for inclusion after review of abstracts and application of inclusion and exclusion criteria were evaluated and appraised using the John Hopkins Nursing Evidence-Based Practice Research Evidence Appraisal and Non-Research Evidence Appraisal tool (JHNEBP). The appraisal tools are used to rate the strength of evidence based on the type of study from Level 1 to Level 5, with Level 1 being the highest quality of research. Each article was appraised with the appropriate, corresponding tool. The research appraisal tool designated Level 1 evidence as experimental studies and meta-analysis. Level 2 evidence is quasi-experimental studies. Level 3 includes non-experimental studies, qualitative studies, and metasynthesis studies. The appraisal tool critiquing non-research type studies includes systematic reviews and clinical practice guidelines as Level 4 evidence. Level 4 evidence in the JHNEBP appraisal tool represents the highest evidence in non-research due the fact that most evidence evaluating in CPG and systematic reviews are based on RCTs. Level 5 is organizational, expert opinion, case study and literature reviews. The same tool also provides a quality of rating each article. Quality scores are categorized as A for high quality research, B for good quality research and C for low quality or major flaws (John Hopkins Nursing Evidence Based Practice, n.d.). After abstract review of all included articles, 11 articles were selected for inclusion to design this EBP project (see Table 2.2). There were three articles found on the subject matter to be Level 1. Three quasi-experimental studies were identified as Level 2 evidence. Five articles were non-experimental in nature and therefore evaluated as Level 3 evidence. All five pieces of evidence in Level 3 were descriptive studies. No Level 4 or Level 5 evidence was included.

Appraisal of Relevant Evidence

After review of abstracts, appraisal of the 11 articles that met the inclusion and exclusion criteria were completed. Appraisal was conducted using a standard tool with a systematic process to assess practicality of evidence in relation to the project topic and goals, and validity

Table 2.1

Studies Obtained from Database

Database	Initial Articles For Review	After Inclusion/exclusion Criteria Applied	Number of Duplicate Articles	Articles Included for Review
CINHAL	35	8	0	8
MEDLINE	42	9	7	2
ProQuest	39	5	4	1
JBI	0	0	0	0
Cochran	0	0	0	0
ERIC	0	0	0	0

Table 2.2

Levels of Evidence

Levels of Evidence	Articles
Level 1	3
Level 2	4
Level 3	4
Level 4	0

Level 5	0

Note. Adapted from John Hopkins Nursing Evidence Based Practice. (n.d.)

of results. Strength and weaknesses of evidence were also identified through the use of the tool (see table 2.3).

Level 1 evidence.

In 1997, Goldstein and Samsa initiated a randomized control trial of 30 physicians and 29 non-physicians evaluating the reliability of the raters after initial NIHSS training. The researchers used NIHSS video training patient examinations. A series of 4 patients were rated initially. After 3 months, the same 4 patients were rerated, providing a measure of intra-observer and inter-observer reliability. An additional series of 4 new patients were rated after another 3 months and with the initial 4 ratings, provided data for assessment of interobserver and intra--observer reliability. Results of the study showed that 28% of the raters had previous experience with the NIHSS, and 22% had training with the video previously. Fifty percent had no previous exposure or training to the NIHSS. The raters were evaluated on all 15 sections of the NIHSS. There were no differences between groups after the initial video training with inter-observer scores immediately after following the training. The coefficients of determination were each greater than .95. However, 3 months after the initial training when participants were ask to reassess the same 4 patient scenarios, the participants that had no previous experience to the NIHSS intra-observer and inter-observer reliability went down to a coefficient of .80. Rating items such as facial paresis and limb ataxia primarily affected the change in the reliability of the observer's scores incorrectly. In addition, the authors noted that it is possible that there is a decrease in reliability when time increases from the last time the rater performed the NIHSS on a patient. The authors refer to this as the "drift effect ". The data demonstrated that reliability of

the NIHSS regardless physician or non-physician can perform the NIHSS rapidly and reliably but periodic recertification or training is necessary.

According to Lyden, Brott, Tilly, Welch et.al. (1994), the NIHSS scores demonstrate improved reliability when raters are trained using video training. The researchers trained and certified 162 investigators during a tPA pilot study. The purpose of this research was to show that video training would minimize the variation between studies sites. This trial was their attempt to standardize the use of the NIHSS and to measure its reproducibility throughout the trial. Lyden, al et. (2001) taped real stroke patients and reviewed the tapes with all investigators. The raters scored 5 patients on the certification exam after the video training. The results of the inter-rater reliability was high after the initial training, but the reliability went down in several of the sections of the NIHSS, including ataxia and language scores after 4 weeks of not scoring any stroke patients. The researchers attributed this to the fact that over half of the participants in the NIHSS training did not review the second NIHSS videotape that was included in the initial training. However, it does suggest that repeated exposure to performing and practicing the NIHSS is critical to maintain reliability of the NIHSS.

Teaching inexperienced nurses to assess neurological function in acute ischemic stroke patients posed challenges for nurse educators in Taiwan. A study by Chiu, Cheng, Sun, Chang et.al (2009) examined the effectiveness of Chinese version of the NIHSS. The researchers used two forms of education to teach the Chinese nurses, interactive computer assisted instruction (ICAI) and instructor-led video learning program (IVLP). The study included 137 nurses from two hospitals with different degrees of neurological nursing experience. The nurses were enrolled and stratified by clinical experience and prior training into two groups. There were 68 nurses assigned ICAI and 61 assigned 61 IVLP. Both groups participated in their assigned training then took a pretest. After 4 weeks each group took a follow up posttest. The results showed that both groups' scores on the assessment of correctness significantly increased ($p=0.00$) after the intervention. However, there was a significant difference between

the experience differences in the two groups (p=0.02). After using one-way ANCOVA analysis, and adjusting for the length of experience in neurological nurses, the results showed that in the second post test, the ICAIs groups scores was significantly higher than that of the IVLP group (p=0.03). In addition, nurses with less experience in neurological nursing preferred the ICAI methods better. The last point the authors note is that in the posttest at 4 weeks, there was a significant decrease in intra-rater reliability in NIHSS scores in both groups. (p=0.04). Again this study demonstrates that there are several good ways to educate on performing the NIHSS, but reliability decreases with time.

Level 2 evidence.

In a study by Charles Andre', MD, he found the NIHSS is unreliable in untrained hands. In this quasi-experimental trial, last year medical students with no NIHSS training volunteered. The NIHSS was presented between 2 stroke lectures, followed by a 30-minute study period. A case from the NIHSS training videotape was presented and the 15 items were scored by 42 volunteer students. The results showed that only 36% of the students scored all the items correctly. Forty-eight percent of the students gave scores that were 2 points off from the correct score and 27% of students scored greater than 6 points off of the correct score which could have lead to an incorrect treatment decision. The main finding in the study is the large number of errors with the use of NIHSS; only about 1/3 of the last year medical students correctly assessed all items. Expertise in the use of the NIHSS is not innate. The author concluded that training programs are strongly recommended and audiovisual materials should be included in that NIHSS training and is repeated when needed.

A meta analysis performed by Hinkle (2014), looking at reliability and validity of the NIHSS in neuroscience nurses found that the NIHSS has been taught in person, with videotapes, DVDs or on the web. Most instruction takes 2-3 hours. Still the best method of learning the scale is debated. However, all forms of training have shown intra and inter-rater reliability. But, she cautions that just because an individual has been educated about the use of

the scale and even received certification does not indicate he/she is competent in the performance of the scale. Her analysis of 5 different studies show this is particularly true when the scale is not used on a day-to-day basis. Hinkle stated that self-assessment of competency of neurological assessment techniques followed by NIHSS simulation may prove to help neurological nurses maintain their competence.

In a quasi-experimental study by Schmulling, Grond and Rudolf (1998), they found that adequate training and regular reinforcement is a prerequisite for reliable use of the NIHSS. They investigated the reliability of the NIHSS as used by trained and untrained raters in 22 stroke patients in major university hospital. Four neurologists at their hospital independently assessed the patient's neurological status. Two raters were experienced in using the NIHSS, video trained, and instructed by the materials for the original tPA trials. The other two raters were inexperienced in the application of the NIHSS and were given no information other than the original NIHSS examination form. There were no instructions on how to handle problematic cases, such as aphasic, comatose and unresponsive patients. To minimize a possible bias from a training or fatigue effect in the patients, untrained and trained raters were assigned random order. To reduce the impact of fluctuation on the patient's neurological status, evaluation had to be performed with a close time window. As would be expected, the untrained raters showed poor inter-rater reliability whereas the trained raters showed substantial inter-rater reliability. The inter-rater reliability between the trained and untrained was alarming with the untrained raters scoring some patients as much as 10 points higher than appropriate. The researchers conclude that even among neurologists that would be expected to know how to assess a stroke patient, when they are not trained adequately on the NIHSS the inter-rater reliability is extremely poor. Without a systematic training program and knowledge of detailed instructions, the NIHSS cannot reliably be applied. Therefore, a standardized use of the NIHSS is mandatory.

A retrospective data analysis of the American Heart Association NIHSS DVD training video found that inter-rater reliability is high between nurse and physicians when obtaining NIHSS certification. The researcher found that all raters struggled with certain items on the NIHSS certification exam, specifically ataxia and aphasia. This is consistent with other findings from previous NIHSS training. In addition, the time that lapsed from the DVD training to trying to obtain certification showed that those raters that waited longer than a week to take the test from learning how to use the scale had poorer inter-rater reliability. The authors concluded that there is probably value in obtaining certification as soon as possible after NIHSS training (Lyden, Brott, Welch, Mascha, Levine, Haley, Grotta, & Marler, 1994).

Level 3 evidence

O'Farrell and Guang (2008), implemented a program using the Canadian Neurological Scale (CNS) on an Acute Care Neuroscience Unit. They developed an educational program that included an opportunity for nurses to practice the assessment and receive feedback so they can confidence with the CNS tool. The main goal of the program evaluation was to assess confidence and perceptions in using the CNS scale. To evaluate the effect of their training workshop and implementation process they used a pre and post self-efficacy survey. Nurses reported moderate to strong that the training was valuable. In addition, before the workshop the nurses were moderately confident with their CNS assessment skills but immediately following the training the nurse's confidence increased immediately ($p<.0001$). However confidence decreased three months after the workshop and training due to infrequent exposure to using the neurological assessment on a day-to-day basis.

