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Community Education: Impact on Earlier Recognition of Stroke

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by

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Abstract

Cerebrovascular disease was identified as the fourth leading cause of death in Cleveland County, North Carolina from 2014 to 2018 (Cleveland County Public Health Center, 2020). Community education was identified as a potential solution to decreasing the number of community members affected by cerebrovascular disease and resulting death and disability. Five community classes were taught with 97 participants. Pre-, post-, and 1-week post-class surveys were distributed to assess baseline knowledge, knowledge gain, and knowledge retention, with 74 pre-class, 72 post-class, and 28 1-week post-class surveys returned. Of these surveys, after exclusionary criteria were used, 40 pre-class, 53 post-class, and 22 1-week post-class surveys were deemed usable. Data findings showed that mean and median improved from pre- to post-class surveys and knowledge was improved by 19.3-73.4% from pre-class to post-class surveys. Community education was shown to help improve the community's baseline understanding of stroke and improve their comfort with identifying stroke symptoms.

Keywords: stroke, community education, symptom recognition, cerebrovascular disease

Table of Contents

Problem Recognition 8

Problem Statement 10

Literature Review 10

Community Involvement, Awareness, and Empowerment 10

Stroke Survivors' Requests 14

All Ages, Races, and Occupations Need Involvement 15

Needs Assessment 22

Target Population 22

PICOT Statement 23

Available Resources 23

Desired and Expected Outcomes 24

Team Selection 24

Scope of Project 25

Goal, Objectives, and Timeline 26

Goal 26

Objectives 26

Timeline 27

Theoretical Underpinning 28

Orem's Theory of Self-Care 29

Orem's Theory of Self-Care Deficit 30

Orem's Theory of Nursing Systems 30

Orem's Categories of Technologies 31

Key Takeaways from Orem's Theory and Nursing Process 31

Application 31

Work Planning 33

Project Management Tool 34

Cost/Benefit Analysis 35

Evaluation Plan 37

Project Implementation 41

Threats and Barriers 42

Monitoring of Implementation 45

Interpretation of Data 46

Quantitative Data 47

Qualitative Data 50

Process Improvement Data 52

References 58

List of Figures

Figure 1: CTE Model of Orem's Theory as Applied to Community Stroke Education ... 33

Figure 2: Work Breakdown Structure Tool ... 35

Figure 3: Logic Model of Evaluation Plan ... 41

List of Tables

Table 1: Cost/Benefit Analysis 36

Table 2: Interpretation of Data: Pre-, Post-, and 1-week Post-Class Survey Grades..... 47

Table 3: Interpretation of Data: Pre-, Post, and 1-week Post-Class Select All That Apply Questions..... 48

Table 4: Interpretation of Data: Comparison of Quantitative Questions 2-5..... 50

Table 5: Interpretation of Data: How Comfortable Participants Felt Recognizing Signs of Stroke on a Scale of 1-10 51

Problem Recognition

Cerebrovascular disease is known for being a leading, often silent, cause of death in the United States. Risk factors for stroke are often modifiable, such as hypertension, diabetes, and smoking. Commonly and unfortunately, however, populations at the highest risk for strokes often view these risk factors as not very concerning or dangerous either due to lack of education, lack of financial means, denial, reluctance, disbelief, or even not having adequate transportation (Hsia et al., 2011).

North Carolina and Cleveland County both had cerebrovascular disease ranked fourth in the leading causes of death for the years 2014-2018 (Cleveland County Public Health Center, 2020). North Carolina had a rate of 48.9 per 100,000 deaths attributed to cerebrovascular disease with a total number of deaths at 24,832 (Cleveland County Public Health Center, 2020). Cleveland County, in comparison, had a rate of 66.3 per 100,000 deaths attributed to cerebrovascular disease with a total number of deaths of 322 (Cleveland County Public Health Center, 2020). Cerebrovascular disease has not budged in being ranked the fourth leading cause of death in Cleveland County; it has stayed the same for the last two 5-year period measures gathered by the North Carolina State Center for Health Statistics (Cleveland County Public Health Center, 2020).

Deciding why Cleveland County has such a high prevalence of stroke-related death in relation to North Carolina can be attributed to several factors. Cleveland County has been ranked among the least healthy counties in North Carolina, being in the lowest 0-25% in the state for health outcomes and lower than 25-50% for health factors (University of Wisconsin Population Health Institute, 2022a). Much of this can be attributed to higher rates in Cleveland County as compared to North Carolina for

smoking (23% versus 19%), obesity (37% versus 34%), and physical inactivity (30% versus 26%) (University of Wisconsin Population Health Institute, 2022a). These rates can be attributed, at least in part, to issues affecting the county when compared with the state including less access to exercise (50% versus 68%), lower high school completion (86% versus 89%), higher rate of unemployment (7.8% versus 7.3%), lower median household income ($49,000 versus $59,600), and a higher rate of uninsured (14% versus 13%) (University of Wisconsin Population Health Institute, 2022a). Not only does Cleveland County score lower on almost every health marker when compared to the state of North Carolina, but it also scores lower overall than its surrounding counties of Gaston, Lincoln, and Rutherford. Gaston County ranks in the higher range for health outcomes (50-75%) and lower middle range (25-50%) for health factors (University of Wisconsin Population Health Institute, 2022b). Lincoln County ranks with the healthiest counties in North Carolina for both health outcomes and health factors (75-100%) (University of Wisconsin Population Health Institute, 2022c). Rutherford County ranks in the lower middle range for counties in North Carolina for both health outcomes and health factors (25-50%) (University of Wisconsin Population Health Institute, 2022d). These various health factors, issues, and outcomes come together as the perfect storm to make Cleveland County among the unhealthiest counties to live in the state and surrounding areas. This finding combined with the low education rates, low-income rates, less access to healthcare due to fewer insured people, and fewer exercise opportunities paints a clearer picture as to why the cerebrovascular disease has found a home in being the fourth leading cause of death for this county.

Problem Statement

Cleveland County residents have an increased risk of stroke-related death, which may be related to low education, low-income rates, less access to healthcare due to fewer insured people, and higher rates of smoking, obesity, and physical inactivity compared to surrounding counties (University of Wisconsin Population Health Institute, 2022a).

Literature Review

The purpose of this literature review was to gather evidence-based practice information regarding stroke education in the community, stroke educational tools used, and implications for future research and improvement. An English language search of 10 articles was collected, utilizing databases such as Wiley Online Library, National Library of Medicine, Wolters Kluwer, and AHA. Keywords used for the search included “stroke education”, “community education”, “stroke”, and “stroke symptom awareness.”

Community Involvement, Awareness, and Empowerment

Gribko (2019) conducted a qualitative research study to determine whether stroke champion volunteers could learn and distribute information about stroke symptoms and the importance of quickly activating EMS in their community. This study was conducted at a large comprehensive stroke center that employed over 6,000 employees (Gribko, 2019). The study included both clinical and nonclinical volunteers (Gribko, 2019). A secured web-based survey that used a Likert scale to evaluate the effectiveness of the program was sent to the 46 stroke-champion clinical and nonclinical volunteers and collected information on whether the stroke champion needed a license to perform their job at the hospital, evaluated the content of the program, the setting of the meeting, the presenter’s effectiveness, the instructional method, and the learner’s achievement of the

program's objectives (Gribko, 2019). The BE FAST mnemonic (balance, eyes, face, arm, speech, time) was a major focus in this class and was taught using a visual teach-back technique (Gribko, 2019). Over 90% of respondents from the survey taken after the class agreed or strongly agreed that the program achieved the objectives in each category of the survey (Gribko, 2019). This suggests that a stroke champion program that incorporates all employees, not just nurses, could lead to positive social change through increased health literacy by distributing stroke information to all community members (Gribko, 2019). Limitations of the study included: the program was voluntary so individuals who were interested in the issue would be the ones to participate; recruiting volunteers may require creating strategies to generate interest in the program; measuring understanding of stroke awareness in the public is difficult to do; keeping interested in the issue and refreshing the program; and continued support from leadership to support members to attend the meeting (Gribko, 2019).

