FEASIBILITY OF USING A NOVEL AND INTERACTIVE COMPUTER PROGRAM TO ASSESS EMOTIONAL HEALTH AFTER A STROKE

by

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As members of the DNP Project Committee, we certify that we have read the DNP Project prepared by Katherine Janell Sallee entitled "Feasibility of Using a Novel and Interactive Computer Program to Assess Emotional Health After a Stroke" and recommend that it be accepted as fulfilling the DNP Project requirement for the Degree of Doctor of Nursing Practice.

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Final approval and acceptance of this DNP Project is contingent upon the candidate's submission of the final copies of the DNP Project to the Graduate College.

I hereby certify that I have read this DNP Project prepared under my direction and recommend that it be accepted as fulfilling the DNP Project requirement.

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ABSTRACT

Purpose: Many patients suffer from depression after a stroke. The aims of this feasibility study were to: examine the recruitment process of community dwelling stroke survivors in a study using an interactive computer program (Cognues®), determine the ability to assess cognitive function and depression status in subjects using Cognuse® and ascertain the usability of the Cognuse® program from the perspective of eight study participants.

Methods: Stroke survivors in two community support groups and personal contact referrals were provided a research flyer and study synopsis, including background and study participation explanation. Eight stroke survivors agreed to take part in study. Each participant completed a depression and cognitive scale, three weeks of online computer exercises assigned by the PI, then a post-exercise depression and cognitive scale and a usability survey.

Results: Recruitment was difficult; the proposed number (8-10) of stroke survivors was successfully fulfilled over a 6 month time period. Of the eight consented subjects, seven completed the study with one lost to follow-up. Pre- and -post depression and cognitive scales were compared and analyzed. Half of the participants showed a small increase in cognitive function and showed a significant positive change after completion of the online exercises. Usability of the Cognuse® program was overall perceived in a neutral capacity by the participants and although the subjects liked the idea of the program, it was not as user friendly as expected.

Conclusion: Recruitment of community dwelling stroke survivors is feasible for a study using an online computer exercise program to determine emotional health. However, the usability of the selected program was determined to be neutral; participants liked the idea of the program but

found there were many limitations. Upon completion of the three week online exercises, subjects showed an increase in cognitive function and slight decrease in depressive symptoms, illustrating a possible link between cognitive function and depression.

INTRODUCTION

Approximately 800,000 new or recurrent strokes occur each year. Strokes are the fifth leading cause of death in the United States, killing an estimated 150,000 Americans and 4.5 million people worldwide. More than 50% of stroke survivors in America suffer from varying degrees of disability after 6 months, making strokes the number one cause of disability (American Heart Association [AHA], 2016). The type of stroke (ischemic or hemorrhagic) along with the size and location of the brain injury will determine the side effects and severity reported. Because the brain controls motor and sensory commands including how an individual moves, feels, thinks, speaks, behaves and reacts, there are many potential complications and combinations of complications. Complications include physical manifestations such as weakness, numbness, tingling or paralysis unilaterally or loss of sensation and motor impairment (American Stroke Association [ASA], 2014).

Difficulties with speech and language or swallowing are common in adults post-stroke along with impaired vision, cognitive changes (judgment, memory or problem solving) and behavior changes (improper actions and language and changes in personality). Changes in mood and emotions have been increasingly reported. These include new or worsening feelings of apathy, lack of motivation, tiredness and fatigue, frustration and anger, reflex crying, denial and depression (Chung et al., 2015). Because stroke can be a traumatic, life changing, and potentially devastating event, stroke survivors are highly susceptible to depression (Astrom, Adolfsson & Asplund, 1993) (National Stroke Association [NSA], 2014). While depression affects 350 million individuals globally, or one tenth the population, research has shown that approximately one in three stroke patients (~33%) develop depression within the first year after their event (Lees, Scott & Broomfield, 2003). Depression contributes to negative health

outcomes. If left untreated, hospital stays can be lengthened, quality of life and functional outcomes will be decreased and overall mortality rates are increased.

Interactive tablet-based technology has been used for both cognitive and emotional health/depression assessment and management. However, few studies have been conducted regarding the feasibility or usefulness of this technology for these purposes in the post stroke population. According to the National Stroke Association (2016), although there are suggestions that a computer exercise technology can support aphasia and memory loss recovery as a part of cognitive rehabilitation, there is no scientific evidence of overall improvement.

Cognuse® Rehabilitation Platform for the Continuum of Care is a new technological digital platform to help hospitals and clinicians assess and rehabilitate patients with serious neurological conditions such as strokes, traumatic brain injury (TBI), mild cognitive impairment (MCI) or Alzheimer's, using real-life themes as well as educational components. Cognuse® helps patients recover faster by improving accessibility to rehabilitation tools, providing a personalized rehabilitation program with real-time feedback, and decreasing the length of time to regain their functional skills (Dissertation project, unpublished).

Studies show that approximately 80-90% of individuals diagnosed with depression have been reported to respond well to treatment (American Psychiatric Association [APA], 2015). With adequate diagnoses being made and effective treatment, it is estimated that 15-57% of post-stroke patients will recover from depression within the first year (Ayerbe, Ayis, Wolfe & Rudd, 2013). According to de Man-van Ginkel and colleagues (2012), evidence has demonstrated that treatment of post-stroke depression leads to an increase in functional status and decrease in overall depression. Katon (2011) goes on to explain that using a combination of

evidence-based therapy and antidepressant medications delivered through collaborative care is most effective to treat depression in primary care services but does not specifically address the stroke population.

PURPOSE/AIMS

This feasibility study was designed to determine the effects of the use of the interactive computer program Cognuse® Rehabilitation Platform for the Continuum of Care on post-stroke depression. To my knowledge, a study of this kind has neither been conducted in any stroke population nor in the community setting.

The purpose of this feasibility study was to evaluate:

1) the barriers and/or ease of recruiting community stroke survivors into a study that would use an interactive computer program (Cognuse®)
2) the ability to assess cognitive function and depression using pre- and post scales in the Cognuse® program
3) the usability of the Cognuse® interactive program from the perspective of 8 to 10 stroke survivors

BACKGROUND

Depression

Major depressive disorder, also known as depression, is a medical condition that affects roughly 350 million of people across the world, throughout different cultures, races, ethnicities and socioeconomic classes (World Health Organization, 2012). Depression is a serious medical illness and mood disorder that has a negative effect on the way an individual feels, acts and

thinks. As with many mental illnesses, devastating consequences can occur if left untreated or undiagnosed (APA, 2015).

Depression may be diagnosed when emotional states such as sadness, become predominant and uncontrollable for more than two weeks (APA, 2015). Just like any other medical condition, depression affects each individual differently. Some of the most common symptoms are: increasing sadness, irritable mood, loss of interest and pleasure in activities, changes in appetite with a significant weight gain or weight loss, insomnia, loss of energy and fatigue, psychomotor agitation or retardation, increase in restless activity, poor concentration or increased indecisiveness, feelings of guilt, hopelessness and worthlessness and thoughts of death and suicide (APA, 2015).

Individuals with depression die roughly 5 to 10 years earlier than those who do not suffer from the mood disorder and have an increase of medical symptom burden, functional impairment, medical costs and poor adherence to self-care regimens (Katon, 2011). Depression contributes to maladaptive health risk behaviors due to the lack of coping skills or taking preventative measures. There is a higher risk of these individuals having a sedentary lifestyle, increased obesity rates, smoking, and poor medical regimen compliance (Katon, 2011). Therefore, there are greater incidences of major chronic medical illnesses such as diabetes, cardiovascular diseases, osteoarthritis, asthma and epilepsy in patients suffering from this psychiatric mood disorder (Katon, 2011).