In a qualitative study by Richardson, Murray, House and Lowenkopf (2006), researchers surveyed 46 nurses in a stroke in a community hospital in Oregon to measure NIHSS education using in-services, video, resource booklets and ASA certification. They used a pre and post survey. The results indicated that nurses felt more comfortable with the NIHSS assessment after the training 57% to 97%. In addition the researchers evaluated inter-rater

reliability using a questionnaire. The inter-rater reliability went from 35% to only 50% after the training, which is not a dramatic difference. The researchers recommend continuous education on more difficult items of the NIHSS such as aphasia and comatose patients through an individualized discussion during stroke rounds and at the bedside.

Nursing neurological assessment practices can vary widely between colleagues on a given unit or between healthcare institutions so using a standardized assessment tool such as the NIHSS is critical. It has been noted in the literature that the most efficient and lasting technique to achieving expertise at any skill, physical or intellectual, is repeated practice in the same setting or conditions as those under which the skill will be performed (Del Bueno, 2013).

Gocan and Fisher (2008) administered a survey to evaluate the effectiveness of the current NIHSS education program at a Canadian stroke center in Ontario. The education included video simulation, practice scenarios where nurses simulated assessment in pairs, and clinical expertise that was supported at the bedside. The nursing self-assessed competency results of their survey results demonstrated a high level of proficiency and expertise across stroke scale items immediately after the education. However, six months after the implementation of the training program when nurses were resurvey, the stroke scale items that measure aphasia, visual fields and ataxia dropped back to the pre-education scores in 30% of nurses. The authors developed a “Tips and Tools Aphasia, Vision and Ataxia Guide” to help coach the nurses on these more difficult NIHSS items. This educational guide increased the problem areas back up to the scores originally seen with the initial post education survey scores.

In another qualitative study done by Gocan and Fisher (2009), the survey questions were open-ended. Ten participants were invited to describe current comfort level with performing the NIHSS or the Canadian Neurological Scale (CNS) using a telephone conversation with the authors. The questions focused on type of scale used, frequency of scale use and best strategies nurses believed to help with learning a new assessment scale or

skill, plus personal experiences and challenges associated with using the specific standardized assessment scales. The results showed that multiple strategies are used when implementing a new assessment scale. On-going in-services, video demonstration, bedside demonstrations mock-code scenarios were the most frequently mentioned. The two greatest challenges identified by participants were associated with obtaining consistent assessment results from one nurse to the next and having the nurse feel overwhelmed by the lack of experience in performing the new scale. The authors conclude that a sustainability plan aimed at enhancing continuity of care including educating nursing staff on the NIHSS or CNS scale is mandatory to support nurses accurate neurological assessment and confidence.

Table 2.3

Levels of Evidence from the Appraisal of Literature

Authors (s)	Level of Evidence /Rating		Key Evidence related to EBP project
Andre' (2002)	Level: 2	Rating: B	Large errors in scoring patients using the NIHSS when NIHSS education is not specific and not reinforced with practice
Chiu et al. (2009)	Level: 1	Rating: A	Although both groups had a significant increase in inter-rater reliability, the interactive computer assisted instruction showed higher inter-rater reliability between nurses that used instructor led video learning program (p=0.03). However, after 4 weeks there was a significant decline in inter-rater reliability of both groups thus, reliability decreases with time and when no exposure to practice
Gocan et al. (2008)	Level: 3	Rating: A	Nursing self assessed competency showed high proficiency and expertise on Canadian Stroke Scale after NIHSS education however, 6 months after the education showed certain items on the CNS went back to pre-education in 30 % of nurses. After targeted education on those certain areas (aphasia, ataxia and vision) the scores were back to post education outcomes.
Gocan et al. (2009)	Level: 3	Rating: B	Ten participants were surveyed asking open-ended questions on best education strategies to learn new assessment tools; most common strategies included in-services, video demo, bedside demo, and mock

			codes. The greatest challenges nurses identified inconsistent neurological scoring results from nurse to nurse and feeling overwhelmed by lack of experience in preforming new assessment. Authors concluded a sustainability education plan is important to maintain accurate neurological assessment and nursing confidence.
Goldstein et al. (1997)	Level: 1	Rating: A	RCT evaluated inter-rater and intra-rater reliability on the NIHSS on 59 physicians and nonphysicians after providing NIHSS video training. Immediately following training the intra and inter-rater reliability was high after 3 months from training both intra and inter-raters reliability went down on facial paresis and limb ataxia. The researches noted that a decrease in reliability was noted as time increased. They coined this “drift effect”
Hinkle (2014)	Level: 3	Rating: A	Meta-synthesis analyzing that the best method for teaching the NIHSS is debatable, however, most training and education has shown some inter-rater and intra-rater reliability. Hinkle analysis of 5 studies shows that just because a nurse is trained or certified does not indicate he/she is competent in the performance of the scale over time.
Lyden et. al. (1994)	Level 2	Rating: A	The researchers trained and certified 162 investigators during a tPA pilot study. The purpose of this research was to show that video training

			would minimize the variation between studies sites. This trial was their attempt to standardize the use of the NIHSS and to measure its reproducibility throughout the trial. The results of the inter-rater reliability was high after the initial training, but the intra-rater and inter-rater reliability went down in several of the sections of the NIHSS, including ataxia and language scores after 4 weeks of not scoring any stroke patients. The researchers attributed this to the fact that over half of the participants in the NIHSS training did not review the second NIHSS videotape that was included in the initial training. However, it does suggest that repeated exposure to performing and practicing the NIHSS is critical to maintain reliability of the NIHSS.
Lyden et. al. (2009)	Level: 2	Rating: A	A retrospective quasi-experimental study looked at inter-rater reliability of AHA NIHSS DVD training video between nurses and physicians. Inter-rater reliability was high if the certification exam was taken shortly after the instructional videos however, if the certification exam was taken longer than 1 week after then a week after reviewing the DVD video the inter-rater reliability was poorer.
O'Farrell et. al. (2008)	Level: 3	Rating: A	76 nurses from 6 different hospitals were included in a qualitative study using a survey to evaluate confidence using the Canadian Neurological Scale after CNS

			training. Before the training the nurses were moderately confident in using the CNS scales however after the specialized training nurse confidence increased immediately (p>.001) However, 3 months after CNS workshop and training due to infrequent exposure of utilizing the CNS, the confidence levels fell to pre-workshop levels. Authors concluded day to day exposure to performing the CNS may be necessary to maintain confidence in performing the CNS
Richardson et al. (2006)	Level: 3	Rating: B	Qualitative study 46 nurses measuring effectiveness of NIHSS education using in-services, videos, resource booklets and ASA certification. They used pre and post survey, which indicated that nurses felt more comfortable with performing the NIHSS after the training 57% to 97%. However, inter-rater reliability only changed from 35% to 50% after training. The researchers identified and recommended continuous NIHSS education on more difficult NIHSS items such as aphasia and non responsive patients.
Schmulling et al. (1998)	Level: 2	Rating: B	In this quasi-experimental study, researchers found that adequate training that is reinforced regularly is a prerequisite for reliability of the NIHSS. Using four stroke neurologists, two extensively trained in the NIHSS and two with no or minimal NIHSS training, the inter-rater reliability between the trained and non-trained was extremely poor. In addition,

the intra and inter-rater reliability of the untrained neurologist ranged from 4 to 10 points higher than appropriate. The conclusion that without a systematic NIHSS training and detailed instructions, the NIHSS cannot reliably be applied. Therefore, standardized use of the NIHSS is mandatory.

Construct of EBP:

The critically appraised literature provides a solid foundation for this EBP project. This is elaborated on in the following section.

Synthesis of the critically appraised literature. In summary, the available relevant literature supports the benefit of NIHSS certification and on-going NIHSS education to maintain nursing intra-rater and inter-rater reliability. In addition, nurses' confidence is decreased as time increases from performing the NIHSS. The "drift effect" in the literature ranges from 1 week to 6 months in this data, with the majority of the research showing 4 weeks to 3 months as the most common time lapsed from NIHSS training for intra-rater and inter-rater reliability to be diminished. There are many different modalities to train on the NIHSS; at this time no research has identified one ideal method. However, much of the research discusses a need for some type of regular retraining and education to keep NIHSS raters competent. The most robust inter-rater reliability was noted when using virtual computer assisted instruction. Mock simulations using different NIHSS scenarios were used in three of the Canadian research articles in this literature review. The evidence synthesized is slightly older, but it is important to understand that the NIHSS was invented in 1994 when tPA trials were starting. The NIHSS has been shown to be reliable when select individuals were specifically trained to perform the scale in research but clearly in the evidence discussed in this chapter, there is a need for consistent re-education and re-training on the NIHSS. Today the problem that arises in hospitals is that many health care professionals including ER physicians, neurologist, internist, nurses from a variety of departments are being trained on the scale. This leads to a decrease in opportunities for all NIHSS trained professionals to perform the scale on a regular basis to keep their assessment skills current. In addition, the inter-rater and intra-rater reliability becomes more important than ever before due to new stroke treatments that rely heavily on the NIHSS and patient outcomes.

Best practice recommendation. The best practice model recommendation is one that aims to re-educate and re-train to help nurses keep their NIHSS skills current to improve intra-

rater and inter-rater reliability. Benner's theoretical framework was used to guide the EBP project. Buy-in from the telestroke team was accomplished.

Answering the clinical question. The best practice recommendation will answer the clinical question: *In nurses with NIHSS certification, what is the effect of NIHSS standardized patient simulation education on maintaining competence compared to expert rater's NIHSS scores within 3 months?* The DNP student will use a simulation to reinforce nurses on the correct way to assess using the NIHSS (see Chapter 3). The DNP student will use debriefing techniques following the simulations as directed by the simulation experts at Mirro Parkview Research Center. In addition, pre and post surveys will be given to allow nurses to self-assess their competence and confidence in performing the NIHSS. A more detailed description of the intervention design that is based on the literature follows in Chapter Three. Demographic data will be obtained and correlated with the survey results and NIHSS scores during the pre and post simulations. Results of the project will be disseminated to the organization internally and through a scholarly publication and/or presentation at a stroke conference.