Khan et al. (2021) designed a longitudinal observational study to establish the awareness of stroke and its management among high school and college students through an educational intervention. A questionnaire was given before and after an educational session on strokes (Khan et al., 2021). The lecture covered stroke definition, signs, risk factors, actions, time window for thrombolytic therapy, and types of rehabilitation interventions (Khan et al., 2021). A total of 1,036 participants were included in this study and were students from five high schools and four colleges with different areas of focus (arts, science, and commerce), types of schools (public, semi-public, private), and economic locations in South India (Khan et al., 2021). Of the participants, 36.3% were male and 56.4% were high school students, and the mean age was 17.15 ± 1.29 (15–22)

years (Khan et al., 2021). Before the lecture, 147 participants were unaware of any signs of stroke and 124 participants did not know the risk factors (Khan et al., 2021). After the class, 439 participants knew four signs of stroke and 196 knew 12 risk factors (Khan et al., 2021). Results showed that: female students retained better knowledge about stroke signs (odds ratio 3.08; 95% confidence interval, 2.15-4.43); hypertension (52.7%) and weakness (59.85%) were the most well-known signs and risk factors; the proportion of students who picked traditional medicine as the mode of treatment decreased from 34.75% to 8.59% after the lecture and other rehabilitation methods (physical therapy, occupational therapy, speech therapy, counseling, etc.) were chosen by more than 80% of the students after the lecture (Khan et al., 2021). These findings suggested that the awareness of stroke risk factors and management among high school and college students can be significantly improved with regular educational interventions and help decrease the prevalence of stroke (Khan et al., 2021). Limitations of the study included a longitudinal design, which may skew some findings due to it being a longer time period, where participants were required to consent to participate and could not leave the session if they wanted to be included in the study, and participants had to be familiar with the Malayalam or English languages in which the presentation was delivered in order to participate which may have decreased some volunteers (Khan et al., 2021).

Zhang et al. (2020) conducted an observational study aimed at the significance of multi-level education in the treatment and prognosis of acute ischemic stroke. Multi-level stroke education was carried out among residents and medical staff for 1 year in the Guancheng district (Zhang et al., 2020). After 1 year, 519 patients with acute ischemic stroke were invited to the study, 272 patients from the Guancheng district were divided

into the experimental group, and 247 patients not from the Guancheng district were divided into the control group (Zhang et al., 2020). Statistical methods were used to analyze the degree of awareness of stroke, the time from onset to hospital, the route to hospital, the number of patients coming to the hospital within 4.5 hours, the number of intravenous thrombolysis, door-to-needle time, modified Rankin scale score, and the number of hemorrhagic transformation cases (Zhang et al., 2020). Significant differences were noted after 1 year of multi-level systematic stroke education between the experimental group and the control group in terms of limb weakness (87.87 vs. 62.75%), speech inarticulation (78.3 vs. 55.06%), facial paralysis (69.12 vs. 38.06%), limb numbness (57.35 vs. 29.15%), consciousness disorder (62.50 vs. 42.11%), and walking instability with severe dizziness (39.97 vs. 15.79%) ($P<0.05$) (Zhang et al., 2020). There were statistical differences found between the two groups (1) in the time from the onset to the hospital (14.82±17.67 versus 25.92±25.23); EMS (36.02 versus 16.19%); the number of patients coming to the hospital within 4.5 hours (67 versus 32); venous thrombolysis cases (55 versus 17); door-to-needle time (42.43±17.30 versus 63.35±26.53); hemorrhagic transformation cases (11 versus 21); and (2) modified Rankin scale score grade ≥2 (230 versus 169) ($p<0.05$) (Zhang et al., 2020). There was no statistically significant difference in unclear vision, blind eyes, or severe headache ($p>0.05$) (Zhang et al., 2020). The study concluded that multi-level education effectively improved the patients' awareness of stroke, encouraged more patients to use EMS to the hospital, made more patients aware that they should reach the hospital within 4.5 hours, helped shorten the door-to-needle time, and gave patients the opportunity to receive intravenous thrombolysis or intravascular thrombectomy, which may improve their

prognosis and reduce hemorrhagic transformation without reducing mortality (Zhang et al., 2020). Limitations included a small study size and the limited area of the region in which the study was conducted, which may not be generalizable to other populations (Zhang et al., 2020).

Stroke Survivors' Requests

Finch et al. (2022) conducted a qualitative descriptive study to study the perceptions of stroke survivors and caregivers towards stroke in an Australian health context. Focus groups were used to explore the education received and the preferred content, format, and timing of education (Finch et al., 2022). Data was analyzed using qualitative content analysis to identify key categories, subcategories, and an overarching theme (Finch et al., 2022). Fifteen stroke survivors and four caregivers participated in the study (Finch et al., 2022). Four categories emerged including the timing of, the content of, the format of, and reactions to stroke education (Finch et al., 2022). There were also several subcategories, but one overarching theme that emerged as being woven throughout was that everyone is different, and everyone has different needs (Finch et al., 2022). Overall, this study showed that participants were generally positive toward stroke education and felt that education should occur at multiple time points and in a mixed format (Finch et al., 2022). Stroke survivors preferred group education, while caregivers did not prefer this method (Finch et al., 2022). All participants reported receiving education in the hospital but not in the community (Finch et al., 2022). Survivors and caregivers wanted information about post-stroke physical changes and computer use, with the survivors desiring additional information spanning a variety of areas like motivation and driving (Finch et al., 2022). Tailoring stroke education to each individual

was shown to be critical to ensure that education meets the needs of stroke survivors and caregivers alike from the hospital to the community (Finch et al., 2022). Limitations of the study included restriction of recruitment to a single hospital site and a single point in the recovery process; further longitudinal research with multiple sites would be required to see if needs vary along the recovery continuum and at different health sites (Finch et al., 2022). Other limitations included only using the perspectives of the stroke survivor and caregiver, recall bias due to the post-stroke time range varying from 1 month to 4 years, use of a single methodology, the idea that some participants knew the researchers before the study while others did not and could have led to participation bias and that the study did not explore whether the education provided was culturally appropriate, or the ethnicity or desired language of participants (Finch et al., 2022).

All Ages, Races, and Occupations Need Involvement

Zhong et al. (2022) developed a self-designed questionnaire to investigate the current status of stroke management by community doctors in the Jinjiang district of Chengdu, China to investigate the current ability of community doctors in stroke management and the effect of intensive education on stroke prevention and management abilities of these doctors. Zhong et al. (2022) then designed a series of intensive stroke management education courses for community doctors according to relevant guidelines for cerebrovascular accident prevention and treatment in China. All community doctors were trained and their ability to prevent stroke was reassessed using the self-designed questionnaire (Zhong et al., 2022). Results showed that of the 450 questionnaires issued, 370 (82.2%) community doctors were enrolled before the intensive education, and 389 (86.4%) were enrolled after the intensive education (Zhong et al., 2022). The results

showed that only 37.8% of the community doctors knew the guidelines for the prevention and treatment of cerebrovascular diseases, and only 45.9% had stroke management ability (Zhong et al., 2022). The stroke management ability of these doctors improved after intensive education ($p < 0.05$), including pre-hospital identification and management of stroke and its risk factors (Zhong et al., 2022). Overall, the study concluded that the capacity of the community doctors in the Jinjiang district of Chengdu, China is far from meeting the requirements of stroke prevention and treatment but was greatly improved by promoting intensive education (Zhong et al., 2022). Limitations of this study included that the scope of the survey was limited to the Jinjiang District of Chengdu, the sample size was small, the results did not reflect the overall situation in Chengdu, closed-ended questions used in the survey may have resulted in a higher response rate in the evaluation of the ability to master stroke-related knowledge, and not all knowledge of stroke management was assessed in the test questionnaires (Zhong et al., 2022).