There are multiple risk factors that contribute to developing depression. Biochemistry and the imbalance of chemicals or neurotransmitters in the brain is associated with depression, along with a strong genetic predisposition. Twin studies have reported a 59-70% risk of the

second twin acquiring the illness at some point in their life if the first twin has it (Katon, 2011). However, personality and environmental factors play a significant and important role in developing the mood disorder. Pessimistic and overwhelmed individuals with low self-esteem are at higher risk for depression as are those that are continuously exposed to any kind of abuse whether it be emotional, physical, sexual, psychological or neglect (APA, 2015). Traumatic life events such as loss of a loved one, extreme stress, financial concerns, new or worsening onset of a medical illness play a considerable role as well (Mayo Clinic, N.d.). There has also been increasing evidence suggesting that inflammation, or chronic medical illnesses that increase proinflammatory cytokines that in turn can modulate brain function, may play a substantial role as a risk factor of developing depression (Katon, 2011).

Depression and Stroke

Post-stroke depression is a common side effect that affects one third of stroke survivors and is often both undiagnosed and inadequately treated or managed (Williams et al., 2015). If left untreated or mismanaged in these patients, hospital stays can be lengthened, quality of life and functional outcomes will be decreased, and overall mortality and morbidity rates are increased (Lees et al., 2014) (Williams et al., 2015).

Hackett and colleagues (2005) conducted a systematic review on observational studies that looked at the frequency that depression occurs after having a stroke. Their goal was to examine high-quality study reports in order to ascertain the frequency a post-stroke survivor develops depression, the outcome, and how depression was managed. Out of the 12,000 studies identified, 96 met inclusion criteria with 51 research studies examined. Post-stroke depression is seen in at least one fourth of stroke survivors within the first year of the event with the onset

being the same in early, medium and late recovery periods. New or worsening onset of depression in stroke victims is the same in early stages of recovery than in the late stages. In addition, the majority of patients found with stroke-associated depression were not being adequately managed or treated (Hackett, Yapa, Parag & Anderson, 2005).

Astrom and colleagues (1993) conducted a 3 year longitudinal study that confirmed a heightened prevalence of depression after a stroke event. They concluded that depression onset occurred 31% at 3 years post-stroke versus 29% within 3 months.

A more recent systematic meta-analysis by Ayerbe and colleagues (2013) revealed that 39-52% of stroke patients developed depression within 5 years after their initial stroke event with 29% at 10 years. With adequate diagnoses being made and effective treatment, 15-57% of patients recovered from depression within that first year (Ayerbe et al., 2013). Disability, previous depression diagnosis, cognitive impairment, anxiety and stroke severity were found to be predicting factors of developing depression with outcomes including increased disability, lower quality of life and mortality.

Depression Assessments

There are multiple depression scales used to evaluate patients, both patient and clinician administered tools. The PHQ-9 was developed by Spitzer et al. and is copyrighted by Pfizer. It is a nine question, self-administered questionnaire that is frequently used to evaluate major depressive disorder according to the Diagnostic and Statistical Manual of mental disorders. The questionnaire addresses symptoms such as lack of sleep or oversleep, appetite changes, self-worth, concentration, decreased vigor and thoughts of hurting oneself over the previous 2 weeks (Chung et al., 2015). According to Chung and colleagues (2015) it has shown both good internal

consistency and test-retest reliability along with high diagnostic accuracy when evaluating post-stroke depression (Chung et al., 2015)(Williams et al., 2005).

The PROMIS-D-8 (Patient Reported Outcome Measurement Information System) questionnaire is a universal, non-disease specific, scale used to evaluate depression over the last seven days in individuals. It was developed by the National Institutes of Health (NIH) to create and validate patient reported outcome scales that measure function, feelings and perception in patients with chronic medical conditions to determine their physical, mental and social well-being (NIH, N.d.). The instrument has not been used to evaluate depression in stroke patients. However, a study conducted by Chung and colleagues (2015) showed that in patients with multiple sclerosis and spinal cord injury, the test-retest reliability of the PROMIS-D-8 depression scale was similar to the PHQ-9.

Cognitive Assessments

Just as there are multiple scales to evaluate depression, there are a large number that determine the level of cognitive function of individuals. Some of the instruments that are commonly used for stroke survivors are the Mini-Mental Status Examination (MMSE) and Montreal Cognitive Assessment (MoCA). Cumming and colleagues (2013) compared the validity of using the MMSE and MoCA scales in post-stroke patients in a study in 2013. The results showed that the MoCA had higher sensitivity than the MMSE but lower specificity, however both screening tools prove to be valid scales to determine cognitive impairment after a patient has a stroke (Cumming, Churilov & Bernhardt, 2013). The NIH PROMIS also provides an 8 question cognitive evaluation tool (Applied Cognitive Abilities Short Form 8a). Although

there is no evidence published on using this tool for post-stroke patients, using similar tools in this study to determine depression and cognitive function will provide optimal consistency.

FRAMEWORK

The Ottawa Model of Research Use (OMRU) provided the framework for this project. It is a planned change theory, or planned action model, that has a primary objective aimed at assisting practitioners and facilitators in applying interventions to clinical practice based on valid evidence-based research along with implementing continuity of care innovations (Rycroft-Malone & Bucknall, 2010). The OMRU provided a knowledge-to-action framework that focuses on an interactive collaboration to promote research and to apply knowledge found through research to practice (both scientific and clinical) (Graham & Logan, 2010).

The key elements of the OMRU offer a sturdy foundation that is dynamic, synergistic and multidisciplinary, can be used at any level of care, and will assist in the translation of evidence based research data into clinical practice or policy implementation. These six elements are essential to the research use process: research-informed innovation, potential adopters, practice environment, implementation interventions to transfer research to practice, adoption of innovation, and key outcomes (Rycroft-Malone & Bucknall, 2010). Each of the elements can both influence and be influenced by one another and is not only descriptive but also prescriptive, meaning a process of assessment, monitoring and evaluation are incorporated in the model (Logan & Graham, 2010). All of these factors have the potential to provide sufficient and necessary data to support and guide this feasibility study.

The interventions that are implemented by the OMRU can be measured and evaluated through quantitative and qualitative methods. Interviews and questionnaires can be

administered, chart reviews or audits completed, databases analyzed, and quality of life indicators and health outcomes examined. Supply costs and financial burdens can also be reviewed (Rycroft-Malone & Bucknall, 2010). The OMRU model can be utilized by breaking down the process into attainable phases while offering a big picture view simultaneously. It provides a structure that includes all individuals, organizations/corporations or systems that would be affected by the proposed intervention, while decreasing barriers that arise from implementation and increasing buy-in from stakeholders (Logan & Graham, 2010). The model will force consideration of alternative action, encouragement and support of adoption of research-informed recommendation. It should be systematic, transparent and useful for multidisciplinary healthcare practitioners while using neutral language (Rycroft-Malone & Bucknall, 2010). Together, these factors have provided sufficient information that has supported the recruitment of post-stroke patients in a feasibility study utilizing an interactive computer program. The model assisted in determining the ease of participant recruitment along with the usability of the online program consisting of cognitive, language/aphasia, and daily living activity exercises.

Barriers that are potentially seen to accompany this feasibility study consist of the online program delivering exercises at an acceptable level of understanding for the participants. The academic education level along with the cognitive function will differ among the post-stroke patient.

The education intervention and determination of computer program usability in this feasibility study can be implemented using the Ottawa Model of Research Use framework

because it will contribute to the implementation of research knowledge into clinical and scientific practice (Graham & Logan, 2010).

METHODS

Study Design

This was a feasibility study that enrolled both males and females who had previously been diagnosed with a stroke. Each participant underwent the consent process and provided personal demographic data. Then they completed a depression and cognitive scale, three weeks of online computer exercises and post-activity depression and cognitive scales along with a usability survey.