Overall, the NIHSS is an important part of the nursing process in many hospitals that treat stroke patients. The treatment strategies and patient outcomes rely heavily on this score. In fact, studies have shown that the NIHSS can predict a stroke patient's outcome at 90 days and 1 year (Alberts, 2014). Clearly, having the correct NIHSS number will be important in order to plan for patients' treatment and discharge care.

CHAPTER 3

IMPLEMENTATION OF PRACTICE CHANGE

The method used for the design and implementation of the Evidence-Based Practice (EBP) project is discussed in this chapter. Management of the data and protection of human subjects is also addressed. The purpose of this EBP project was to increase the confidence and inter-rater reliability of nurses performing the National Institute of Health Stroke Scale (NIHSS), so this project was an educational intervention with a single cohort, pre and posttest design to measure outcomes. The literature clearly shows that there is a "drift effect" noted in the inter-rater reliability of NIHSS between 4 weeks and 3 months of certification if the skill is not practiced on a regular basis (Andre', 2002). In addition, the research shows that nurses complain of low confidence in performing the NIHSS due to minimal opportunities in performing NIHSS on stroke patients. It is estimated that nurses may only have the opportunity to perform the NIHSS once every two or three months (Gocan and Fisher, 2008).

Participants and Setting

The participants for this project were twenty-one nurses. The nurses were recently NIHSS certified by the American Heart Association or had not performed the NIHSS more than one time in the last month. This single cohort of nurses was from the two hub hospitals of the telestroke network in Northeast Indiana. Nurses that worked in emergency department and intensive care unit were the cohort included in this project.

Outcomes

The three outcomes that were measured in this EBP project as a result of the evidence-based intervention include: (a) nurses confidence when performing the NIHSS on stroke patients, (b) inter-rater reliability between nurses NIHSS scores, and (c) accuracy of scoring a stroke patient as compared to 3 expert neurologist in all 15 items of the NIHSS (see table 3.1)

Table 3.1

The 15 NIHSS items

1a. Level of Consciousness

1b. LOC Questions (month, age)

1c. LOC commands (open, close eyes, make fist, let go)

2. Best Gaze (eyes open- patient follows examiners finger)

3. Visual (introduce visual stimulus)

4. Facial Palsy (show teeth, raise eyebrows and squeeze shut eyes)

5a. Motor Arm-Left (elevate extremity 90 degree and score drift)

5b. Motor Arm-Right (elevate extremity 90 degree and score drift)

6a. Motor Leg-Left (elevate extremity 30 degree and score drift)

6b. Motor Leg-Right (elevate extremity 30 degree and score drift)

7. Limb ataxia (finger-nose, heel down shin)

8. Sensory (pin prick to face, arm, trunk, and leg-compare side to side)

9. Best Language (name this item, describe a picture and read sentence)

10. Dysarthria (evaluate speech clarity by patient repeating listed words)

11. Extinction and Inattention (use information from prior testing to identify neglect or double stimulus testing)

Intervention and Planning

The telestroke network implemented a new policy that certain staff nurses and nurse supervisors become NIHSS certified through the American Heart Association. This certification is a free on-line certification that offers 3 hour of instruction. The certification provides six patient scenarios to be viewed and tested on; in addition there is a certification exam. This certification is valid for two years. The deadline for these nurses and supervising nurses to complete the NIHSS certification was July 1, 2015. Research shows that just because an individual has been educated about the use of a scale and even received a certificate does not indicate they are confident or competent in the performance of the scale (Andre, 2002). This is particularly true in instances when the scale is not used on a day-to-day basis. Based on a gap survey completed by the telestroke's stroke coordinator, recently certified nurses fear that they will not be able to keep their NIHSS skills reliable due to the infrequency of stroke patients presenting to their emergency departments, particularly the smaller telestroke network hospitals.

The EPB project intervention is based on a thorough review of current literature on simulation in nursing practice. The Institute of Medicine (IOM) recommends simulation as a method to support nurses in the ongoing acquisition of knowledge and skills (Galloway, 2009). Overall, simulation development has shown to be successful and it includes a five-step process: (1) key concept identification; (2) competency; (3) scenario building; (4) debriefing development; (5) beta testing (if needed) of the scenario (Aebersold & Tschann, 2012). Simulation used to support education aimed in improving the nurse's ability to recognize and manage patients has shown to be highly effective in training nurses' new skills, techniques and improving competency. This can be done by using a variety of methodologies, ranging from simple role-play to use of high fidelity and virtual simulators (Aebersold et al., 2012). Based on this information, the following intervention is proposed:

This intervention included a single cohort group of recently NIHSS certified nurses and nurses that have minimal opportunities to use the NIHSS on a regular basis. The telestroke program had an emergency nurses/ ICU nurses annual skills days and the first intervention took place on those days.

Procedure: The project consisted of an initial group meeting with all project participants and the DNP student who acted as the project manager. A detailed explanation of the project was discussed. In addition, the completion of the consent paperwork related to the study was completed. There were three parts to this project:

- Part 1**:** First, the participants were asked to complete a demographic form and complete a self-assessed competency survey before the initial simulation NIHSS assessment. Then participants were required to demonstrate performing the NIHSS on a standardized patient (actor) pretending to have neurological deficits associated with a stroke while being video taped by the DNP student using an Ipad. Following the videotaped session, a debriefing session took place to discuss the results of the each participants' NIHSS scores individually using the taped scoring session for review and discussion. In addition, best practice examples of how to correctly perform a particular item on the NIHSS tool were demonstrated by the DNP student. The videotape was erased immediately following the participant's debriefing session. Part 1 took approximately 45 minutes for each participant.
- Part 2: The volunteer participants accessed *www.AISvirtualpatient.com* four weeks from completing part 1. Using the AIS Virtual patient scenarios, the participant calculated an NIHSS score on a selected stroke patient simulation assigned by the DNP student. An email with the link and instructions was sent to each participant. The DNP student assigned the same simulation for each participant. This part took approximately 15 minutes to complete. The DNP student did not track correct scores on this virtual simulation but participants were able to reach out to the DNP student with questions.

The participants sent a certificate of completion to the DNP student when they had completed part 2 as proof that they did in fact do the simulation since this aspect of the project was not monitored and participants did this at home. The purpose of part 2 was to offer some NIHSS simulation to evaluate if some type of exposure of practicing the NIHSS 4 weeks after part one would make a difference in outcomes of the project.

- Part 3: The volunteer participants were sent an email asking for their availability to complete scoring another standardized patient using simulation. This part of the project took place approximately three months from part 1. The participants filled out the same twelve-question self-assessed competency survey as in part 1 as well as a separate three-question survey that included how many times they had performed an NIHSS since part 1 of the project. They score another standardized patient (the DNP student served as patient due to difficultly getting standardized patient at varied times) simulation using the same NIHSS score sheet. A simulation lab was set up on their respective units and they completed part 3 on a one at a time basis with the DNP student. Part 3 took about 20 minutes. There was no coaching done by the DNP student at this session. However, the participants' questions were answered following the session.

For this EBP project the goal was to get at least twenty nurses to participate and there were 21 that completed part 1, 15 that completed part 1, part 2, and 3; and 19 that completed part 1 and part 3. Flyers were hung in all the emergency and neurological departments to recruit volunteers. The stroke coordinator sent an email asking for volunteers for the project as well. The stroke coordinator kept a list of all NIHSS certified nurses so it was easy for them to access the NIHSS certified nurses.

During the simulations, the stroke actor was given specific deficits and scenarios to act out. The stroke research team at one of the hub hospitals wrote the scenarios during a previous research project. This research project evaluated the feasibility of using IPADS to assess stroke patients using the NIHSS in ambulances. Three NIHSS expert raters from the stroke program

had already validated the scenarios and scores. Each expert rater had over ten years of using the NIHSS. Part 1 of the project included the nurses filling out a 10 minute survey called the National Institute of Health Stroke Scale -Self-Assessed Competency of Neurological Assessment Techniques. This tool measures the nurse's self-assessment in performing each of the NIHSS 15 items. In addition, the categories used in the self assessment were based on Patricia Benner's Novice to Expert Theory, which is the theoretical framework used in this project. After each nurse completed the survey he/she performed the NIHSS independently. The DNP student received training on how to correctly debrief participants in the project from the simulation lab faculty associated with the hospitals used in this project. Also, the site facilitator assisted in the debriefing sessions of Part 1. The second intervention took place within 4 weeks of the first intervention. This intervention is called *AISVirtualpatient* (education resource provided by Genentech, Inc.). This is a free stroke education resource that allows for the nurse to walk through a virtual stroke patient and rate their neurological deficits using the NIHSS. The nurses were asked to access the AIS*Virtualpatient* program on line on their own computers by logging on to www.Aisvirtualpatient.com. The program offers a certificate of completion after the participants have walked through the scenario. The nurses printed off their certificate of completion to prove they performed the AIS*Virtualpatient* intervention. Three months after part 1 intervention, participants were contacted and scheduled part 3. A simulation lab was set up in their respective departments to score another actor stroke patient with different neurological deficits, again scored by three NIHSS experts. In addition all nurses filled out the National Institute of Health Stroke Scale -Self-Assessed Competency of Neurological Assessment Techniques survey before the last simulation. The baseline NIHSS scores and survey results were collected from part 1, as well as the last NIHSS scores and survey results performed during part 3.

Data

Measures and their reliability and validity The single cohort group scored the same actor stroke patient during the launch of the project. In addition, they filled out the same pre-intervention and post intervention survey after they score the same actor stroke patient pre and post intervention. Sophia Gocan and Andrea Fisher developed the National Institute of Health Stroke Scale -Self-Assessed Competency of Neurological Assessment Techniques survey in 2008. This survey tool has been referenced in 4 other articles, but there is no data on the validity or reliability of the survey. The DNP student did receive approval to use this survey from the authors. Again, each nurse involved in the project was able use the original NIHSS scoring sheet when scoring the stroke actor they did not have to go off memory. This was the same score sheet they used to score the NIHSS on a real stroke patient in their departments. In the *AISVirtualpatient* program, the nurse participants viewed a simulated emergency stroke scenario involving different patients who vary in age, gender, medical history and presentation. The DNP student did choose only one AISVirtualpatient scenario for all participants to complete. There is no validity or reliability data available on this AISVirtualpatient education program.