Williams et al. (2018) evaluated the effectiveness of a stroke preparedness intervention given to preadolescent economically disadvantaged minority urban public-school children on the stroke knowledge and preparedness of their parents. A total of 3,070 4th through 6th graders and 1,144 parents from 22 schools were put into a cluster randomized trial with schools being randomized to the HHS (Hip-Hop Stroke) intervention or attentional control (nutrition classes) (Williams et al., 2018). HHS is a 3-hour culturally tailored, theory-based, multimedia stroke literacy intervention that targets school children and empowers them to share stroke education with their parents (Williams et al., 2018). The main outcome measures were stroke knowledge and preparedness of children and parents using validated surrogates (Williams et al., 2018).

The results showed that among children, it was estimated that 1% (95% confidence interval [CI], 0%-1%) of controls and 2% (95% CI, 1%-4%; p=0.09) of the intervention group demonstrated optimal stroke preparedness (perfect scores on the knowledge and preparedness test) at baseline which increased to 57% (95% CI, 44%-69%) immediately after the program in the intervention group compared with 1% (95% CI, 0%-1%; p<0.001) of controls (Williams et al., 2018). At a 3-month follow-up, 24% (95% CI, 15%-33%) of the intervention group retained optimal preparedness, compared with 2% (95% CI, 0%-3%; p<0.001) of controls (Williams et al., 2018). Only 3% (95% CI, 2%-4%) of parents in the intervention group could identify all four letters of the stroke FAST (Facial droop, Arm weakness, Speech disturbance, Time to call 911) acronym at baseline which increased to 20% at immediate post-test (95% CI, 16%-24%) and 17% at 3-month delayed post-test (95% CI, 13%-21%; p=0.0062), with no significant changes (3% identification) among controls (Williams et al., 2018). Four children, all in the intervention group, called 911 for real-life stroke symptoms, in one case overruling a parent's wait-and-see approach (Williams et al., 2018). This study concluded that HHS is an effective, intergenerational model for increasing stroke preparedness among economically disadvantaged minorities (Williams et al., 2018). Limitations included parental participation, attention, and involvement decreasing over time (Williams et al., 2018).

Nemade et al. (2020) conducted a community-based interventional study amongst 305 kids ranging from 2nd to 8th grade to assess and improve the knowledge about strokes among children. This study was conducted because Nemade et al. (2020) recognized that stroke is the third leading cause of death and the major cause of long-term disability in

the United States, timely recognition of symptoms is critical, and family members are crucial in recognizing stroke symptoms since <5% of patients can call EMS themselves due to an inability to speak or dial the phone. A pre-test questionnaire was given, followed by health education regarding stroke taught to the children using audiovisual aides, and then a post-test was conducted to assess the impact of stroke education (Nemade et al., 2020). Components of education included were the definition of stroke, FAST mnemonic, time-sensitive treatment, risk factors, how children can help, whom to call, and where to go (Nemade et al., 2020). Data was compiled and analyzed using the Chi-square Test (Nemade et al., 2020). Results showed that there was a significant lack of knowledge in the pretest groups, and the posttest groups showed significant improvement in all tested components regardless of age or grade (p<0.001) (Nemade et al., 2020). The study concluded that targeting the younger generation for stroke education is one way to improve community knowledge of stroke symptoms and increase the chances that stroke patients may receive acute stroke therapy (Nemade et al., 2020). The study also concluded that children can be used to transmit educational information to parents and other family members and raise awareness (Nemade et al, 2020). Limitations included: no assessment if the children did eventually call EMS for real-life stroke symptoms in family members, and no assessment identifying if patients who were brought in because a child activated the EMS after correctly identifying the symptoms of stroke had been involved in this study (Nemade et al., 2020).

Murthy et al. (2019) conducted a cross-sectional qualitative study aimed at exploring the awareness of stroke among Accredited Social Health Activists (ASHAs) in India as they worked in the community as part of the public healthcare delivery systems.

A purposive sample of 12 ASHAs participated in the study (Murthy et al., 2019). Data was analyzed manually through direct content analysis (Murthy et al., 2019). Through the study, it was revealed that the ASHAs did not have adequate general awareness of stroke, its causes, or its related treatment procedures (Murthy et al., 2019). The study showed the level of awareness of stroke among ASHAs was inadequate at present and would benefit from systematic sensitization programs (Murthy et al., 2019). The study emphasized a need for comprehensive educational programs to increase the ASHAs' awareness of stroke since limited awareness could lead to failure to identify early warning signs and appropriate timely help (Murthy et al., 2019). The study also revealed that the knowledge of hospital workers with respect to treatment choices for stroke was considerably influenced by cultural and religious beliefs (Murthy et al., 2019). Limitations included a small sample size found through purposive sampling (Murthy et al., 2019).

Williams et al. (2019) held a cluster randomized clinical trial between July 26, 2013, and August 16, 2018, to evaluate the effect of using two culturally tailored 12-minute stroke films on stroke preparedness versus the usual care practice of distributing stroke education pamphlets with randomization of 13 black and Hispanic churches located in urban neighborhoods to intervention or usual care. This study was conducted since Williams et al. (2019) recognized that Black and Hispanic individuals are less likely to recognize a stroke and call 911, which contributes to racial and ethnic disparities in intravenous tissue plasminogen activator use. In total, 883 congregants were approached, 503 expressed interest, 375 completed eligibility screening, and 312 were randomized due to 63 individuals who were considered ineligible due to being younger than 34 years old and/or did not have at least one traditional stroke factor (Williams et al., 2019). The

primary measure of this study was the Stroke Action Test (STAT), which was assessed at baseline, 6 months, and 12 months (Williams et al., 2019). Results showed 261 of 312 individuals completed the study (83.7% retention rate), with most participants being female (79.1%) (Williams et al., 2019). The average age of participants was 58.57 years, 51.1% were non-Hispanic black, 48.9% were Hispanic, and 31.7% had low levels of education (Williams et al., 2019). Results also showed no significant end differences for the STAT at follow-up; mean baseline STAT scores were 59.05% (29.12%) correct for intervention and 58.35% (28.83%) correct for normal care (Williams et al., 2019). At 12 months, the mean STAT scores were 64.38% (26.39%) correct for intervention and 61.58% (28.01%) correct for usual care (Williams et al., 2019). No difference was noted for stroke readiness at 12 months in response to culturally tailored 12-minute stroke films or stroke education pamphlets (Williams et al., 2019). Additional studies are needed to confirm findings from a post-subgroup analysis that suggested a significant education effect (Williams et al., 2019). Limitations included a small subgroup of black participants with low education, subgroup analyses examining interactions of race/ethnicity, education, and intervention status requiring confirmation with future research, and STAT measuring the intent to act and not the action itself (calling 911) (Williams et al., 2019).