Setting and Population

Eight stroke survivors were recruited from an urban community in the southwest U.S. Recruitment occurred from local stroke support groups and from personal contact referrals.

Inclusion and Exclusion Criteria

Inclusion criteria were 1.) 18 years of age or older, 2.) a diagnosis of ischemic stroke or hemorrhagic stroke, per patient report, 3.) had no more than moderate cognitive impairment based the PROMIS cognitive evaluation scale, 4.) had access to and ability to use a computer. Individuals were excluded from participation if unable to read and follow directions on the computer or were non-English speaking.

Intervention

Cognuse® Rehabilitation Platform for the Continuum of Care (Cognuse®). Cognuse® is an interactive tablet-based rehabilitation platform that was developed in 2013. The program was originally developed to provide cognitive support for people with Alzheimer's dementia with

total of 100 patients, through ongoing studies at Johns Hopkins University. As part of the Continuum of Care platform, the program is currently being used in intensive care populations in New York City and outpatient facilities in California. According to Olari Koresaar, Chief Operating Officer, this program has not been used in a stroke population (O. Koresaar, personal communication, September 16, 2015).

For the user, the program consists of assessments, exercises, and chat/discussion boards. For the researcher, the program has analysis and reporting systems.

The Platform consists of:

- Standard Assessments in Physical Therapy, Occupational Therapy, Cognition and Depression
- Real-time exercises that include Activities of Daily Living, Aphasia, Cognition
- Individualized training plan
- Intervention planning and execution
- Real-time participant feedback and interactions

The user can access the Cognuse® program from any computer, tablet, or mobile device. Unique benefits of the Cognuse® platform include real-time reporting that profit the user as well as detailed analytics powered by Cognuse® technology that provide data for the researcher.

Measures

A total of five questionnaires/survey will be required for completion by the participant. These include two depression scales (the PROMIS Emotional Distress - Depression - Short Form 8a), two cognitive scales (the PROMIS Applied Cognition - General Concerns - Short Form 8a)

and the Cognuse® Rehab Usability Survey. Three weeks of online computer exercises will be assigned to each study participant.

Procedure

Prior to the start of the study, the Cognuse® team conducted a "train the trainer" session with the PI. The training consisted of a one-one-one phone call with the Cognuse® team as the PI navigated the program and learned how to help users with all aspects of the program. This training took approximately 30 minutes. The Cognuse® team was available online 24/7 to answer any questions the PI had.

Contact information was provided on the study information flyers (Appendix D) and potential participants either called or emailed the PI if they were interested. After screening for eligibility, informed consent and study details was discussed. If still interested in participation, the PI made an appointment and met participants in their homes where informed consent was obtained. At that appointment a login URL, provided to the PI by the Cognuse® team, was given to the participant. The PI facilitated initial website login and a training session was conducted that took approximately 30 minutes. This training included the use of the assessments and exercises, along with navigation of the computer program.

Following training, on the same day or another day but prior to beginning the online exercises, the participant completed the initial depression (PROMIS Emotional Distress - Depression - Short Form 8a) (Appendix A) and cognitive (PROMIS Applied Cognition - General Concerns - Short Form 8a) (Appendix B) scales online. An individualized, interactive exercise (includes 14 Activity Planning, Aphasia, and Cognitive exercises, as appropriate) plan was designated by the PI. The plan was assigned by random, using a mixture of Activity Planning

exercises, Aphasia exercises and Cognition exercises. Each of the online exercises will have the same number of participants assigned to them to accurately determine ease of usability. Participants completed the interactive exercises 2-3 times per week for 3 weeks.

The interactive exercises include the following: Word Repetition, Picture Word Matching, Picture Exclusion, Fill InThe Blank, Picture Identification, Picture-Sentence Matching, Sentence Writing, Sentence Reading Comprehension, Album Pages, Home Cooking, Route Planning, Kitchen Skills, and Falling Numbers.

In addition, the PI was available via email or phone should the users have had questions with technology. Cognuse® team support was available online 24/7 for the users and the PI was be available for questions Monday through Friday 8am to 5pm.

After three weeks of online interactive exercises, the participant completed the depression and cognitive scales along with the Cognuse® Rehab Usability Survey.

Data Analysis

For Aim 1, descriptive statistics were used to calculate the ease of recruitment. This was completed through the collection of data on the number of study inquiries and the number of those who were eligible for study participation, the number who agreed to participate, and how they were informed of the study. Reasons for ineligibility will be collected. Demographic data was collected on each participant to include type of stroke and date of event, age, gender, education level, marital status and presence of caregiver. Descriptive statistics (mean, SD) will be used for demographic data (Appendix F). Aim 2 used quantitative data analysis comparing pre-test and post-test results from the depression and cognitive scales. Aim 3 used quantitative data analysis to determine the usability of the online interactive computer program by examining

the frequency of line-by-line items entered on the Usability Survey (Appendix C). The Usability Survey uses a Likert Scale with each of the answers directly assigned to a numerical value for analysis.

PROTECTION OF HUMAN SUBJECTS

This feasibility study was submitted to the University of Arizona Institutional Review Board (IRB). Potential study participants were approached and asked to participate anonymously without coercion or persuasion. Subjects were able to withdraw their participation at anytime without penalty. There were no risks to the subjects to participate. However, the benefits included the contribution to data for future larger studies that may use this online program in a larger or acute setting stroke population. No compensation was provided to study subjects and the only cost was their time.

During and throughout the study, patient identity was not revealed or accessed. Data collection was highly encrypted and controlled in an environment where it was not released to anyone unless requested by the study coordinator. The Cognuse® platform assured that each patient's "source ID" (identifier at the data source) was dynamically encrypted into a "study ID" (identifier at the study site) when transferring data to the study database. In order to support study protocols that permit patient re-identification from the study site back to different source sites to collect follow-up data, a layered encryption scheme was used to create the study ID.

Additionally, Cognuse® took a number of steps to protect ePHI according to the standards set out by HIPAA including administrative safeguards, physical safeguards, and technical safeguards. For example, rigorous access controls ensure that only appropriate parties had access to Cognuse® systems. In addition, numerous controls within the Cognuse®

technology and infrastructure ensured that data was secure both in transit and at rest. Cognuse® used strong encryption methods to ensure that ePHI was protected against compromise. In addition to digital safeguards, Cognuse® used physical safeguards by using Amazon's EC2 service to provide the computing capacity needed to run applications and Amazon's S3 service. Amazon is a well known provider and had appropriate controls in place for facility security, access control, and contingency operations.

RESULTS

Description of the Sample

Eight individuals consented to participate in the study. A description of the Sample is n Table 1. The sample was comprised of 3 males and 5 females. Seven were Caucasian and one was an American Indian. The mean age was 72 years (range 55 to 89 years).

TABLE 1. Participant Characteristics

		N=8
Age Mean		72
Females, n (%)		5 (62.5%)
Males, n (%)		3 (37.5%)
White (Non Hispanic)		7 (87.5%)
White (Hispanic)		0 (0%)
Black		0 (0%)
Native American		1 (12.5%)
Marital Status, n (%)		
Married		7 (87.5%)
Single		1 (12.5%)
Education, n (%)		
High School		1 (12.5%)
Trade School		1 (12.5%)
Some College		3 (37.5%)
Master's Degree		3 (37.5%)

Ischemic Stroke, n (%)		6 (75%)
Hemorrhagic Stroke, n (%)		1 (12.5%)
Unknown, n (%)		1 (12.5%)
Physical Deficits, n (%)		2 (25%)
Cognitive Deficits, n (%)		2 (25%)
No Deficits, n (%)		4 (50%)

All eight participants had a history of stroke within the last 12 years. One participant smoked as recently as March 2016. None were smokers at the time of the study. Regarding stroke subtype, six were ischemic one was hemorrhagic and one participant did not know which type he/she had.