Collection After approval from the institution Review Board from both the hub hospitals and Valparaiso University, the recruitment flyers and emails were distributed. The first session took place at skills check off on Oct 5th, 6th and 7th, 2015 for all participants. The project was explained, all questions were answered and informed consent was signed. The DNP student assigned each nurse a code number (that appeared in the upper right hand corner of their consent form and demographic data form) to be used in the completed pre and post surveys and NIHSS score sheets The DNP student developed a code book that correlated the code with demographic data, surveys and score sheets. This codebook was kept in a secure and locked location at one of the implementation site's research department.

Management and analysis. This project used Pearson's correlation coefficient to evaluate comparisons of all variables and total NIHSS scores. Also, a repeated measure

ANOVA with protected *t* tests were used to evaluate pre, post and 3 month results of the total NIHSS as well as each of the 15 items in the NIHSS. A paired t test was used to compare pre and post confidence surveys.

Protection of human subjects

Prior to beginning this project the DNP student completed the web-based computer course on protecting human research participants. The university and the hospital's IRB required this course. Confidentiality was maintained throughout the project to ensure protection to the participants, which minimized potential risks. Anonymity in the reporting of any data was maintained. Participant's names were not used in data collection. Data was stored in a secure, locked location within the research department at one of the implementation site hospitals.

CHAPTER 4

FINDINGS

The purpose of the EBP project was to develop an educational process for maintaining inter-rater reliability and confidence when performing the NIHSS after initial NIHSS certification is obtained by nurses. It was anticipated that nurses would demonstrate consistent and reliable NIHSS assessments regardless of the time that has lapsed from initial certification because this project would provide an NIHSS educational simulation refresher.

Explanation of Findings

The PICOT question was: In nurses with NIHSS certification, what is the effect of NIHSS standardized patient (SP) simulation education on maintaining inter-rater reliability and confidence, compared to expert raters' NIHSS scores, within 3 months? Data were collected at three different time intervals that included prior to intervention, immediately post intervention and 3 months post intervention. An instrument called the Self-assessed Competency of Neurological Assessment Techniques Survey: Clinical NIHSS skills form (SACNAT) was used to measure nurses' confidence in performing the NIHSS assessment evaluating all items on the NIHSS tool; and the NIHSS tool itself was used to actually score a standardized patient evaluating all 15 items on the tool.

Participants Characteristics

Participants' characteristics include sample size, demographics, and attrition details. The characteristics data points were collected through a demographic tool, which was filled out before the simulation was performed. The demographic tool contained six questions: age, years as an RN, number of times they performed a stroke screening using the NIHSS tool in the last month, department they work currently work in and when they first became certified in the NIHSS (Table 4.1). Of the twenty-one nurses who were eligible to participate in the NIHSS simulation, 19 (90%) of nurses completed the project. Two nurses that did not complete the

project were due to no longer working at project site and they could not be located. The data from these participants were not included in the final data analysis.

Table 4.1

Participants' Demographic Data

Characteristics	Frequency (N=19) Results
Age	
18-29	3 = 15.8%
30-49	11 = 57.9%
50-65	5 = 26.3%
Years as a nurse	
< 5 years	4 = 21.1%
5-10 years	8 = 42.1%
11-15 years	1 = 5.3%
>15 years	6 = 31.6%
# Of times performing NIHSS in last month	
< Than 1	16 = 84.2%
1 time	3 = 15.8%
Department	
ICU	10 = 53%
ED	9 = 47%
What type of NIHSS education have you had in last 3 months?	
In-service	0 = 0%
One on One instruction	0 = 0%
Simulation	0 = 0%
None	17 = 89.4%
Certification	2 = 10.6%

Instrumentation

There were two instruments used in this project. The first instrument was used to score the participants' self-confidence. It was called the Self-assessed Competency of Neurological Assessment Techniques Survey: Clinical NIHSS Skills (SACNAT) developed by Gocan and Fisher (2008). This instrument evaluates the respondent's confidence in scoring all 15 items on the NIHSS. The DNP student changed some of the questions on the original instrument in order to simplify the questions to connect with each of the areas on the NIHSS. The DNP student renamed the modified tool Self-assessed Competency of Neurological Assessment Techniques Survey: Clinical NIHSS Skills II (SACNAT II). The authors of the original tool gave written permission to use and reword questions. The original instrument demonstrated acceptable internal consistency reliability (Cronbach's alpha = 0.89) for nurses' confidence (Gocan and Fisher, 2008). The modified instrument (SACNAT II) also demonstrated acceptable internal consistency reliability for nurses' confidence in this project (Cronbach's alpha = 0.81). The second instrument used in the project was the National Institute of Health Stroke Scale tool (NIHSS); it has demonstrated a Cronbach's alpha coefficient for internal consistency of 0.92 (Lyden, et al., 1994).

Statistical Testing and Significance. To demonstrate the effectiveness of the NIHSS standardized simulation, detailed statistical analyses were performed using the commercially available IBM SPSS statistics software, version 22. An analysis was conducted to answer the proposed PICOT questions using repeated measures ANOVA and post-hoc paired *t*-tests were chosen to compare differences from NIHSS scores pre-intervention, immediate post-intervention and 3 months post intervention compared to correct scores. Three NIHSS experts determined the correct NIHSS scores used in this project, which included two stroke neurologists and one stroke research nurse. Data from the NIHSS tool was analyzed utilizing cumulative total scores as well as an individual item within the NIHSS tool. A paired *t*-test was

completed to compare pre-intervention and 3-month post intervention on participants' self-assessment of confidence in performing the NIHSS. Statistical significance for all analysis of the NIHSS pre, post and 3-month post intervention was established as $p < .05$ for ANOVA analysis and $p<0.017$ for post-hoc paired *t*-test analysis. A value of 0.017 for post hoc testing was chosen because 0.05 divided by 3 time intervals is 0.017 (Cronk, 2014). A Pearson correlation coefficient was completed to determine the strength of the relationship between nurses' self-confidence scores and pre and post NIHSS scores, plus the relationships between nurses' self-confidence scores and each correlating individual item in the NIHSS tool. In addition, secondary analysis was done to evaluate correlations between participants' demographic data, number of times participants used the NIHSS between part 1 and 3-month post implementation, part 2 completion and other NIHSS education they participated in after part 1 and before completing part 3 of project.

Significance. Descriptive means were assessed for the SACNAT II and NIHSS totals and NIHSS individual item scores. A paired *t*-test was used to measure results of the SACNAT tool. A one-way repeated –measures ANOVA was calculated comparing the NIHSS total scores and each subclass scores at three different times: pre-intervention, post intervention and 3 months post intervention. Once significance was determined the repeated-measures ANOVA was determined and post-hoc testing with protected paired *t*-test was completed to ensure the results were truly significant (Table 4.3). Results were assessed for significance from pre-intervention and immediate post intervention, and 3 months post intervention. The project aimed to sustain knowledge gained from the intervention out to 3 months.

SACNAT II results. Analysis pre and post scores on confidence were performed using the Self-assessed Competency of Neurological Assessment Techniques Survey: Clinical NIHSS skills survey. The scores ranged from 1-5. A score of 1 represented the confidence of an expert, 2 represented having confidence at a proficient level, 3 score represented a competent level of confidence, 4 was equal to that of an advance beginner level and a 5 meant that the

nurse's confidence was that of a novice. There were definitions given to the participants on each confidence level. The nurses scored themselves accordingly (Figure 4.1 and 4.2). In addition, a paired-sample *t*-test was calculated to compare the accumulative mean pre-confidence scores to the mean post-confidence scores of the participants. The mean of the pre-confidence score was 33.68 (sd=7.17), and the mean of the post-confidence score was 30.21 (sd=9.75). A significant increase in confidence was found in post-confidence scores compared to pre-confidence scores (t (18) = 2.373, p = 029). A paired sample *t* test result of less than 0.05 indicated statistical significance for the pre and post confidence survey results. It is important to understand the ratings are on a scale with "Expert" equaling "1" and "Novice" equaling "5", then one would expect the lower the total mean scores, the higher the confidence in overall scoring of all items on the NIHSS.