Garrett-Jones et al. (2019) recognized that strokes result in devastating consequences for both survivors and caregivers; it is therefore important to make sure strokes are managed appropriately and caregivers are well supported. Garrett-Jones et al. (2019) proposed that in order to carry this out effectively, a better understanding of the challenges faced by stroke survivors and their caregivers in a country that had limited provisions for rehabilitation. The aim of this study was to explore the experiences of

stroke survivors and their caregivers 1-year after discharge from a stroke rehabilitation in Bangladesh (Garrett-Jones et al., 2019). Twenty stroke survivors and their caregivers were selected for this qualitative, single-centered study with participants being chosen using a convenience sampling method (Garrett-Jones et al., 2019). A semi-structured questionnaire was used to collect data during face-to-face interviews (Garrett-Jones et al., 2019). Six themes were found following analysis of the data collected including: prior knowledge of stroke, hospitalization post-stroke, access to rehabilitation following discharge from hospital, level of independence 1-year post-discharge from rehabilitation center, challenges of returning home following rehabilitation at the center, and the challenges experienced by caregivers (Garrett-Jones et al., 2019). Results of the study showed a low return-to-work rate and poor awareness of stroke and its risk factors, no provision of rehabilitation in the hospital or at home, lack of advice on how to access rehabilitation after the hospital and stroke survivors and caregivers experienced physical, social, and emotional wellbeing challenges (Garrett-Jones et al., 2019). Increasing awareness of stroke and its risk factors can reduce the incidence of stroke (Garrett-Jones et al., 2019). The study also concluded that earlier access to rehabilitation and ongoing support and training through the implementation of a stroke pathway may improve outcomes for stroke survivors and caregivers (Garrett-Jones et al., 2019). This study suggests that future research should investigate the challenges of returning to work and the experiences of stroke survivors and caregivers who did not receive rehabilitation (Garrett-Jones et al., 2019). Limitations included small sample size, misinterpretation of the wording used in the study given to participants due to the translation from Bengali into English, population not being representative of those who did not receive any

rehabilitation due to the absence of a care pathway to identify stroke survivors, potential professional bias since the interviewer was a student physiotherapist affiliated with the rehabilitation center, and the possibility of reduction in the generalization of findings across Bangladesh due to this being a single-centered study based near Dhaka which may have accounted for the high prevalence of educated and employed participants (Garrett-Jones et al., 2019).

Literature supports the need for stroke awareness in the community for numerous reasons. Stroke affects all ages, races, and occupations; whether this is due to being the patient affected by the stroke, the family member watching their loved one deal with the effects of stroke, or the caregiver aiding the stroke victim. Stroke survivors have requested more education for themselves, their caregivers, and the community. Community education increases awareness and empowers individuals to help take control of and improve their health and the health of others. These reasons are just a few of the justifications for the need for this project.

Needs Assessment

Target Population

The target population of this project was the general laypeople of Cleveland County, North Carolina. The need for this project was driven by statistics showing cerebrovascular disease to be the fourth leading cause of death in Cleveland County, higher morbidity due to cerebrovascular disease in Cleveland County than surrounding counties and the state, and direct observation by the project leader of Cleveland County residents often waiting prolonged periods of time before seeking medical help in the project leader's place of work in a local Cleveland County emergency department

(Cleveland County Public Health Center, 2020). The project leader observed various reasons for prolonged periods of time before seeking medical care including miseducation, the belief that symptoms will resolve on their own, or inability to recognize the seriousness of symptoms in a timely fashion.

PICOT Statement

For the general population of Cleveland County, North Carolina (P), how did participating in an educational community class on strokes and stroke symptom recognition (I), as compared to their baseline knowledge level of strokes before participating in the class (C), improve their knowledge and remembrance of signs of the cerebrovascular accident determined by pre- and post-class self-assessment questionnaires (O) after attending the offered community class (T)?

Available Resources

Resources required for this project to be successful included a common local place within the community to hold the classes, a projector, a PowerPoint presentation, tables, chairs, paper surveys, pens, and handouts with stroke symptom mnemonics to aid in the retention of knowledge once the class concludes. The resources supplied five 30-minute classes of 5-30 participants each. Cleveland County EMS incorporated these classes into their community hands-on only CPR classes at no charge. Tables, chairs and a projector were included in the local community classroom setting. The PowerPoint presentation was provided by the project leader at no charge other than time spent researching and compiling data and information, in conjunction with project partners. Handouts, pens, and paper surveys were obtained and provided by the project leader at

low costs. The project leader surveyed participants through a survey platform available through Gardner-Webb University.

Desired and Expected Outcomes

The desired outcomes of this project included improving knowledge of stroke within Cleveland County, North Carolina, and contributing to the earlier recognition of signs and symptoms of cerebrovascular accidents by the general layperson population. The expected outcome was that the knowledge level of strokes and symptoms related to strokes would increase for residents of Cleveland County, North Carolina who attended a class offered in the community setting as was determined by pre-class, immediate post-class, and 1-week post-class self-assessment questionnaires.

Team Selection

The team consisted of the project leader who dedicated time weekly to the project implementation. The project chair was available to guide the project leader and provide support. The project partners were the medical director and the community paramedic/coordinator for community outreach of emergency medical services operations for Cleveland County. The project leader partnered with the medical director and community paramedic of Cleveland County's emergency medical services due to their interest in the outcomes in the community that this project can offer (Zaccagnini & Pechacek, 2021). The medical director and community paramedic of Cleveland County's emergency medical services also brought with them the ability to offer more educational material, the ability to allow for more insight into education on cerebrovascular disease, the ability to incorporate stroke awareness into layperson CPR education, ability to allow

for a central place within the county for the classes to be offered, and the ability to reach a larger audience in the community than would be possible otherwise.

Scope of Project

This project aimed to improve local community knowledge of what a stroke is, its signs/symptoms, and early indicators through community-offered classes, with the intended outcome of increasing knowledge in the community by at least 25% as proven possible by previous studies (Zhong et al., 2020) and as was judged by questionnaires administered pre-class, post-class, and 1-week post-class attendance. This project intended for Cleveland County residents to be interactive during class, ask questions, and be able to answer survey questions indicating an increase in knowledge by the end of the class period. The project aimed for participants to be able to retain enough knowledge to be able to identify signs of cerebrovascular accident, know when to seek medical attention, and be able to teach others early stroke symptom recognition as well adequately and appropriately.

This project was not intended to measure the long-term effects of offering the educational classes to the community such as, but not limited to: improvement in symptom-to-door time for stroke victims seeking medical attention within the community, whether or not participants seek medical attention due to taking the class, whether or not participants help others seek medical attention faster due to taking the class, and whether or not participants retain the information they learn in class and pass it on to others in the community. While the project leader would hope to see the aforementioned items realized in the long term as a result of this project, it is beyond the magnitude of this project to see that these goals come to fruition in the measurable future.

Goal, Objectives, and Timeline

Goal

The goal of this project was to improve earlier recognition of signs and symptoms of cerebrovascular accidents to improve population health. To achieve this goal, specific objectives were needed, which included both process objectives and outcome objectives.

Objectives

Process Objectives

- Five classes were held with 5-30 participants each.
- Questionnaires were provided to all participants pre-class, post-class, and 1-week post-class to assess education level and evaluate retention of education.

Outcome Objectives

- Immediately after attending the class, 75% of participants would show a 25% increase in the knowledge of stroke symptoms compared to pre-class knowledge.
- One week after attending the class, 65% of participants would maintain the 25% increase in knowledge of stroke symptoms compared to pre-class knowledge.

Adequate resources were available to achieve process objectives. Participants were recruited by word of mouth and posted on social media in coordination with Cleveland County Emergency Medical Services. The objective to increase participants' knowledge of stroke symptoms by at least 25% is supported by the literature (Zhong et al., 2020). Literature that further supports this objective includes studies such as Zhang et al. (2020) who conducted an observational study over 1 year that concluded that multi-level education effectively improved the patient's awareness of stroke, encouraged more patients to use EMS to the hospital, made more patients aware of the need to reach the

hospital as soon as possible, helped shorten door-to-needle time, and gave patients the opportunity to receive intervention that may improve their prognosis and reduce negative outcomes. Khan et al. (2021) also designed a longitudinal observational study to establish awareness of stroke and stroke management among high school and college students through educational sessions, and the results showed a significant increase in knowledge and awareness of stroke risk factors and management.