While a formal assessment of post-stroke impairments was not performed, participants discussed their impairments with the PI and were observed to be accurate by the PI. The degree of stroke-related impairments varied among the subjects. Four participants had no physical or cognitive changes, two had mild cognitive changes, one had mild physical impairments and one had moderate physical impairment. Two participants (with physical impairments) required assistance for activities of daily living and/or household tasks. For one participant, assistance came from an occasional caregiver that helped around the house and for the other participant, assistance came from the spouse.

Seven of the eight participants were married and one was single. Educational backgrounds were diverse amongst the individuals and ranged from a Master's level to trade school. Six had a minimum of some college and 3 of those had earned a Master's degree.

Depression was not formally diagnosed in any of the eight subjects. However, two participants were seen by a psychiatrist in the hospital as a part of their treatment regimen and

were immediately prescribed an antidepressant, which they were still taking at the time of the study.

Aim #1: Recruitment

Recruitment was conducted over an eight month period. A total of eight stroke survivors were enrolled. The principal investigator attended two community stroke support groups to provide a verbal and written summary of the study. There were approximately 20 stroke survivors in these two support groups. Five study participants who were members of these community support groups approached the PI after the meeting, either in person or via email, stating their interest in participation. The other three study participants were contacted by the PI at the request of an individual close to the stroke survivor.

After interest in the study was ascertained, an appointment was arranged with the potential participant to discuss the study including the objectives, methodology and participant expectations, review and sign the consent form and complete training on navigating the online exercise program.

The consent discussion took place in the participant's house and was between the individual and the principal investigator, and in one conversation the spouse was present as well. An IRB approved consent form was handed to the individual and the individual was provided with sufficient time to read and review the form. At that time, a discussion then took place to ensure the individual understood what the study entailed, including the aims or objectives, what the participation expectations were, and that participation was completely voluntary and held no bearing on current or future medical care and treatment. The demographic form was then completed by the individual and eligibility was verified by the principal investigator. Each

participant was reassured that all study and health information collected, including demographics data and results from the scales and exercise completion would be kept confidential.

At this visit, a username and password was created for the participant and the online program navigation training was completed. The PI verified that the subject could log into the website and then multiple exercises and questionnaires were reviewed. A follow-up email was sent by the PI that same day that included a link to the website and PI contact information if the individual should have any questions.

Of the 8 subjects who willingly consented to participate in this research study, seven successfully completed the program. The eighth participant did not begin the study due to computer difficulties and was unable to log into the website to start participation. He/she contacted the PI one time via phone message stating this and the PI emailed twice and left two messages to provide assistance with no response. This subject was considered lost to follow-up.

Aim #2: Questionnaires and Exercises

A total of eight stroke survivors received the questionnaires and online module training. Seven of the eight subjects completed all five questionnaires and three weeks of interactive computer exercises, giving a response rate of 87.5%. The eighth subject was lost to follow-up and did not complete the questionnaires or begin the online computer modules. The pre- and post-exercise depression and cognitive scales along with the usability survey were all completed correctly and in full by the seven subjects. No questions were left blank or had multiple answers.

As described earlier, the Patient-Reported Outcomes Measurement Information System (PROMIS) scales are designed to measure health outcomes from the perspective of a patient and were selected for this study to ensure consistency and reliability in the questions and statistical

scoring for the two necessary scales. The short eight question form was chosen for both. The depression scale, Emotional Distress-Depression-Short Form 8a, was designed to assess self-reported mood, interest level and social engagement over the previous 7 days. The cognitive scale, Applied Cognition-General Concerns-Short Form 8a, assesses the perception of an individual's functional abilities within the last 7 days. Using a scale of 1 to 5, subjects rank their answers for both PROMIS scales as follows: 1= Never, 2= Rarely, 3= Sometimes, 4= Often and 5= Always. The lowest possible score is 8 while the highest is 40. The Usability Survey was created to obtain feedback from the subjects on the functionality and ease of operating the Cognuse® interactive program. For this survey, participants used a scale of 1 to 5 (1= Highly Disagree, 2 = Disagree, 3= Neutral, 4= Agree, 5= Highly Agree).

Emotional Distress–Depression–Short Form 8a (PROMIS D-8a)

The PROMIS depression scale was completed by each participant prior to beginning the online computer exercises. The results are shown in Table 2 and summarized below.

TABLE 2. Pre-Exercise Depression Scores

Key	1- Never	4- Often
	2- Rarely	5- Always
	3- Sometimes	

DEPRESSION SCALE Pre-exercise	Subject 01	Subject 02	Subject 03	Subject 04	Subject 05	Subject 06	Subject 07	Total	Mean	SD
I felt worthless	2	1	1	4	1	1	1	11	1.5714	1.134
I felt helpless	2	1	1	4	1	1	1	11	1.5714	1.134
I felt depressed	2	1	1	5	1	2	1	13	1.8571	1.464
I felt hopeless	1	1	1	4	1	1	1	10	1.4286	1.134
I felt like a failure	1	1	1	4	1	1	1	10	1.4286	1.134
I felt unhappy	2	1	2	4	1	2	1	13	1.8571	1.464
I felt that I had nothing to look forward to	1	1	1	3	1	1	1	9	1.2857	0.756

I felt that nothing could cheer me up	1	1	1	3	1	1	1	9	1.2857	0.756
Total (Raw Score)	12	8	9	31	8	10	8		12.2857	
T-Score	57.7	53.2	54.3	79.3	53.2	55.5	53.2		58.7	
SE	3	3.1	3.1	3.5	3.1	3	3.1		3.0	

'I felt worthless', five of the seven subjects responded never, one answered rarely and one often with a mean score of 1.5714 +/- 1.134 standard deviation (SD). 'I felt helpless', five subjects responded never, one rarely and one often for a mean of 1.5714 +/- 1.134 SD. 'I felt depressed', four subjects answered never, two rarely and one always for a mean of 1.8571 +/- 1.464 SD. 'I felt hopeless' six stated never and one often, mean of 1.4285 +/- 1.134 SD. 'I felt like a failure' six answered never and one often for a mean of 1.4285 +/- 1.134 SD. 'I felt unhappy' three responded never, three rarely and one often, mean of 1.8571 +/- 1.464 SD. 'I felt that I had nothing to look forward to', six answered never and one responded sometimes, mean of 1.2857 +/- 0.756 SD. 'I felt that nothing could cheer me up' six responded never and one stated sometimes, mean of 1.2857 +/- 0.756 SD.

The total score for the subjects ranged from 8 to 31 with a mean of 12.2857. The majority of subjects enrolled in this study were not depressed, evidenced by their low depression scale scores. The participant that scored 31 discussed through personal conversation with the PI that he/she was not clinically diagnosed with depression by his/her provider, but is currently on an antidepressant medication and is being followed by his/her primary provider.