Figure 4.1

Pre-Intervention SACNAT

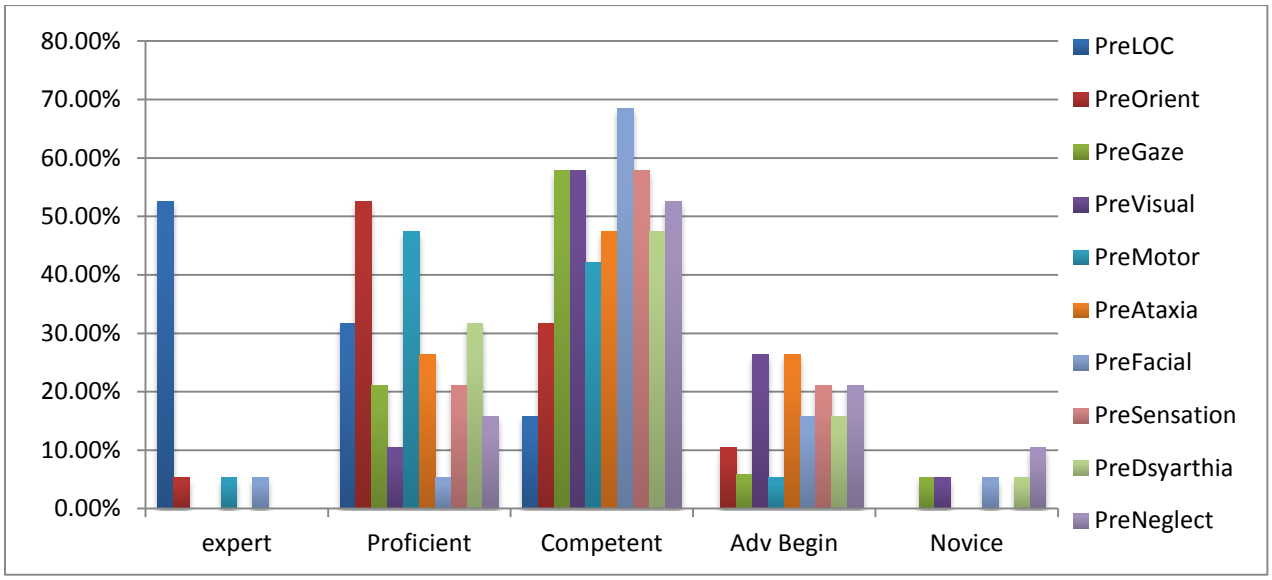
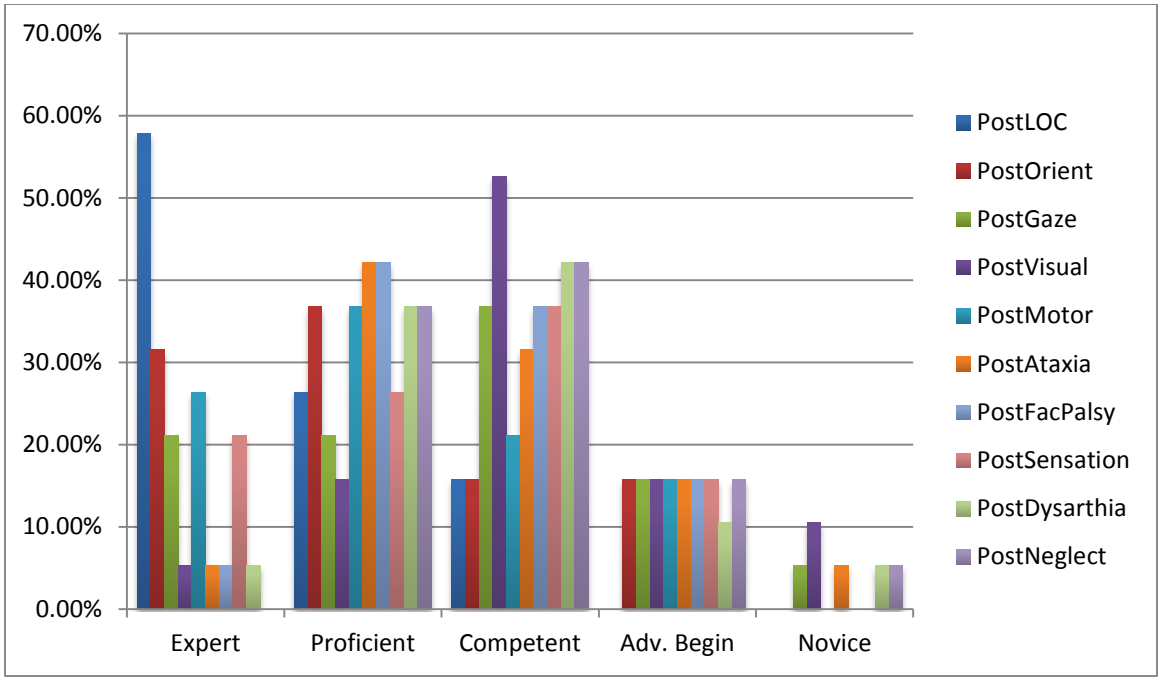


Figure 4.2

Post-Intervention SACNAT



NIHSS results. A significant effect was found with the NIHSS totals using a repeated measures ANOVA comparing scores at three different times: in pre-intervention, post-intervention and post 3 months intervention (F (2, 36) = 15.206, p = 0.000) and a protected *t*-test revealed scores improved significantly pre-intervention to post-intervention (m = 12, sd = 2.08), and pre-intervention to 3-month intervention (m = 1.75, sd = 2.077). Because three tests were performed and, therefore, inflating the Type 1 error rate, a significance level of .017 (.05/3) instead of .05 was used. Significance was found with the following individual items of the NIHSS: NIHSS visual fields (F (2, 36) = 20.28, P<0.001) at pre-post (M= .89474, sd= .080930, p = 0.000), post- 3 month (M= .31579, sd = .47757, p= 0.011) and pre-3 month (M= .57895, sd = .50726, p = .000) ; NIHSS ataxia (F(2, 36) = 16.714, p < 0.000) pre-post (m = .57895, sd = . 90159, p = 0.012), post- month (m = .36842, sd = .76089, p = 0.049) and pre- 3 month (m = .94737, sd = .40465, p = 0.000); NIHSS language (F (2, 36) 9.143 = p, 0.001), pre-post (m =

.42105, sd = .60698, p= 0.00),post-3 month (m = .0000, sd = .33333, p = 0.026) and pre- 3 month (m = .42105, sd = .42105, p = 0.002) ; NIHSS neglect (F(2, 36) = 60.353, p = 0.000) pre-post (m = - 1.3684, sd = .89508, p = 0.000), and post to 3 month (m = 1.9473, sd = .91127, p = 0.000) pre-3 months (m = .57895, sd = .50726, p = .006) (Table 4.2).

Table 4.2

Comparison of Key data points of NIHSS items using protected *t*-test

NIHSS Item	Mean Difference	Standard Deviation	Significance(Yes/No)	p<0.017
NIHSS Total				
Pre-Post	2.01211	2.05480	Yes	p=0.000
Post-3 months	0.26316	0.61959	No	p=0.056
Pre-3 months	1.73684	2.07745	Yes	p=0.000
NIHSS Visual				
Pre-Post	0.89474	0.80930	Yes	p=0.000
Post-3 months	0.31519	0.47757	Yes	p=0.010
Pre-3 months	0.57895	0.50726	Yes	p=0.000
NIHSS Ataxia				
Pre-Post	0.57895	0.90159	Yes	p=0.012
Post-3 months	0.36842	0.76089	No	p=0.049
Pre-3 months	0.94737	0.40465	Yes	p=0.000
NIHSS Language				
Pre-Post	0.14296	0.11212	Yes	p=0.009
Post-3 months	0.85712	0.23235	No	p=0.226
Pre-3 months	0.51221	0.36776	Yes	p=0.011
NIHSS Extinction/Neglect				
Pre-Post	0.24542	0.23458	Yes	p=0.000
Post-3 months	0.99111	0.12879	Yes	p=0.000
Pre-3 months	0.88901	0.16578	Yes	p=0.006

There was no statistical significant improvement in NIHSS items, level of conscience (LOC), motor, gaze, facial palsy, sensory or dysarthria (Table 4.3)

Table 4.3

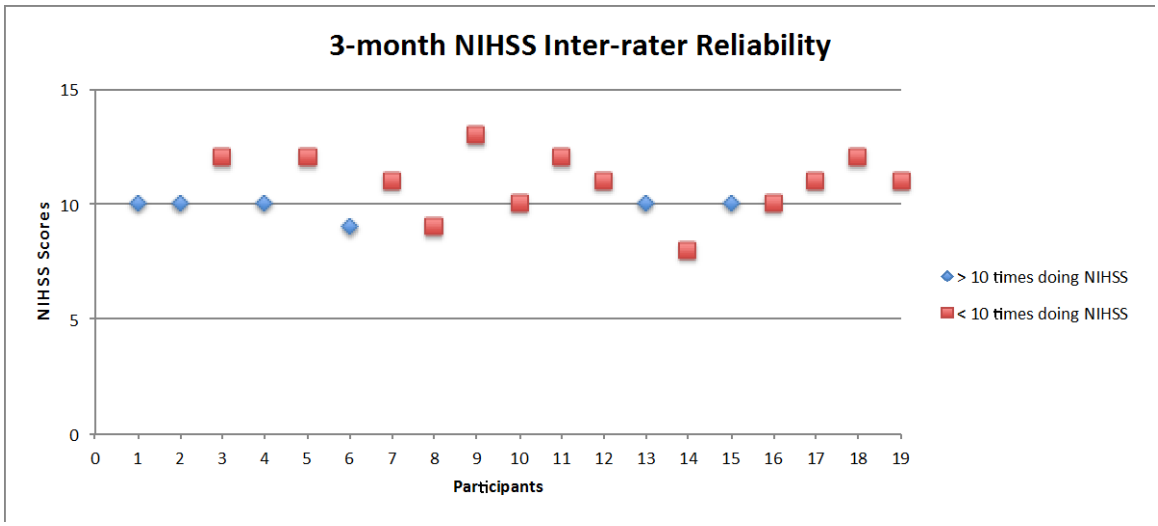
NIHSS items that showed no significant improvement

NIHSS Item	F value	P value
NIHSS LOC	F (2, 36) = 1.78	P = 0.342
NIHSS Motor	F (2, 36) = 1.65	P = 0.453
NIHSS Gaze	F (2, 36) = 1.98	P = 0.543
NIHSS Facial Palsy	F (2, 36) = 1.54	P = 0.453
NIHSS Sensory	F (2, 36) = 1.89	P = 0.324
NIHSS Dysarthia	F (2, 36) = 1.90	p = 0.565

A Pearson correlation was calculated examining the relationship between confidence and correct NIHSS scores pre and post intervention. There was no significant correlation in nurses' confidence to perform the NIHSS pre-intervention ($r(17) = .275$, $P > 0.05$) and post-intervention ($r(17) = .516$, $p > 0.05$). In addition, the individual items of the NIHSS scores that improved post 3-months showed there was no correlation with nurses' increased confidence at 3 months. However, a Pearson correlation coefficient was calculated for the relationship between number of times participants performed the NIHSS on live patients after part 1 of the intervention and before they completed part 3 of the intervention. A weak positive correlation was found ($r(17) = .607$, $p < 0.05$), indicating a significant relationship between the two variables. Thus, the more times the participants performed an NIHSS on a patient after the project intervention the better their inter-rater reliability of the correct NIHSS score (Figure 4.3).

Figure 4.3

Participants' NIHSS scores based on the # of NIHSS performed



The following variables showed no correlation in improved NIHSS inter-rater reliability (Table 4.4).