Timeline

A project timeline was used to estimate the time required to complete tasks associated with the project to ensure successful completion. The timeline of the project is indicated as follows:

- January 2023-July 2023: Completed needs assessment, literature review, work planning for project, and stroke symptom presentation in order to begin the QI application. This included time to meet with the emergency medical services director and community paramedic to review the presentation, receive feedback, and adjust the presentation as deemed necessary.
- August 2023-October 2023: Completed the QI application and submitted it to the QI committee with the intention of obtaining approval for implementation from Cleveland County Emergency Medical Services and Gardner-Webb University.
- October 2023-December 2023: Recruitment of participants for classes through word of mouth and social media posts in coordination with Cleveland County Emergency Medical Services.
- January 2024-February 2024: Implementation of five community classes during this time in coordination with Cleveland County Emergency Medical Services.

Pre-class questionnaires were given to participants to take immediately before class began to judge the level of knowledge at baseline. Post-class questionnaires were given out immediately after class was over and taken up before participants left to judge the level of knowledge gained after taking the class. Participants were asked to provide their email addresses on a voluntary basis which was used by the project leader solely to send out a reminder link to a voluntary 1-week post-class survey that was set up online by the project leader in order to judge the level of knowledge retained 1-week post-class.

- February 2024-March 2024: This time was set aside to allow for the project leader to ensure as many survey questionnaires as possible were collected in order to synthesize data appropriately. Data was recorded, synthesized, reflected on, and finalized during this time by the project leader. Findings were assessed to reflect on knowledge levels in Cleveland County pre-class, immediately post-class, and 1-week post-class. Conclusions drawn from these findings were used by the project leader to evaluate if knowledge levels were increased and retained due to education implemented in the community.

Theoretical Underpinning

Dorothea Orem's self-care theory was first published in Nursing: Concepts of Practice in 1971 (Current Nursing, 2020). Orem's theory has six major assumptions:

1. People should be self-reliant and responsible for their own care and the care of their family members.
2. People are distinct individuals.
3. Nursing is a form of action—interaction between two or more people.

4. Successfully meeting universal and development self-care requisites is an important component of primary care prevention and ill health.
5. A person's knowledge of potential health problems is necessary for promoting self-care behaviors.
6. Self-care and dependent care are behaviors learned within a socio-cultural context (Current Nursing, 2020).

Orem's theory also separates nursing into three related parts: self-care, self-care deficit, and the nursing system (Current Nursing, 2020).

Orem's Theory of Self-Care

Orem's theory says there are self-care requisites—action directed towards an element of self-care (Current Nursing, 2020). Her three categories of self-care requisites are universal self-care, developmental self-care, and health deviation self-care (Current Nursing, 2020). Universal self-care is common to all and associated with life processes and maintenance of the integrity of human structure and functioning, i.e., activities of daily living (ADLs) (Current Nursing, 2020). Examples of universal self-care include maintenance of sufficient intake of air, water, and food; balance between activity and rest, and solitude and social interactions; promotion of human functioning; prevention of hazards to human life and well-being; provision of care associated with elimination process (Current Nursing, 2020). Developmental self-care is associated with developmental processes, derived from a condition, or associated with an event (Current Nursing, 2020). Examples of developmental self-care include adjusting to a new job or adjusting to body changes (Current Nursing, 2020). Health deviation self-care is required in conditions of illness, injury, or disease (Current Nursing, 2020). Examples of health

deviation self-care include seeking and securing appropriate medical care and assistance; being aware of and attending to the effects and results of pathologic conditions; effectively carrying out medically prescribed measures; modifying self-concepts in accepting oneself as being in a particular state of health and specific forms of health care; and learning to live with effects of pathologic conditions (Current Nursing, 2020).

Orem's Theory of Self-Care Deficit

Orem's theory of self-care deficit specifies when nursing is needed (Current Nursing, 2020). It says that nursing is needed when an adult is incapable or limited in providing continuous effective self-care (Current Nursing, 2020). Orem states five methods of helping include: (1) acting and doing for others, (2) guiding others, (3) supporting others, (4) providing an environment promoting personal development in relation to meeting future demands, and (5) teaching others (Current Nursing, 2020).

Orem's Theory of Nursing Systems

Orem's theory of nursing systems describes how the patient's self-care needs will be met by the nurse, the patient, or both, and then classifies the nursing system into three subcategories of meeting self-care requirements of the patient: wholly compensatory system, partly compensatory system, and supportive-educative system (Current Nursing, 2020). Orem then goes on to recognize that specialized technologies are usually developed by members of the health care profession, and she defined technology as systemized information about a process or a method for affecting some desired result through deliberate practical endeavor, with or without the use of materials or instruments (Current Nursing, 2020).

Orem's Categories of Technologies

Orem splits technology into two categories: social or interpersonal and regulatory technologies (Current Nursing, 2020). Social or interpersonal technology includes communication adjusted to age and health status; maintaining interpersonal, intra-group, or inter-group relations for coordination of efforts; maintaining therapeutic relationships considering psychosocial modes of functioning in health and disease; and giving human assistance adapted to human needs, actions, abilities, and limitations (Current Nursing, 2020). Regulatory technologies include maintaining and promoting life processes; regulating psycho-physiological modes of functioning in health and disease; promoting human growth and development; and regulating position and movement in space (Current Nursing, 2020).

Key Takeaways from Orem's Theory and Nursing Process

Orem says the nursing process presents a method that determines the self-care deficits and then defines the role of the person or nurse in meeting self-care demands (Current Nursing, 2020). Orem says the steps within the approach are considered to be the technical component of the nursing process (Current Nursing, 2020). Orem emphasizes the technological component must be coordinated with interpersonal and social processes within nursing situations (Current Nursing, 2020).

Application

Orem's theory applies to this project in that people need to be self-reliant, active in their own care, and active in the care of their family members to promote overall health and well-being. People and nurses interact to help promote self-care through education, activities of daily living, and health promotion. Technology helps to promote