After participating in three weeks of online computer exercises each subject completed the depression scale again. The results are shown in Table 3 and are summarized here:

TABLE 3. Post-Exercise Depression Scores

Key	1- Never	4- Often
	2- Rarely	5- Always
	3- Sometimes	

DEPRESSION SCALE Post-exercise	Subject 01	Subject 02	Subject 03	Subject 04	Subject 05	Subject 06	Subject 07	Total	Mean	SD
I felt worthless	1	1	2	4	1	1	1	11	1.5714	1.134
I felt helpless	2	1	1	4	1	1	1	11	1.5714	1.134
I felt depressed	2	1	3	4	1	1	1	13	1.8571	1.464
I felt hopeless	1	1	1	3	1	1	1	9	1.2857	0.756
I felt like a failure	1	1	2	4	1	1	1	11	1.5714	1.134
I felt unhappy	2	1	3	3	1	1	1	12	1.7143	0.951
I felt that I had nothing to look forward to	1	1	1	3	1	1	1	9	1.2857	0.756
I felt that nothing could cheer me up	1	1	1	4	1	1	1	10	1.4286	1.134
Total	11	8	14	29	8	8	8		12.2857	
T-Score	56.6	53.2	59.7	75.9	53.2	53.2	53.2		58.7000	
SE	3	3.1	2.9	3.2	3.1	3.1	3.1		3.0000	

'I felt worthless', five of seven subjects responded never, one answered rarely and one often with a mean of 1.5714 +/- 1.134 SD. Five answered never, one rarely and one often to 'I felt helpless' for a mean of 1.5714 +/- 1.134 SD. 'I felt depressed', four responded never, one rarely, one sometimes and one often, mean 1.8571 +/- 1.464 SD. 'I felt hopeless' six answered never and one sometimes for a mean of 1.2857 +/- 0.756 SD. 'I felt like a failure' five stated never, one rarely and one often, mean of 1.5714 +/- 1.134 SD. 'I felt unhappy' four marked never, one rarely and two sometimes with a mean of 1. 7142 +/- 0.951 SD. 'I felt that I had nothing to look forward to' six responded never and one sometimes. This had a mean of 1.2857 +/- 0.756 SD. 'I felt that nothing could cheer me up' six answered never and one sometimes, mean of 1.4285 +/- 1.134 SD.

The mean depression score after completing the exercise was 12.2857. The pre- and post-exercise depression scores were the same. However, the scores changed for four of the subjects. One increased his/her score and three decreased their scores. One subject felt more worthless, depressed, hopeless and more like a failure in the post-exercise scale, increasing his/her score five points. Of the three who decreased their scores, one felt less worthless, two were less depressed, one more hopeful, two felt happier and one felt more like nothing could cheer him/her up. One decreased his/her score by one point and other two by two points. The level of depression in this selected population is very low with a range of scores between 8 and 14 and one participant scored 29.

The pre- and post-exercise scale analysis showed a slight decrease in overall depression score demonstrating a decrease in depressive symptoms after completing three weeks of computer exercises.

Applied Cognition-General Concerns-Short Form 8a (PROMIS 8a)

Results for the pre-exercise cognitive scale are seen in Table 4 with line item results shown below:

TABLE 4. Pre-Exercise Cognitive Scores

Key	1- Never	4- Often
	2- Rarely	5- Always
	3- Sometimes	

COGNITIVE SCALE Pre-exercise	Subject 01	Subject 02	Subject 03	Subject 04	Subject 05	Subject 06	Subject 07	Total	Mean	SD
My thinking has been slow	2	2	1	5	1	2	3	16	2.2857	1.380
It has seemed like my brain was not working as well	3	2	1	5	1	2	3	17	2.4286	1.397

as usual										
I have had to work harder than usual to keep track of what I was doing	3	1	1	5	1	2	2	15	2.1429	1.464
I have had trouble shifting back and forth between different acitivities that require thinking	3	2	1	5	1	2	2	16	2.2857	1.380
I have had trouble concentrating	3	2	1	5	1	2	2	16	2.2857	1.380
I have had to work really hard to pay attention or I would make a mistake	2	1	1	5	1	2	1	13	1.8571	1.464
I have had trouble forming thoughts	2	2	1	4	1	2	1	13	1.8571	1.464
My problems with memory, concentration, or making mental mistakes have interfered with quality of my life	1	1	1	5	1	2	1	12	1.7143	0.951
Total	19	13	8	39	8	16	15		16.8571	
T-Score	40.7	36.5	27	59.5	27	38.7	38		39.4000	
SE	1.5	1.6	4	2.5	4	1.4	1.5		1.4000	

'My thinking has been slow' two responded never, three rarely, one sometimes and one always for a mean of 2.2857 +/- 1.380 SD. 'It has seemed like my brain was not working as well as usual' two stated never, two rarely, two sometimes and one always, mean of 2.4285 +/- 1.397 SD. 'I have had to work harder than usual to keep track of what I was doing' three answered

never, two rarely and one always, mean of 2.1428 +/- 1.464 SD. 'I have had trouble shifting back and forth between different activities that require thinking', two responded never, three rarely, one sometimes and one always for a mean of 2.2857 +/- 1.380 SD. 'I have had trouble concentrating' two answered never, three rarely, one sometimes and one always, mean of 2.2857 +/- 1.380 SD. 'I have had to work really hard to pay attention or I would make a mistake' four responded never, two rarely and one always with a mean of 1.8571 +/- 1.464 SD. 'I have had trouble forming thoughts' three stated never, three rarely and one often, mean of 1.8571 +/- 1.464 SD. 'My problems with memory, concentration, or making mental mistakes have interfered with quality of my life' five answered never, one rarely and one always, mean of 1.7142 +/- 0.951 SD.

The scores ranged from 8 to 39 with a mean of 16.8571. The score is indicative that the cognitive functionality for all subjects is intact, except one score of 39, demonstrating mild-to-moderate self-perceived impairment. The higher the score indicates a higher cognitive impairment.

Results post-completion of 3 weeks of online computer exercises are in Table 5 and summarized as follows:

TABLE 5. Post-Exercise Cognitive Scores

Key	1- Never	4- Often
	2- Rarely	5- Always
	3- Sometimes	

COGNITIVE SCALE Post-exercise	Subject 01	Subject 02	Subject 03	Subject 04	Subject 05	Subject 06	Subject 07	Total	Mean	SD
My thinking has been slow	2	1	1	5	1	1	3	14	2.0000	1.528
It has seemed like my brain	2	1	1	5	1	1	3	14	2.0000	1.528

was not working as well as usual										
I have had to work harder than usual to keep track of what I was doing	2	1	1	4	1	1	1	11	1.5714	1.134
I have had trouble shifting back and forth between different acitivities that require thinking	2	1	1	5	1	1	1	12	1.7143	0.951
I have had trouble concentrating	3	2	1	5	1	1	2	15	2.1429	1.464
I have had to work really hard to pay attention or I would make a mistake	3	1	1	5	1	1	1	13	1.8571	1.464
I have had trouble forming thoughts	3	1	1	5	1	1	1	13	1.8571	1.464
My problems with memory, concentration, or making mental mistakes have interfered with quality of my life	1	1	1	5	1	1	1	11	1.5714	1.134
Total	18	9	8	39	8	8	13		14.7143	
T-Score	40	31.4	27	59.4	27	27	36.5		38.0000	
SE	1.4	2.4	4	2.5	4	4	1.6		1.5000	

Four responded never, one rarely, one sometimes and one always to the question 'My thinking has been slow' for a mean of 2.0000 +/- 1.528 SD. 'It has seemed like my brain was not working as well as usual' four answered never, one rarely, one sometimes and one always, mean of 2.000 +/- 1.528 SD. 'I have had to work harder than usual to keep track of what I was doing'

five answered never, one rarely and one often, mean of 1.5714 +/- 1.134 SD. 'I have had trouble shifting back and forth between different activities that require thinking' five responded never, one rarely and one always mean of 1.7142 +/- 0.951 SD. 'I have had trouble concentrating' three stated never, two rarely, one sometimes and one always for a mean score of 2.1428 +/- 1.464 SD. 'I have had to work really hard to pay attention or I would make a mistake', five responded never, one sometimes and one always, mean of 1.8571 +/- 1.464 SD. 'I have had trouble forming thoughts' five answered never, one sometimes and one always, mean of 1.8571 +/- 1.464 SD. 'My problems with memory, concentration, or making mental mistakes have interfered with quality of my life' six subjects answered never and one always for a mean of 1.5714 +/- 1.134 SD.