Table 4.4

Variables that showed no correlation in total of NIHSS scores

Variables	Pearson Correlation Coefficient
Age/Total NIHSS	(r (17) = .050, p > 0.05
Years of experience/Total NIHSS	(r (17) = .026, p > 0.05
Group/Total NIHSS	(r (17) = .014, p > 0.05
Part 2 Completion/Total NIHSS	(r (8) = .034, p > 0.05

The purpose of this project was to answer the question on whether or not standardized patient simulation helps maintain nurse NIHSS inter-rater reliability and confidence performing the NIHSS at 3 months. Chapter 5 will discuss the outcomes presented in this chapter.

CHAPTER 5

DISCUSSION

The purpose of the EBP project was to develop an educational process for maintaining inter-rater reliability and confidence when performing the NIHSS after initial NIHSS certification is obtained by nurses. It was anticipated that nurses would demonstrate consistent and reliable NIHSS assessments regardless of the time that has lapsed from initial certification because this project would provide an NIHSS educational simulation refresher. This chapter will discuss the findings of this EBP project. The PICOT question was: In nurses with NIHSS certification, what is the effect of NIHSS standardized patient simulation education on maintaining competence and confidence, compared to expert rater's NIHSS scores, within 3 months?

Explanation of Findings

Data were collected at three different time intervals that included prior to intervention, immediately post intervention and 3 months post intervention on the participants' NIHSS scores. An instrument called the Self-assessed Competency of Neurological Assessment Techniques Survey: Clinical NIHSS Skills form (SACNAT) was modified to measure nurses' confidence in performing the NIHSS assessment evaluating all items on the NIHSS tool; and the NIHSS tool itself was used to actually score a standardized patient evaluating all 15 items on the tool. After permission from the original authors, the tool was slightly manipulated by the DNP student to better match the question with each item on the NIHSS. The DNP student changed the name of the manipulated tool to SACNAT II. A test-retest was performed on the SACNAT II tool and it performed an Alpha Cronbach of 0.81. In addition, all demographics, part two of the project (virtual simulation) participation, and number of times the nurses performed the NIHSS between Part 1 and Part 3 will be discussed. Data analysis was conducted utilizing SPSS 22 software. Extracted data included results of overall level of significance for each NIHSS item pre, post and

3 months as well as total NIHSS scores. Standard deviation, mean scores for each item of the NIHSS tool and the SACNAT results were measured as well.

The explanation of the demographics is as follows for this EBP project. The highest percentage of participants were between 30-49 year of age (57.9%, n= 11), the majority of nurses had been a nurse between 5-10 years (42.1%, n = 8) with the second highest percentage had more than 15 years of nursing experience (31.6%, n = 6). Fifty-six percent of nurses (n = 10) were ICU nurses and the remaining nine nurses were ED nurses (n = 9). The majority of the participants had no NIHSS education within the 3 months prior to the start of the EBP project at 89.4%. However, two nurses had been recently certified within the last 3 months (10.6%). It was important to understand that nurses in this project had no additional education or training three months prior to the project since the literature shows that inter-rater reliability starts to decrease between four weeks and three months. As part of the inclusion criteria for this EBP project, the number of times that the nurses had performed the NIHSS on a live patient was no more than 1 time in the last month before the start of the project, the rationale for this inclusion criteria was to evaluate nurses that had approximately the same limited exposure to assessing patients using the NIHSS tool. Current standard of practice in stroke centers require that nurses be NIHSS certified every 2 years in order to perform the NIHSS on a stroke patient, however, there is no direction or best practice on how frequently the nurses need to perform the NIHSS to be competent in the skill. The evidence simply states “frequent” exposure to NIHSS to maintain inter-rater reliability. In addition, the new 2015 AHA/ASA latest recommendations/guidelines on endovascular therapy for acute ischemic stroke patients and the requirement for more advance imaging, the NIHSS has become a significant part of the decision making process thus, it is more critical than ever that nurses are competent in using the NIHSS (AHA, 2015). The evidence used in this EBP project clearly shows that NIHSS inter-rater reliability “drifts down” after initial NIHSS certification or training sometime between four

weeks and three months if the skill is not utilized (Lyden, 1994, Goldstein et al, 1997, Chiu et al., 2009).

The primary outcomes showed the total NIHSS scores of all 19 participants showed significant better scores from pre intervention to immediately post intervention, ($p = 0.000$), and pre-intervention to 3 month after intervention, ($p= 0.000$). However, there was no difference in participants scores from immediately post intervention to 3 month after intervention compared to the expert scores (correct scores), ($p = 0.056$). The findings showed that nurses' total NIHSS scores were significantly more accurate immediately following the simulation with debriefing intervention, and at 3 months from the pre-intervention NIHSS scores. Thus, the inter-rater reliability improved from pre-intervention to post intervention and pre-intervention to 3 months. There were no improvements in total NIHSS scores from post intervention to 3-month evaluation. The explanation for no significant improvement in total NIHSS scores from post-intervention to 3 month evaluation may be explained by the fact that the nurses had already maximized the correct scores at post intervention thus, there was little room for scoring "more" correctly at 3-months. However, the fact that the nurses improved in the total NIHSS scores from pre-post and pre-3 months means that more nurses scored closer to the expert scores post intervention and at 3 month evaluation, so inter-rater reliability was maintained or improved after the simulation with debriefing.

Other key findings in the EBP project include significant improvement in four separate NIHSS items. These included: visual fields, ataxia, language and extinction/neglect. Nurses showed significantly better visual field scores from pre-intervention to immediately post intervention with a p value of 0.000 and again from post intervention to 3- month ($p = 0.010$), and from pre-intervention to 3-month evaluation ($p = 0.000$). Ataxia scores got better from pre-intervention to immediately post-intervention ($p=0.012$), pre-intervention to 3-month evaluation ($p = 0.000$). However, again as seen with NIHSS total scores there was no significant difference between immediate post-intervention and 3-month evaluation ($p=0.049$), perhaps representing

that there was little room for improved scores because nurses had improved their NIHSS ataxia scores as much as could be improved post-intervention. NIHSS language showed improved scores at pre-intervention and post-intervention (p=0.009) and again from pre-intervention and 3-month evaluation (p = 0.011). Immediately post-intervention to 3-month intervention did not show a significance difference so this item showed similar results to total NIHSS and ataxia outcomes in that inter-rater reliability improved pre-post and pre-3 months representing a significant improvement in NIHSS language scores. The last NIHSS item that showed a significant improvement in all points that were measured, pre-post, post- 3 month and pre- 3 month, p = 0.000, p= 0.000, p = 0.006 respectively was extinction/neglect. These scores improved at each point in time representing that nurses' continued to improve and become more accurate in scoring extinction/neglect as compared to the expert scores. During the debriefing sessions, the DNP student spent a considerable amount of time demonstrating the correct technique assessing extinction/neglect with all participants. The NIHSS items, level of conscience, gaze, motor, sensory, and dysarthria there were no significant improvements in scores compared to the expert scores. The explanation for no improvements in these areas may be due these particular items on the NIHSS are easier items for raters to score overall. Lyden (1994) showed that ataxia, language and visual fields are the most difficult items to score especially when raters do not have regular exposure to performing the NIHSS assessment. Overall, ataxia, language, visual fields and extinction/neglect were the items that participants demonstrated the most difficulty in performing. So, during the debrief session the DNP student took extra time to discuss and demonstrate proper technique on these items and explain rationales on why this is a "best practice" for assessing these items accordingly. This project differed from the literature. Nurses' inter-rater reliability on total NIHSS scores compared to experts at 3-months were significantly improved compared to pre-intervention scores. The literature states that NIHSS inter-rater reliability decreases between 4 weeks and 3 months

(Goldstein, 1997), but the findings of this project showed that inter-rater reliability was improved and maintained.

Another primary outcome in this EBP project was evaluating nurses' confidence in preforming the NIHSS. The SACNAT II tool was used, the nurses were asked to identify their level of confidence in each of the NIHSS items. Benner's novice to expert model was used to formulate a Likert scale so participants can rank their confidence. The scores ranged from 1-5. A score of 1 represented the confidence of an expert, 2 represented having confidence at a proficient level, 3 score represented a competent level of confidence, 4 was equal to that of an advance beginner level and a 5 meant that nurses' confidence was at that of a novice. There were definitions given to the participants on each confidence level (Table 5.1).

Table 5.1

Benner's Novice to Expert Model Definitions

Level	Skill & Knowledge
Expert	* Analysis, synthesis, application, * Highly skilled performance * Extensive exposure, with deep understanding of situation * Able to rapidly and consistently identify actual and potential changes * Able to rapidly change priorities under all conditions
Proficient	* Conceptual understanding * Extensive exposure in most situation * Able to anticipate potential assessment changes * Able to prioritize in response to changing situations
Competent	* Conceptual understanding and skill performance * Varied exposure to many situations * Able to identify normal and abnormal findings * Able to prioritize under stable conditions
Advance Beginner	* Conceptual understanding * Minimal clinical experience * Limited exposure to clinical situations * Able to identify normal findings
Novice	* Marginal conceptual understanding * Minimal clinical experience * Seeks assistance in making clinical decisions

The results from the SACNAT II (confidence survey) showed that means scores for confidence improved. Nurses became overall more confident from pre-intervention to 3- month evaluation ($p = 0.029$). Thus, more nurses moved their confidence level up on more of the NIHSS items at 3 months compared to pre-intervention. However, when a Pearson correlation was performed looking at SACNAT II results pre and 3- month compared to NIHSS pre-intervention and 3-month scores, there was no relationship between higher confidence and better NIHSS total

scores. The p values for both pre-intervention and post-intervention were >0.05. The literature states that when nurses' confidence increases with NIHSS training, their accuracy in NIHSS scores improved (Gocan, 2009). This EBP project did not show a correlation between increased confidence and better NIHSS scores. A possible reason for why there was no correlation between increased confidence and increased correct scores may be due to the small N of the project.