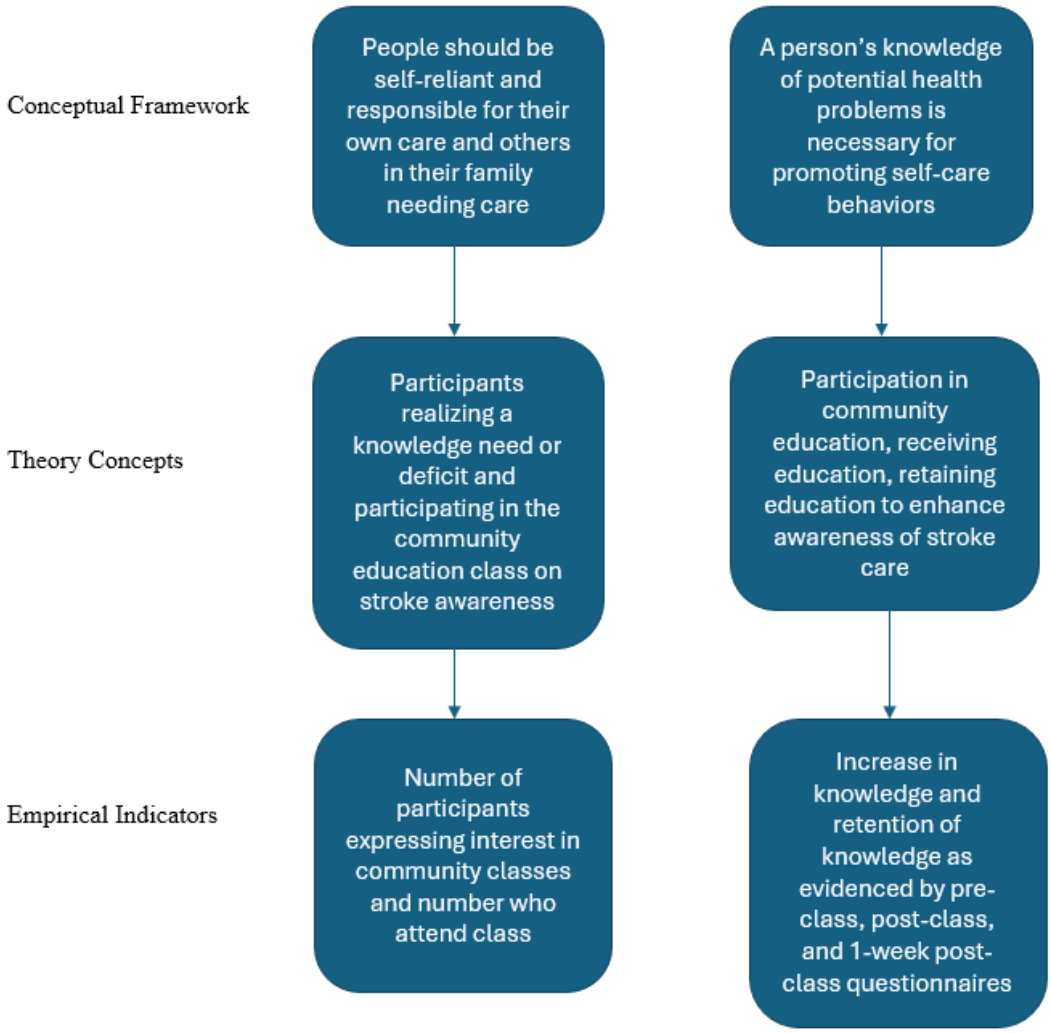
self-care. Technology is not considered just electronics; it is communication, social and interpersonal interaction, and regulations that promote growth, development, and life processes. Orem's self-care theory states not only is recognition of self-care crucial, but it is also important to know when to reach out for help from nursing when one cannot provide self-care or is limited in providing self-care (Current Nursing, 2020). At this point, Orem says that nursing is not only needed, but required to help the person in need (Current Nursing, 2020). Providing community education about stroke and early recognition of the signs and symptoms of stroke helps satisfy Orem's theory through:

- providing self-care (people will acknowledge a need to know more about stroke to help recognize symptoms earlier that could potentially help them, or their family members seek medical care faster and potentially cause a better medical outcome),
- acknowledging and attending to a self-care deficit (providing community education about stroke and early recognition of signs and symptoms of stroke to fulfill a need), and
- addressing the supportive/educative system using technology (providing a presentation, information, and handouts to educate about stroke).

Figure 1 depicts how the CTE model of Orem's theory applies to community stroke education.

Figure 1

CTE Model of Orem's Theory as Applied to Community Stroke Education



Work Planning

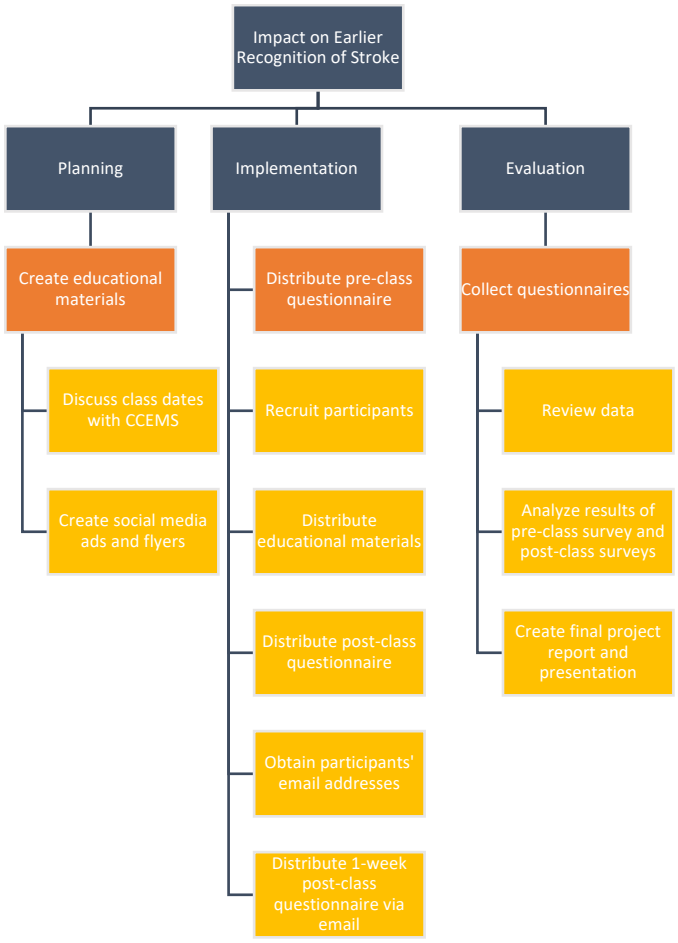
Work planning for this project included accurate planning of work by breaking down work into smaller packages that were more easily monitored and a cost/benefit analysis (Zaccagnini & Pechacek, 2021). This was attained through the work breakdown structure (WBS) project management tool and cost/benefit analysis table.

Project Management Tool

The WBS tool was useful in accurately planning the work of this project and breaking it down into smaller levels or milestones (Zaccagnini & Pechacek, 2021). The benefits of this tool included identifying the work needed for the project to be completed, organizing the work into a logical sequence, predicting when the work may be completed, preparing the budget, identifying which resources are needed and when, providing a communication tool for all team members, and organizing work tasks with milestones (Zaccagnini & Pechacek, 2021). The WBS tool (Figure 2), as applied to this project, focused on planning, implementation, and evaluation. Planning included creating educational materials, discussing class dates with CCEMS, and creating social media ads. Implementation involved distributing pre-class questionnaires, recruiting participants, distributing educational materials, distributing post-class questionnaires, obtaining participant's email addresses, and distributing 1-week post-class questionnaires via email. Evaluation included collecting questionnaires, reviewing data, analyzing results of pre-class surveys and post-class surveys, and creating a final project report and presentation.

Figure 2

Work Breakdown Structure Tool



Cost/Benefit Analysis

Costs for this project included the fixed costs of paramedic assistance with classes and the project leader's time. The average paramedic salary in Cleveland County, North Carolina is $20.63/hour (Indeed.com, 2023). The project leader's time is $0. Variable costs include the number of community members attending and the cost of paper and ink for paper handouts. The actual cost of community members attending is $0, but this amount affects materials and therefore is considered a variable cost. The cost of paper and ink for paper handouts includes the cost of $51.99 for ink cartridge/150 pages=$0.35

per page (hp.com, n.d.), paper=500 sheets for $5.57=$0.01 per page (Walmart.com, n.d.). This totals $0.36 total per page, and 100 handouts with eight pages each (two pages for informed consent, two pages each for pre-and post-class questionnaires, one page for email address to be written down, and one page for educational material), which is 800 pages total. This amount was variable dependent upon the scheduling of these classes, how many participants attended the classes, and how many classes were able to be held dependent on participation. Benefits included potentially decreasing the cost of average annual per-patient costs of stroke victims which, in the United States, was found to be approximately $59,900 in medical expenses per person affected by stroke (Bettger & Cadilhac, 2022). The cost/benefit analysis (Table 1) details this information along with the potential revenue to be acquired by implementing this project.