The subject totals still ranged from 8 to 18, with one participant scoring 39, and the mean score for the post-exercise cognitive scale decreased from 16.8571 to 14.7142. Three subjects had the same pre- and post-exercise score. However, four subjects showed an overall decrease in their score demonstrating an increase in their perceived, self-reported cognitive function.

The pre- and post-exercise cognitive scale analyses concludes there was an overall increase in cognitive function of subjects after completion of the three week online computer exercises.

Cognuse® Exercises

The subjects were given the choice of completing computer exercises on two or three days every week for three weeks. All but one subject chose to complete the assignments over two days.

Fourteen exercises were chosen for subject completion prior to initiation of this DNP research study. They were evenly chosen between speech therapy and cognitive activities. The seven Speech Therapy exercises included: Picture Word Matching, Picture Exclusion, Picture Identification, Naming Days, Picture Sentence Matching, Sentence Writing and Sentence Reading Comprehension. The seven Cognitive exercises included: Album Pages, Home Cooking, Route Planning, UFOs, Clock, Kitchen Skills and Falling Numbers. The exercises were pre-screened by the PI twice, once for IRB submission then again immediately prior to assigning to subjects, to ensure all were appropriate for study inclusion. Following the second pre-screen, 5 of the 14 exercises were excluded due to lack of adequate instruction, insufficient variability (meaning there was only one variation of the exercise and could not be completed multiple times) or was difficult to navigate. To allow more exercise plan options, two additional exercises were included (Word Repetition and Fill in the Blank) for a total of 11 exercises to choose amongst as seen in Table 6. The PI randomly chose a mixture of both speech therapy and cognitive exercises each participant was to fulfill each day. The random choice design was chosen by the PI to limit selection bias.

TABLE 6. Exercise Completion per Subject

Key ? = Assigned but not completed

Completed Exercises	#01	time	#02	time	#03	time	#04	time	#05	time	#06	time	#07	time
Picture Word Matching			**141**	27	**328**	27	**514**	65	**635**	95	**385**	39	**122**	16
Picture Exclusion	**63**	19			**162**	33	**93**	40	**135**	42	**95**	21	**175**	41
Picture Identification	**5**	1	**93**	27	**257**	22	**453**	59			**143**	17	**154**	16
Picture Sentence	**34**	4	?		**524**	46	**400**	43						

Matching														
Sentence Writing	?		?								**64**	19		
Sentence Reading Comprehension	26	3	**76**	15	**263**	26	**365**	45	**219**	45	**498**	47		
Album Pages	1	NA	**148**	NA	**124**	NA	**131**	NA	**179**	NA	**186**	NA	**5**	NA
Home Cooking			**78**	NA	32	NA								
Route Planning	?				**25**	NA					?			
Added by PI														
Word Repetition	**21**	1	?		**861**	37	**451**	24			5	0		
Fill in the Blank	**80**	20			**584**	43	**427**	33			**292**	21		
Additional Exercises Completed by Subject														
Word Repetition without text	158	14												
Word Repetition with delay	49	15												
Action-word Matching	40	9			2	1								
Picture-verb Matching	10	2												
Picture Labeling	5	3												
Two Word and Picture Identification											12	2		
Two Word Repetition	17	5			40	10								
Total Time		96		69		245		309		182		166		73

Each subject was assigned 3-4 exercises each day to take 20-30 minutes. The PI designated time amounts of 7 to 15 minutes for the seven speech therapy exercises while the three cognitive exercises did not have the capability for time allocations and the subjects were instructed to repeat the exercise multiple times for 10 minutes. The cognitive exercises did not configure into the completion time totals or average time spent on the interactive computer

program. Completion time ranged between 69 to 309 minutes for the three weeks, averaging 23 to 103 minutes.

Speech Therapy Exercises (Table 6)

These exercises can be assigned a time limit to complete but the PI does not have the capability to adjust the difficulty level. Picture Word Matching was completed by six of the seven that were assigned to this exercise for a total of 269 minutes. Picture Exclusion was completed by six of the seven for 196 minutes. Six of the seven subjects were assigned to Picture Identification exercise and completed 142 minutes. Picture Sentence Matching was completed by four of the seven for a total of 93 minutes of completion. Sentence Writing was assigned to three subjects, however only one completed the exercise for a total of 19 minutes. Sentence Reading Comprehension was completed by six subjects for a total of 181 minutes.

Cognitive Exercises (Table 6)

When assigning these exercises there is the option to choose difficulty level and time allotment. However, neither have been activated so the subject will complete the exercise and press 'Repeat the exercise' button. They were asked to complete these for approximately 10 minutes by watching their own clock.

Album Pages was assigned to all seven subjects and was completed a total of 744 times. Two subjects were assigned to Home Cooking. Three were assigned to Route Planning but was only completed by one.

The following two Speech Therapy exercises were added to allow more plan options after four of the original 12 exercises were removed.

Word Repetition was assigned to five of the seven subjects but only four initiated the exercise for a total of 62 completion minutes. Fill in the Blank was completed for 117 minutes by the four assigned subjects.

Multiple subjects provided feedback to the PI throughout the three week study period through email, cellular text message or phone call. These comments were collected in Table 7. Many issues arose for participants while utilizing the Cognuse program that included connectivity issues, inadequate instruction to complete exercise or exercise did not appear fully developed, deficient variability and lack of the exercise stopping once the time period has concluded.

Aim #3: Usability

The Usability Survey was completed by all seven subjects at the end of the study. Results are seen in Table 7 with answers to each of the following questions:

TABLE 7. Usability Scores

Key	1- Highly Disagree	4- Agree
	2- Disagree	5- Highly Agree
	3- Neurtal	

USABILITY SURVEY	Subject 01	Subject 02	Subject 03	Subject 04	Subject 05	Subject 06	Subject 07	Total	Mean	SD
The training program was useful to my recovery	2	2	3	2	1	2	1	13	1.8571	1.464
The program was easy to navigate	2	2	1	1	4	3	5	18	2.5714	1.512
I'm satisfied with my performance	3	5	4	5	4	5	5	31	4.4286	0.787
I feel confident using the program	2	3	4	5	4	5	5	28	4.0000	1.155

I feel better after completing the exercises	2	3	3	1	3	3	1	16	2.2857	1.380
My ability to complete the online exercises has improved	2	3	3	5	2	3	1	19	2.7143	1.254
I will continue my recovery at home	4	5	3	5	4	5	1	27	3.8571	1.464
I liked the picture exercises the best	3	2	4	1	4	3	5	22	3.1429	1.345
I liked the sentence exercises the best	3	4	3	5	2	4	1	22	3.1429	1.345
I liked the task exercises best	3	3	3	5	2	1	4	21	3.0000	1.291
Overall I liked the online program	2	2	3	4	4	4	4	23	3.2857	0.951
Total	28	34	34	39	34	38	33		34.2857	

'The training program was useful to my recovery' two responded they highly disagreed, four disagreed and one was neutral for a mean of 1.8571. 'The program was easy to navigate' two highly disagreed, two disagreed, one was neutral, one agreed, and one highly agreed for a mean of 2.5714. 'I'm satisfied with my performance' one subject was neutral, two agreed and four highly agreed, mean score of 4.4285. 'I feel confident using the program' one responded he/she disagreed, one was neutral, two agreed and three highly agreed, with a mean of 4. 'I feel better after completing the exercises' two highly disagreed, one disagreed and four were neutral, mean of 2.2857. 'My ability to complete the online exercises has improved' one highly disagreed, two disagreed, three were neutral and one highly agreed for a mean score of 2.7142. 'I will continue my recovery at home' one answered he/she highly disagreed, one was neutral, two agreed and three highly agreed, with a mean score of 3.8571. 'I liked the picture exercises the

best' one highly disagreed, one disagreed, two were neutral, two agreed and one highly agreed. Mean score of 3.1428. 'I liked the sentence exercises the best' one highly disagreed, one disagreed, two were neutral, two agreed and one highly agreed, mean of 3.1428. 'I liked the task exercises best', one highly disagreed, one disagreed, three were neutral, one agreed and one highly agreed for a mean score of 3.0000. 'Overall I liked the online program' two responded that they disagreed, one was neutral and four agreed for a mean of 3.2857.