The secondary outcomes that were measured in this project included all the demographic data, age, years as a nurse, and ICU/ED groups. Also, analysis was done looking for relationships between participants completing part 2 (NIHSS virtual simulation) of the project and number of NIHSS preformed on patients after the simulation and before 3-month evaluation, compared to pre, post and 3-month NIHSS scores. Again using a Pearson correlation coefficient, there were no relationships between any of the above variables, except the number of times the participants performed an NIHSS on a real patient in the 3-month period of the project. A weak positive correlation was found ($r(17) = .607$, $p < 0.05$), indicating a significant relationship between those two variables. Six nurses performed over 10 NIHSS assessment on live patients between part 1 and part 3 of the project. Although, all nurses in the project total NIHSS scores significantly improved, the nurses that performed the NIHSS at least 10 times in the 3-month period had the most correct scores per the two groups. The evidence states that NIHSS education and practice is critical to maintain or improve inter-rater reliability (O'Farrell, 2008). This project demonstrated that nurses who used the NIHSS at least 10 times in 3 months had a weak positive correlation in scoring the NIHSS correctly at 3 months. Nurses that scored 10 patients or more in this project was an unexpected confounder encountered in this EBP project. The majority of the nurses in the project averaged less than 4 times scoring a live patient in the 3-month project. The reason for the six nurse outliers were that 3 of the nurses had become rapid response nurses and responded to all code stroke calls, 2 of the nurses had become charge nurses so doing NIHSS in the emergency department was required

as part of their new job description and the other nurses moved to a stroke unit which required them to do an NIHSS on all stroke discharge patients.

Applicability of Theoretical Framework

The theoretical framework used for this EBP project is Benner's Stages of Clinical Competence. In the acquisition and development of a skill, a nurse passes through five levels of proficiency: novice, advance beginner, competent, proficient and expert (Benner, 1985). The five stages can be defined as the following:

- Stage 1: The novice or beginner has no experience in the situations in which they are expected to perform. They lack confidence to demonstrate safe practice and require continual verbal and physical cues. Nurse is unable to use discretionary judgment,
- Stage 2: The advance beginner demonstrates marginally acceptable performance because the nurse has had prior experience in actual situations/ there is efficient and skillful parts of their practice area, requiring occasional supportive cues. Knowledge is developing,
- Stage 3: Nurses who have had a specific skill for two or three years demonstrate competence. The nurse is able to demonstrate efficiency, and has confidence in his/her actions. Assessments and tasks are completed within a suitable time frame with supporting cues,
- Stage 4: The proficient nurse perceives situations as a whole. Proficient nurse learns from experiences. The proficient nurse decisions is less labored because he/she has a perspective on which of existing aspects are the most important,
- Stage 5: The expert nurse has an intuitive grasp on each situation. The expert nurse operates with a deep understanding of total situation and performs highly proficient and has the analytic ability.

Application of the theoretical framework. This EBP project included a tool that measured nurses' confidence in performing the NIHSS. The tool is called the National Institute of Health Stroke Scale Self-assessed competency of neurological assessment techniques (SACNAT II). The confidence tool categorized different parts of the NIHSS asking a question about each item. The participating nurses answered each question as it relates to each section of the NIHSS based on Patricia Benner's novice to expert theory. The participants responded either novice, advanced beginner, competent, proficient or expert. Since the certified nurses in this EBP project have either recent certification or minimal experience in performing the NIHSS, Benner's five levels of competence was a good theoretical framework to apply to nurses that have limited exposure to performing the NIHSS on a regular basis. The goal was to understand which items of the scale nurses' feel less/more confident in performing before and after the EBP project intervention. This EPB project provided a NIHSS simulation education intervention that offers practice and debriefing so that the nurses may move from novice to expert in each item of the NIHSS.

Strengths and Limitations of theoretical framework. This EBP project was an educational intervention and Benner's model has been used in nursing education for many years (Benner, 1985). This theoretical framework was well suited for his EBP project. The SACNAT II tool questions formatted using Benner's Novice to Expert stages provided a good way to measure confidence by assigning an objective number (1-5) to the NIHSS item in order to evaluate the nurses' confidence. Nursing schools for many years have used Benner's stages of clinical competence. The strength of this framework was that for the standard patient simulation used in the EBP project, it provided an educational strategy that moved nurses from novice to expert in several of the NIHSS items. The weaknesses of using Benner's model for the confidence survey is that although definitions were given, there may have been some confusion with interpretation. A few nurses asked for clarification while filling out the survey during the project.

In addition, Benner's model is often criticized for its simplistic approach to a very complicated aspect such as nursing competence.

Applicability of EBP Framework

The Stetler Model was selected to guide this EBP project for two reasons: (a) the model focuses on critical thinking and use of research findings (b) the model is nurse-oriented (Stetler, 2001). The five stages of the Stetler Model used for organizing this EPB project: phase 1: preparation, phase 2: validation, phase 3: comparative evaluation/decision making, phase 4: translation/application, and phase 5: evaluation. This framework was a good fit for this EBP project using standardized patient simulation as a way to improve and maintain inter-rater reliability among NIHSS certified nurses. It was a good fit for the following reasons. The first step was to identify the need for a change in NIHSS training at the EBP implementation site while completing clinical hours in the setting. Discussion of the problem with key stakeholders as well as identification of recent AHA stroke treatment changes for using the NIHSS to make decisions about endovascular stroke treatment confirmed the need for this practice change. Time was dedicated to evaluating the environmental factors that could influence this proposed practice change. Consolidation of the goal into a concise purpose statement and PICOT question format guided the initial search for relevant evidence to guide this EBP project.

Using phase two of the Stetler Model, research findings were critiqued with a focus on their practice applicability (Stetler, 2001). The DNP student completed a systematic search of the evidence and critically evaluated the resources for the use within this project following the John Hopkins Nursing Evidence Based Practice Appraisal tool.

Following phase three of Stetler's Model, the DNP student scrutinized the evidence to determine whether or not its use within the designated implementation sites would meet the determined simulation strategy need. The standardized patient (SP) simulation supported within the evidence was also evaluated for overall feasibility in this implementation facilities

setting. The DNP student determined that the evidence supported the intended SP simulation strategy and implementing this change with the designated implementation facility was not only feasible, but also would pose low-risk and provide potentially high-net benefit for the NIHSS certified nurses. In phase four, using helpful input from the site facilitator at the implementation sites, the DNP student outlined a detailed plan for intervention that delineated the steps to carry out the specific EBP change and submitted for IRB approval.

The final phase in the Stetler Model, evaluation, was undertaken through the debriefing of the NIHSS standardized patient simulation and data collection. The debriefing part of the intervention provided an opportunity to evaluate the participants one and one, in addition, the data collection aspect of the project allowed for exploration of the effectiveness of the SP simulation in improving and maintaining inter-rater reliability of NIHSS certified nurses. The Stetler model helped the DNP student assess how findings and other relevant evidence that can be applied to practice. This model examines how to use evidence to create formal change within the organization as well how individuals can use research on an informal basis as part of critical thinking and reflective practice (Stetler, 2001), making it a good fit for this EBP project.

Strengths and Weakness of the EBP Project

Evaluation of the EBP project by the DNP student revealed a number of strengths and weaknesses. Careful consideration of both the strength and weaknesses with this process will provide an objective view of potential contributing and inhibiting factors, as well as way in which similar future endeavors could be improved.

Strengths. Implementation of the EBP project, standardized patient simulation to improve NIHSS inter-rater reliability among NIHSS certified nurses was effective in increasing and maintaining inter-rater reliability. Additionally, the EBP project provided an unmet need for stroke coordinators at the implementation sites. This project helped keep NIHSS certified nurses competent in using the NIHSS on acute stroke patients. The SP simulation was easy to implement. All that is needed is a person to “act” like a stroke patient and use of a video

camera. The educator or stroke coordinator would then provide debriefing with demonstration on the NIHSS items that the nurse performed incorrectly.

The SP simulation may prove to be more cost effective in the future for hospitals too. NIHSS re-certification takes two to four hours to complete and nurses are paid their time becoming re-certified. A standardized patient NIHSS simulation with a debriefing session takes about 15-20 minutes and can be done on a "spot check" basis or during annual skills labs and competency check offs. Also, NIHSS certification programs have not shown to maintain inter-rater reliability after initial certification but this EBP project did.

Weaknesses. There was a con-founder noted in the project: six nurses had performed the NIHSS on live patients 10 times or more after part 1 and before part 3. This fact may have skewed the outcomes. The evidence states that NIHSS practice is critical in maintaining inter-rater reliability, so theses six nurses had more exposure to using the NIHSS than expected. The scenarios used for the SP simulation were straightforward and simple. They did not represent all types of stroke patient presentations so this could have affected the results. The small N may have been a weakness of the project results as well. Of course, there were only ED/ICU nurse groups and this project was implemented in only two hospitals. Lastly, the debriefing sessions highly emphasized visual fields, language, ataxia and neglect because that is where the need was of most participants, this could have contributed to the significant outcomes in these areas.

Implications for the Future

Practice. Based on the positive outcomes of this EBP, it is recommended that implementation of a NIHSS standardized patient simulation continues at these stroke centers. A greater focus on simulation with debriefing has already been a practice standard during both the implementation sites' nursing orientation as well as some other critical care skills and techniques. With the removal of the data collection portion of the project, the SP simulation process fits seamlessly with some of the simulation already occurring at these facilities. It is

also recommended that other stroke centers explore their current standards of NIHSS education and certification. This project targeted NIHSS certified nurses that had minimal exposure to performing the NIHSS, but future practices should include all NIHSS certified nurses even if they perform the NIHSS daily to ensure that they do not have any gaps in their knowledge and demonstrate best practice in the NIHSS assessment. Standardized patient simulation with debriefing offers an effective teaching and competency assessment strategy for the NIHSS certified nurses.

Theory. The DNP student heavily relied upon each phase of the Stetler Model. This EBP model helped formulate the entire EBP project process from beginning to end. It is proposed that with continued use by other leading EBP changes in healthcare settings and publishing works that the Stetler Model be synonymous with impacting change in the healthcare arena.

Research. The review of literature undertaken at the beginning of this EBP project helped establish that sufficient sources of knowledge regarding standardized patient simulation with debriefing already exist and that NIHSS inter-rater reliability is compromised as time passes from initial certification or training. Future nursing research endeavors might explore both the immediate and long-term effects of NIHSS standardized patient simulation and its effect on inter-rater reliability. In addition, evaluating the current certification programs (AHA and NIH) might provide some direction on which one may provide better inter-rater reliability longer than what the current literature discusses, i.e.: 4 weeks to 3 month “drift effect”. A cost effective analysis may be helpful to understand the difference between using SP simulation with debriefing for NIHSS training versus current certification programs and the return on investment (ROI) between the two programs.