Table 1

Cost/Benefit Analysis

Item	Cost Per Unit	Projected Units	Time	Total
Fixed Costs				
Paramedic assistance with classes	$20.63/hour	1	9 hours	-$185.67
Project leader's time	$0	1	7 hours	-$0
Variable Costs				
Community members attending	$0	80-120	1 session	-$0
Cost of paper handouts	$0.36 total per 1 page	800 pages		-$288

Item	Cost Per Unit	Projected Units	Time	Total
	Benefits			
Decreasing annual average per-patient costs in stroke victims	$59,900	1		+$59,900
Potential Revenue				+ $59,426.33

Evaluation Plan

Process and outcome objectives were evaluated in a variety of ways. The process objectives of five classes held with 5-30 participants each and questionnaires provided to all participants pre-class, post-class, and 1-week post-class to assess education level and evaluate retention of education was measured through direct observation of participation and data collection. This was appropriate and acceptable since the only requirements were to record data on how many participants attended classes and to make sure the questionnaires/surveys or information on how to access said questionnaires/surveys were available to the class participants. The outcome objectives of 75% of participants showing a 25% increase in knowledge of stroke symptoms compared to pre-class knowledge and 65% of participants maintaining that 25% increase in knowledge of stroke symptoms 1-week post-class compared to pre-class knowledge were measured through questionnaire/survey data. These surveys were developed using the Qualtrics survey tool which allowed for the surveys to be accessed both online and in paper/hard-copy formats making this tool feasible and responsive. Surveys as evaluation tools of this project were appropriate and acceptable because they assessed baseline knowledge, amount of education learned, and amount of education retained which gave data pertinent to the objective outcomes showing whether there was an increase in knowledge from baseline

after the class and retention in knowledge 1-week after the class. The surveys were reliable since they asked many of the same questions from the first survey to the last survey in order to judge growth in and retention of knowledge. The survey questions were reviewed for face validity by the DNP project leader and project faculty chair.

There were five baseline questions with multiple-choice or select all that apply answers to be graded on each survey. Each question was worth 20 points. The select all that apply question had seven answer choices with six being correct. Each answer was worth 2.86 points. If the participant got all six answer choices right, they got the full 20-point credit for that question. If they got all six answer choices but also picked the wrong answer choice, they had 2.86 points counted off. If they picked some of the correct answers and the wrong answer, the correct answers were each counted for 2.86 points and the wrong answer took away 2.86 points.

The first survey question dealing with how comfortable the participants are with stroke knowledge on a scale of 0-10 is a qualitative question that was incorporated into the final conclusions and can be used to improve the project in the future should it be sustained. This is also true about the questions added to the post-class and 1-week post-class surveys inquiring about participants' own perceptions of knowledge base and knowledge gain. These questions were not used in the data collected to determine if there has been a 25% increase in knowledge from prior to the class versus after the class.

Survey questions were guided by the guidelines set forth by the American Stroke Association in conjunction with the American Heart Association (American Stroke Association, 2020). Survey questions included:

Pre-class:

- On a scale of 0-10, with 0 being the least comfortable and 10 being the most comfortable, please rate how comfortable are you with knowing the signs of a stroke. (Circle number 0-10)
- What are the signs of a stroke? (Select all that apply) (Answer Options: a. Facial droop, b. Weakness on one side of the body, c. Dizziness, d. Headache, e. Blurred vision, f. Change in walk or becoming unsteady, g. Cough; Correct answers: ABCDEF)
- If you or your family member is showing signs of a stroke, where should you go for medical care? (Answer options: A. Urgent Care, B. Primary Care/Family Doctor, C. Emergency Room; Correct answer: C)
- What should you do first if you or your family member is showing signs of a stroke? (Answer options: A. Wait to see if signs/symptoms go away, B. Give them aspirin, C. Call 911/seek medical care, d. Let them take a nap; Correct answer: C)
- If the doctors find a clot has caused a stroke, what is the longest amount of time after the signs/symptoms of stroke started that the medication to break up the clot can be given? (Answer options: A. 3 hours, B. 4 and ½ hours, C. 30 minutes, D. 2 days; Correct answer: B)
- If the doctors find a clot has caused the stroke, what is the longest amount of time after the signs/symptoms of stroke started that a clot can be surgically removed? (Answer options: A. 24 hours, B. 36 hours, C. 48 hours, D. 5 days; Correct answer: A)

Post-class:

- The same questions will be used as listed above for the pre-class questionnaire/survey with the addition of the following questions:
    - Do you feel this class helped you to understand strokes and the signs of stroke? (Yes or no)
    - Name one or more things you learned since taking this class. (Open-ended)

1-week post-class:

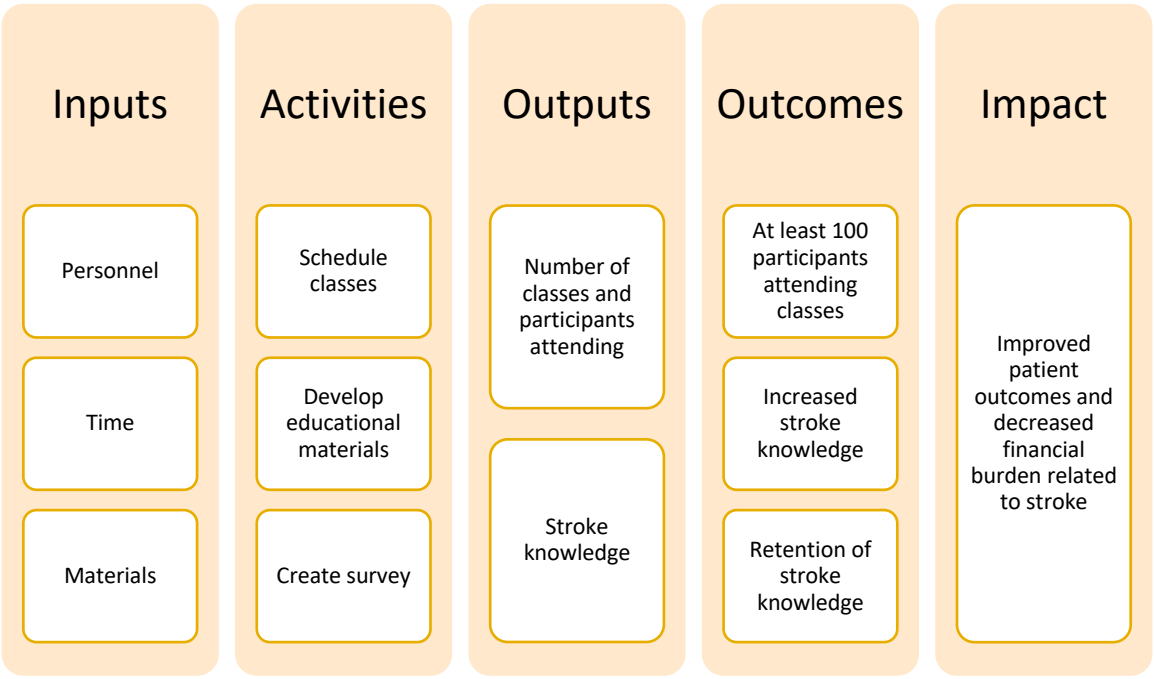
- The same questions will be used as listed above for the pre-class/post-class questionnaires/surveys with the addition of the following questions:
    - How much information about strokes and signs of stroke that you learned in class do you feel like you remember now? [Answers/Circle one: None to very little of the information (0-25%), Some of the information (25-50%), Most of the information (50-75%), All/close to all of the information (75-100%)]

Figure 3 is a Logic Model derived from Zaccagnini and Pechacek (2021) detailing the relationship between the activities and evaluation methods of this project. Personnel, time, and materials were put into this project to create classes, education, and technology. The classes consisted of education given through a lecture using media through a PowerPoint and a question-and-answer session at the conclusion of the lecture. Outputs included the number of participants and stroke knowledge prior to the intervention. Outcomes measured were the number of participants who attended the class, stroke knowledge improvement post-intervention, and retention of stroke knowledge 1-week

post-intervention. The potential impact of this project was improved patient outcomes and decreased medical and financial costs due to the potential decrease in the time it takes to seek medical care after the onset of stroke symptoms.