The lowest possible score for the Usability Survey is 11 with 55 being the highest. The total scores that were reported by the subjects ranged from 28 to 39 with 34.2857 being the mean.

DISCUSSION

This was a feasibility study that examined recruitment of community stroke survivors in a three week online exercise program, determined the overall usability of the selected program and assessed changes in cognitive function at completion of participation. Although this feasibility study incorporated a small number of subjects, enough feedback was provided to validate adequate conclusion for two of the three aims, specifically, the recruitment of community stroke survivors proved to be much more difficult than anticipated and the usability of the Cognuse platform was less than optimal.

While recruitment of the proposed number (8-10) of stroke survivors was successful, the ability to enroll this small number of community participants into the study proved to be very challenging. Approximately 20 community stroke survivors were presented the opportunity to participate in the study, only five were willing to partake and the additional three volunteers were referred from personal contacts.

There is a large number of community dwelling stroke survivors in Tucson, AZ because there are 5 primary stroke centers in this city, each with over 300 stroke discharges per year (L. Ritter, personal conversation, August 25, 2015). While there is a large stroke population available and many ways to access appropriate individuals, there has shown to be a lot of resistance for inclusion. Multiple barriers contribute to the difficulty of recruitment, 2 of which potentially include feeling overwhelmed and decreased computer literacy.

It may be that the stroke survivors that were approached have already been through a life changing event and asking them to add another item to their recovery process appeared to simply be too much. Secondly, computer literacy is a large issue with successful utilization of an online exercise platform. If one cannot navigate the system independently and if necessary support is not available to assist then they may be unable to participate in a study of this nature, as was the case with my eighth subject. These barriers were not present with the seven subjects who completed study participation. They were all at the least moderately computer literate and had sufficient time to complete online exercises multiple times per week.

The Cognuse® platform has a lot of potential for use in the stroke population, however, the usability of the program was overall perceived in a neutral capacity by the participants. Although all eight study subjects liked the idea of the program, they each faced multiple issues which made it difficult for them to navigate the system, leading to their deducing that the platform was not as user friendly as expected.

The third and exploratory aim attempted to determine if there were cognitive changes in the subjects after three weeks of online exercise completion. As previously mentioned, four of the seven subjects had a decrease in score, meaning a self-reported increase in cognitive

function. The changes were minimal except one participant showed to improve in all eight questions. It is unclear whether there is sufficient data to support or deny conclusive evidence for this aim.

To my knowledge, this is the first attempt in comparing cognitive function and depression in community recruited stroke victims before and after utilizing an online cognitive exercise program.

New guidelines were published in June 2016 from the American Heart Association (AHA) and American Stroke Association (ASA) regarding rehabilitation recommendations for individuals post-stroke. The AHA/ASA (2016) declare that approximately 33% of stroke survivors develop depression. Stated predictors of depression include a history of previous stroke, family history, female gender, physical disability and cognitive impairment. According the the AHA/ASA, to date there have been few studies addressing the treatment regimen and recovery period of post-stroke depression. Exercise and antidepressant medications are both recommended, however their efficacy has not been proven at this point (AHA/ASA, 2016). The guidelines currently do not have recommendations or directions for improving cognitive function in order to decrease post-stroke depression. The American Heart Association (2013) states that cognitive rehabilitation is typically provided by speech language pathologists, occupational therapists and/or neuropsychologists on an outpatient basis. Computer games, puzzles and thinking exercises are encouraged to help stroke survivors regain cognitive skills (AHA, 2013).

It is the belief of this DNP student that a platform that provides stroke survivors the ability to complete cognitive, speech and daily living activities to exercise the brain is both necessary and helpful in this patient population. The specific interface used in this study shows

potential and was a capable program to incorporate depression and cognitive scales. The platform engineers made it extremely easy to build these scales into the exercise plan for study subjects along with the usability survey.

Further research of this similar nature could be extremely advantageous in increasing cognitive function and in turn could possibly expand the benefit to stroke survivors by lowering the incidences and onset of depression.

Implications of Practice

This feasibility study supports the need to follow the AHA/ASA Guidelines (DNP VI Collaboration & Population Health Outcomes). The 2016 Stroke Rehabilitation and Recovery Guidelines state that post-stroke depression is common and contributes to both increased mortality and poor functional outcomes (AHA/ASA, 2016). Clinical practice recommendations include the evaluation and treatment of depression in the acute phase and on an ongoing basis, and for healthcare providers to monitor and evaluate for post-stroke depression at every visit. The 2009 Nursing Guidelines Comprehensive Overview of Nursing and Interdisciplinary Care of the Acute Ischemic Stroke Patient describes depression as common after a stroke. The clinical recommendations are to have a rehabilitation medicine team, which includes psychiatrist, physical therapist, occupational therapist, speech/language/cognition therapist, all completed individual evaluations during the acute phase of medical treatment for upcoming discharge needs.

Screening for depression in stroke survivors should be included in the standard of care in the acute care setting (DNP II Organizational & Systems Leadership for Quality Improvement & Systems Thinking and DNP VII Clinical Prevention and Population Health for Improving the

Nation's Health). The appropriate means to do so could be completed through a quality improvement (QI) project using the Model of Improvement and PDSA cycle in order to implement a screening procedure.

Lastly there is an imminent need for state policy reform (DNP V Health Care Policy & DNP VI Interprofessional Collaboration for Improving Patient and Population Health Outcomes). At this time there are no policies, regulations or guidelines recommendations for patients who have had a stroke after the acute phase and are in the community. This continuity of care would be beneficial in the recovery process for this patient population. An Advanced Practice Nurse is a great advocate and facilitator due to having the ability to integrate education, research, management, leadership, and consultation into the clinical role in order to make decisions about clinical management and develop therapeutic interventions for care (DNP VIII Advanced Nursing Practice) (AHA/ASA, 2016).

CONCLUSION

In conclusion, this study demonstrated the difficulty of recruiting stroke subjects from the community in a study using a computer program to enhance as well as assess emotional health. It also showed that the particular computer program used was neutral to navigate for the participants. Lastly, while the study sample was very small, half of the participants showed a small increase in cognitive function and showed a significant positive change after completion of the online exercises. These results show both the promise and urgency for further investigation of this topic with additional research using similar aims. There is a link between cognitive function and depression and is supported by the literature. It therefore stands to reason that if cognitive function can be enhanced after a stroke, through use of computer exercises, then the

incidence of post-stroke depression may decrease. Follow up studies might include exploring ways to increase recruitment success in the community, employing the use of a more fully developed or different computer platform that is easy to navigate and also increasing the time spent on cognitive exercises (eg, three months vs. three weeks) before assessing cognitive changes.

APPENDIX A

PROMIS EMOTIONAL DISTRESS-DEPRESSION-SHORT FORM 8a

PROMIS Item Bank v1.0 – Emotional Distress – Depression–Short Form 8a

Emotional Distress – Depression – Short Form 8a

Please respond to each question or statement by marking one box per row.

In the past 7 days...