Education. The positive outcomes of this EBP project may have a direct impact on future NIHSS education of nurses and APNs involved in assessing stroke patients. Professionally, nurses and APNs alike pride themselves on being experts in their skills. The NIHSS is most

accepted and most commonly used stroke assessment tool used today. This EPB project provides an educational strategy to increase and maintain inter-rater reliability. The NIHSS evaluates stroke severity, and the rater must have the ability to accurately and consistently assess the patient using the NIHSS tool. It has been demonstrated in the literature that standardized patient simulation with video debriefing is a proven and cost effective way to educate health care professionals (INACSL, 2013). Practice and regular exposure to performing a skill increases competence (Del Beuno, 2013), so an education protocol for "spot checking" NIHSS certified nurses that do not regularly use the NIHSS tool should be implemented to keep inter-rater reliability high and maintained.

Conclusion

The problem that this evidence-based practice (EBP) project addressed was the lack of competence and confidence with nurses using the NIHSS tool. Research has demonstrated that individuals certified on the NIHSS do not consistently demonstrate reliability when scoring patients from one health care professional to the next (Kiencke,1998). Thus, the inter-rater reliability is low, which contributes to inaccurate NIHSS scores and may affect proper stroke treatment. The objective of the EBP was to develop an educational process to maintain nurses' inter-rater reliability and confidence when performing the NIHSS. This EBP project did offer an education strategy to increase and maintain inter-rater reliability. Nurses in the project did have an improved level of self-confidence but those findings did not correlate with better NIHSS scores. Standardized patient simulation with video debriefing may provide an educational process to identify NIHSS assessment gaps. Lastly, SP simulation offers the opportunity to share NIHSS best practice assessment techniques through demonstration which this project validated in total NIHSS scores, and individual items such as ataxia, language, visual fields and extinction/neglect increases inter-rater reliability compared to expert raters.

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BIOGRAPHICAL MATERIAL

Kelly J. Trieglaff

Ms. Trieglaff graduated from California State University-Bakersfield with a Bachelors degree in the science of nursing in 1988. She worked in various intensive care settings, as well as a critical care educator and critical care manager. In 1996, Kelly received her MSN as a family nurse practitioner from Indiana Wesleyan University. She practiced as a FNP for 12 years in various roles including internal medicine, primary care, and emergency/urgent care. In 2004, Ms. Trieglaff was the co-founder of the Huntington County Free Clinic. She served as the nurse practitioner at the clinic for over 4 years. In addition, Kelly has served as adjunct faculty at Huntington University and has served as a preceptor to Ball State University and University of Saint Francis FNP students. Currently, she is employed as a senior clinical specialist with Genentech, USA. As a senior clinical specialist, her focus has been in acute stroke care, thus her interest in acute neurological assessment and the national institute of health stroke scale (NIHSS). Kelly has participated in several community leadership roles including a member of the American Heart Association Board in the Northwest Indiana Affiliate as well the United Way, AHA/Operation Stroke Taskforce and Aboite trails. Also, she has traveled to Haiti for three medical mission trips serving as nurse practitioner. She is certified as a FNP by the American College of Nurse Practitioners and is a member of the American College of Nurse Practitioners. Her other memberships include the Indiana Nursing Association, American Neurology Nursing Association and Infusion Nursing Society. Ms. Trieglaff is pursuing her DNP from Valparaiso University and will graduate in May 2016.

ACRONYM LIST

AHA: American Heart Association

AIS: Acute Ischemic Stroke

CNS: Canadian Neurological Scale

ED: Emergency Department

IOM: Institute of Medicine

JHNEBP: John Hopkins Nursing Evidence Based Practice Appraisal Tool

NIH: National Institute of Health

NIHSS: National Institute of Health Stroke Scale

SACNAT: Self-assessed Confidence Neurological Assessment Tool

SP: Standardized Patients

tPA: Tissue Plasminogen Activator

NIH STROKE SCALE

SCORING SHEET

Date & Time of Testing

CATEGORY:		SCALE DEFINITION	Date Time				
1a	**<u>Level of Consciousness</u>:** **(Alert, Drowsy, etc.)**	0=Alert 1=Drowsy 2=Stuporous 3=Coma					
1b.	**<u>LOC Questions</u>:** **(Month, Age)**	0=Answers both correctly 1=Answers one correctly 2=Both incorrect					
1c.	**<u>LOC Commands</u>:** **(Open & Close Eyes;** **Make fist & Let go)**	0=Obeys both correctly 1=Obeys one correctly 2=Both incorrect					
2.	**<u>Best Gaze</u>:** **(Eyes follow examiner's finger/ face horizontally)**	0=Normal 1=Partial gaze palsy 2=Forced deviation					
3.	**<u>Visual</u>:** **Test visual fields upper and lower quadrants on both sides.**	0=No visual loss 1=Cannot see in 1 quadrant 2=Cannot see in 2 quadrants 3=Cannot see in any quadrant					

4.	**<u>Facial Palsy</u>:** **(Show teeth, raise eyebrows, and squeeze eyes shut)**	0=Normal 1=Minor paralysis 2=Partial paralysis 3=Complete paralysis					
5. **&** **6.**	**<u>Motor Arm & Leg</u>: Arms--Extend the arms with palms down 90 degrees (if sitting) or 45 degrees (if supine). Drift is scored if the arm falls before 10 seconds.** **Begin with the non-paretic limb.** **Legs--With pt in the supine position, extend the legs 30 degrees. Drift is scored if the leg falls before 5 seconds.**	0=No drift for elapsed time 1=Drift (But does not hit bed) 2=Can't resist gravity (Drifts to bed) 3=No effort against gravity (Falls to bed quickly, but can move limb) 4=No movement. U=Untestable **5a. Left Arm** **5b. Right Arm** **6a. Left Leg** **6b. Right Leg**					
7.	**<u>Limb Ataxia</u>:** **Perform finger-nose-finger and heel-shin tests on both**	0=Absent 1=Present in one limb 2=Present in two limbs					

	sides.						
8.	**<u>Sensory</u>:** **Pin-prick to face, arm, leg, trunk. Compare side to side.**	0=Normal; no sensory loss 1=Mild to moderate loss 2=Severe to total loss					
9.	**<u>Best Language</u>:** **Name items, describe a picture, and read sentences. Tests ability to express ideas verbally.**	0=Normal; No aphasia 1=Mild to moderate aphasia 2=Severe aphasia 3=No usable speech					
10.	**<u>Dysarthria</u>:** **Evaluate speech clarity by pt repeating listed words.**	0=Normal Articulation 1=Mild to Mod Dysarthria 2=Nearly unintelligible or Worse U=Intubated or other physical barrier					
11.	**Extinction & Inattention** **Using touch & visual stimuli, evaluate for extinction or inattention.**	0=No Neglect 1=Inattention or extinction in one sensory modality. 2=Complete Neglect					
	TOTAL SCORE						
RN Signature							

Participant #_____

NATIONAL INSTITUTES OF HEALTH STROKE SCALE (NIHSS)

Self-Assessed Competency of Neurological Assessment Techniques

Categories uses in this self-assessment (based on Patricia Benner's Novice to Expert Theory: Please use the following levels to determine your level of skill in performing the competencies identified in the following questions

Level	Skill & Knowledge
Expert	* Analysis, synthesis, application, *highly skilled performance > Extensive exposure, with deep understanding of situation > Able to rapidly and consistently identify actual and potential assessment changes > Able to rapidly change priorities under all conditions
Proficient	* Conceptual understanding, * proficient performance > Extensive exposure in most situation > Able to anticipate potential assessment changes > Able to prioritize in response to changing situations
Competent	* Conceptual understanding and skill performance * competent > Varied exposure to many situations > Able to identify normal and abnormal findings > Able to prioritize under stable conditions
Advance Beginner	* Conceptual understanding, minimal clinical experience > Limited exposure to clinical situations >Able to identify normal findings
Novice	* Marginal conceptual understanding, minimal clinical experience > Seeks assistance in making clinical decisions

Self- Assessed Competency of Neurological Assessment Techniques Survey: Clinical NIHSS skills	Expert	Proficient	Competent	Adv. beginner	Novice
a. I am able to accurately determine the patient's level of consciousness					
b. I incorporate neurological examinations techniques to complete a comprehensive assessment when assessing stuporous or comatose patients					
c. I am able to accurately assess the mental status of my patients including the patient's orientation, awareness, attention, concentration level, comprehension, memory, reasoning and judgment.					
d. I am confident when assessing the patient's gaze and extra ocular movements. I can determine a normal and abnormal response.					
e. I am confident when assessing gross visual fields. I have the skills and knowledge to determine a normal and abnormal response and identify hemianopia.					
f. I am confident when assessing facial palsy. I incorporate testing into my assessment to determine if the patient has motor weakness of the lower face only or both the upper and lower face.					
g. I am confident in the assessment of motor strength and drift.					
h. I am able to accurately assess limb ataxia. I use assessment strategies to determine cerebellar impairment. I assess limb movement abnormalities in relations to sensory and motor dysfunction.					
i. I am competent in the assessment of sensation.					
j. I am competent in the assessment of expressive and receptive communication deficits. I am able to perform a general assessment to determine the patient's ability to understand the spoken and written word and to express thoughts orally and in writing.					
k. I am competent in the assessment of dysarthria. I evaluate the patients' clarity of speech					
I. I have the skills and knowledge to assess the presence of absence of "neglect". I assess inattention to aspects of the patients' sense including visual and tactile stimuli. I use assessment techniques to determine if a patient is not aware of (or is unable to identify) physical deficits.					

Participant # _____

NIHSS study Part #3 Questions

1. Did you complete Part 2: Yes or No

2. Approximately how many patients did you score since Part 1 (Oct, 2015) of this study? _____

3. Did you participate in any other NIHSS training since Part 1 of this study? (Circle all that apply)

    a. In-service
    b. One on One instruction
    c. Simulation
    d. Other_____
    e. Certification
    f. None