		Never	Rarely	Sometimes	Often	Always
1	I felt worthless	☐	☐	☐	☐	☐
2	I felt helpless	☐	☐	☐	☐	☐
3	I felt depressed	☐	☐	☐	☐	☐
4	I felt hopeless	☐	☐	☐	☐	☐
5	I felt like a failure	☐	☐	☐	☐	☐
6	I felt unhappy	☐	☐	☐	☐	☐
7	I felt that I had nothing to look forward to .	☐	☐	☐	☐	☐
8	I felt that nothing could cheer me up	☐	☐	☐	☐	☐

APPENDIX B

PROMIS APPLIED COGNITION-GENERAL CONCERN-SHORT FORM 8a

PROMIS v1.0-Applied Cognition-General Concerns-Short Form 8a

Applied Cognition-General Concerns-Short Form 8a

Please respond to each item by marking one box per row.

	In the past 7 days…	Never	Rarely (Once)	Sometimes (Two or three times)	Often (About once a day)	Very often (Several times a day)
PC2	My thinking has been slow	☐ 1	☐ 2	☐ 3	☐ 4	☐ 5
PC35	It has seemed like my brain was not working as well as usual	☐ 1	☐ 2	☐ 3	☐ 4	☐ 5
PC36	I have had to work harder than usual to keep track of what I was doing	☐ 1	☐ 2	☐ 3	☐ 4	☐ 5
PC42	I have had trouble shifting back and forth between different activities that require thinking	☐ 1	☐ 2	☐ 3	☐ 4	☐ 5
PC8	I have had trouble concentrating	☐ 1	☐ 2	☐ 3	☐ 4	☐ 5
PC25	I have had to work really hard to pay attention or I would make a mistake	☐ 1	☐ 2	☐ 3	☐ 4	☐ 5
PC1	I have had trouble forming thoughts	☐ 1	☐ 2	☐ 3	☐ 4	☐ 5
PC53	My problems with memory, concentration, or making mental mistakes have interfered with the quality of my life	☐ 1	☐ 2	☐ 3	☐ 4	☐ 5

APPENDIX C

COGNUSE® REHAB USABILITY SURVEY

Cognuse Rehab Usability Survey					
SECTION 1					
Please rate the following statements in order of agreeability: 1- **Highly DISAGREE** to 5- **Highly AGREE**	**1**	**2**	**3**	**4**	**5**
1. The training program was useful to my recovery					
2. The program was easy to navigate					
3. I'm satisfied with my performance					
4. I feel confident using the program					
5. I feel better after completing the exercises					
6. My ability to complete the online exercises has improved					
7. I will continue my recovery at home					
8. I liked the picture exercises best					
9. I liked the sentence exercises best					
10. I liked the task exercises best					
11. Overall I liked the online program					

APPENDIX D

RESEARCH FLYER

RESEARCH STUDY FOR STROKE SURVIVORS

If you or anyone you know has suffered from a stroke in the last year, you may qualify to participate in a research study.

STUDY: **A feasibility study that uses a novel and interactive computer program to assess emotional health after a stroke.**

The study is designed for two purposes:

1. To examine the ability to recruit stroke survivors in the community willing to participate in using an online interactive computer program
2. To determine the ease of using this interactive computer program and the willingness of participants to complete the weekly exercises for 3 weeks.

Background: Approximately 1 of 3 stroke victims develop depression. This is a small-scale study to prepare for a larger future study that will go on to assess the emotional health (specifically depression) of subjects after completing a set number of online interactive computer program exercises.

Inclusion Criteria

- **18 years of age or older**
- **Stroke within the last 12 months**
- **Access to a computer and internet service**

Exclusion Criteria

- **Unable to read**
- **Non-English speaking**
- **Severe cognitive impairment**

Participation includes a 3 week commitment that consists of:

- 3 weeks of individualized online interactive computer program exercises 2-3 times per week, set up by the Principal Investigator
- A Cognition and Depression Scale Assessment completed before starting interactive computer program exercises and again at the end of 3 weeks when all exercises are completed
- Usability survey at the end of the study that will give feedback on the ease of using the interactive computer program

If you are interested in participating in this study or more information, please contact the Principal Investigator:

Katie Sallee
541-852-2323
katiesallee@hotmail.com

APPENDIX E

ELIGIBILITY SCREENING TOOL

Eligibility Screening Tool

Name: _____ Date of Birth: _____

1. Are you 18 years of age or older? Yes ____ No ____

2. Have you been diagnosed with a stroke in the last year? Yes ____ No ____

3. Do you own a computer or tablet? Yes ____ No ____

4. Do you have internet access at home? Yes ____ No ____

5. Are you willing to complete 2 Depression assessments? Yes ____ No ____

6. Are you willing to complete 2 Cognitive assessments? Yes ____ No ____

7. Are you willing to participate in a 3 week research study? Yes ____ No ____

8. Eligible for participation: Yes ____ No ____

If any questions above answered "No", this subject is not eligible.

APPENDIX F

DEMOGRAPHIC DATA

Demographic Data

Name: _____ Date of Birth: _____

Gender: Male ____ Female ____ Age: _____

Race: Caucasian ____ African American ____ Asian ____ Native American ____

Hispanic ____ Non-Hispanic ____

Education Level: High School ____ Some College ____ Trade School ____

Bachelor's ____ Master's ____ PhD/MD ____

Employment Status: Full Time ____ Part Time ____ Unemployed ____ Retired ____

Marital Status: Married ____ Divorced ____ Widowed ____ Single ____

Caregiver: Yes ____ No ____

Date of stroke: _____ Type: Ischemic ____ Hemorrhagic ____ Do not know ____

APPENDIX G

LETTER OF AGREEMENT FROM COGNUSE®

C O G N U S E

September 16, 2015

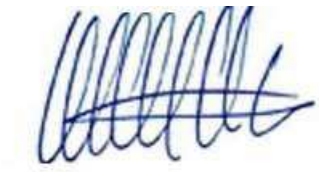
To Whom It May Concern,

The Cognuse® team is honored to work with Katherine Sallee, RN on her project titled "Feasibility of using a novel and interactive computer program to assess emotional health after a stroke." We have read the proposal and fully support the study aims, design and methods.

In support of this study, we will provide, free of charge, unrestricted use of the Cognuse® Rehabilitation Platform to Ms. Sallee and participants, as outlined in the proposal. The Cognuse® team will provide Ms. Sallee training sessions and email access to our technical staff, also without charge. There will be no restrictions on publications that might arise from this study.

We believe that the Cognuse® Rehabilitation Platform has great potential to support the emotional health needs of stroke survivors, and thus look forward to working with Ms. Sallee on this novel project.

Sincerely,



Olari Koresaar
Chief Operating Officer
C O G N U S E
Johnson & Johnson Innovation Labs

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VALIDITY

Study design, author, year	Level of Evidence, Strength of Recommendation	Findings
Systematic review & meta-analysis by Ayerbe et al., 2013	1C – strong	Cumulative post-stroke depression incidence up to 52% results in disability, decreased QOL and higher mortality rates. Post-stroke depression screening and monitoring recommended.
Case-Controlled Study by Astrom et al., 1993	3C – weak	Depression is very common in post-stroke patients. 1/3 stroke patients develop depression in the acute phase post-event. The number decreased at 1 year and then increased at year 3 post-event.
Systematic Review by Hackett et al., 2005	1C – strong	Approximately 1/3 of post-stroke patients develop depression.
Case-Controlled Study by Lees et al., 2014	3B – strong	Depression screening is difficult. If left untreated, mortality & morbidity rates increase, quality of life decreases and hospital stays can be lengthened.
Case-Controlled Study by Chung et	3B – strong	Depression scales PHQ-9 has shown to have high diagnostic accuracy, high test-retest reliability and internal

al., 2015		consistency. The PROMIS scale outcomes are similar to the PHQ-9 in MS patients but has yet to be proven in post-stroke patients.
Case-Controlled Study by Katon, 2011	3B – strong	Evidence suggests that inflammation, or chronic medical illnesses that increase proinflammatory cytokines in turn can modulate brain function, may play a substantial role as a risk factor of developing depression.