Figure 3

Logic Model of Evaluation Plan



Project Implementation

The QI application to implement this project was approved on November 2, 2023, by the University. Communication with the community paramedic began in October 2023 planning for implementation of this project. Once the QI application was finalized, communication resumed, and classes were set to begin in January. Five classes were agreed upon and set up through constant communication between the project leader and community paramedic. These classes occurred on:

1. January 16, 2024, at West Warren Manor Apartments,
2. January 20, 2024, at Shiloh Baptist Church,

3. January 31, 2024, at Lawndale Baptist Church,
4. February 1, 2024, at Lawndale Volunteer Fire Department, and
5. February 12, 2024, at New Beginnings Church.

Time had been allotted to conduct these classes from the beginning of January to mid-February. These classes fell within the planned time frame.

The classes were coordinated with the community paramedic in such a way that hands-on-only CPR, AED usage education, Heimlich maneuver, and other targeted community education were also taught during the same class. The classes all consisted of an introduction, pre-class survey, stroke education presentation by the project leader, post-class survey, instructions for and the option to participate in a 1-week post-class survey by providing an email address if comfortable, distribution of FAST mnemonic flyer from the American Heart Association/American Stroke Association for easy recall to take home, and then the community paramedic taught hands-on only CPR, AED usage education, Heimlich maneuver, and other pertinent community education as needed and/or requested by participants in the class. The project leader assisted with the community education given by the community paramedic as needed and as requested. The classes ended with a question-and-answer session and by thanking the participants for their participation in these classes.

Threats and Barriers

The QI application for this project had previously been approved prior to November 2, 2023, but changes in partnership with EMS for implementation of classes within the community instead of the previous deputy director of EMS required a resubmission and need for reapproval. When contact was no longer able to be made with

the previous deputy director of EMS, the project leader reached out to the training officer, and deputy EMS director, and was given information for the community paramedic to establish this project partnership.

Three classes were originally agreed upon for January 16, 2024, January 18, 2024, and January 20, 2024. The classes on January 16th and 20th were completed, but the January 18th class at Marion West Apartments had to be canceled due to the facility's heating failing due to the winter weather. Attempts were made to reschedule the class since the project leader, community paramedic, and facility all wanted this class to occur, but this was unable to happen due to the extended time it was taking to fix the heat in the building they used for community classes. Other opportunities to teach within the community were secured, allowing three other classes to be scheduled and completed.

The January 20th class was able to be completed but had to be modified due to the illness of the project leader, however, the community paramedic was able to attend and teach his section in person. The project leader was able to teach and attend via Zoom call. This was successful and the project leader was able to teach, answer questions, and view the class via Zoom, although it did retract from the sociality of being there in person. The project leader was able to deliver the handouts to the contact person at the church with instructions prior to the beginning of the class. Unfortunately, this did lead to this class only getting the first page of the pre-class and post-class surveys which could skew the data. There is not a clear answer as to what caused this, but it could have been due to time constraints, misinterpretation of instructions, or lack of resources to name a few. The affected data included 17 pre-class surveys and 16 post-class surveys that only had the first four questions, which included one qualitative question and three quantitative

questions for both the pre- and post-class surveys. The normal pre-class survey included one qualitative question and five quantitative questions. The normal post-class survey included three qualitative questions and five quantitative questions. These surveys were excluded from data analysis, as these 17 pre-class surveys and 16 post-class surveys were not comparable to the complete surveys.

As the grading of the pre- and post-class surveys was conducted by the project leader, some patterns noticed were that due to the marks on the page, it seems some participants may have changed their answers on the surveys, or they circled multiple answers for questions that only requested one answer. This did not happen in every class, but it did happen in more than one class. This reasoning was unclear on most of the affected surveys and had to be addressed. The project leader found that the best way to address this would be to exclude surveys where one or more questions were not answered, answers were changed, or questions that only asked for one answer were answered with multiple answers. These exclusion criteria affected 17 pre-class surveys, three post-class surveys, and six 1-week post-class surveys. Some participants did not answer qualitative data for the pre-, post-, and 1-week post-class surveys. This did not affect the survey score and so was not viewed as exclusionary data. Qualitative data was used if it was available only from surveys that were not excluded for other reasons as listed above.

Surveys during three of five classes were not collected immediately after completion, such as the pre-class surveys were not always collected as soon as they were finished and were instead taken up at the end of the class. This could have the possibility

of skewing data due to the possibility that participants may have changed or added to their original answers which led to surveys having to be excluded as mentioned above.

Other limitations, threats, or barriers to the project included participants' handwriting and legibility, participant educational level and ability to read/write/comprehend, incorrect emails provided for 1-week post-class survey, willingness to participate in surveys, participants only answering some questions but not all, and possibility of human error in distributing, informing, collecting, and grading of data.

Monitoring of Implementation

Implementation was monitored through the collection of surveys pre- and post-class. Participants were given informed consent for their records prior to the start of class and notified that any participation in the class or surveys was completely optional and anonymous. These pre- and immediate post-class surveys were printed off and given to participants in person at all five classes that were conducted so as not to exclude any participants who may not have had access to a smartphone. Participants voluntarily answered the paper surveys pre- and post-class, and the surveys were collected during the class. Paper survey data was graded, reviewed, and interpreted by the project leader. Follow-up surveys for participants who provided their emails at the end of class were sent an email with a reminder and a link to the survey 1 week after the class was conducted. The participants then had 1 week to respond to the survey after receiving the email. Email addresses were kept in a locked briefcase and were shredded after sending a 1-week post-class follow-up survey via email so as not to potentially identify anyone participating.

Data for 1-week post-class survey was collected via Qualtrics and monitored in this forum by the project leader.

The project concluded within the allotted time frame. The last class was conducted on February 12, 2024, with 1-week post-class surveys being sent out on February 19, 2024. Data collection ended on February 26, 2024. All data was collected, graded, reviewed, and interpreted by the project leader within the allotted time frame.

Interpretation of Data

Five classes were conducted with a goal of reaching 100 participants, which resulted in 97 participants attending classes, 74 participants submitting pre-class surveys, 72 participants submitting post-class surveys, and 28 participants submitting 1-week post-class surveys. After reviewing surveys for exclusionary criteria, it was found that there were 40 usable pre-class surveys, 53 usable post-class surveys, and 22 usable 1-week post-class surveys. Pre- and post-class surveys were paper surveys given before and after class and collected before the conclusion of each class. 1-week post-class surveys were sent out via email and responses were submitted and recorded via Qualtrics. Five quantitative questions were on each survey and were graded individually on pre-, post-, and 1-week post-class surveys. This data was entered into Excel. Qualitative data was gathered to interpret how comfortable participants felt with their knowledge of stroke symptoms before, after, and 1-week after class. Post-class qualitative data was also added if the participants felt this class helped them understand signs of stroke and listed anything they learned through this class. The 1-week post-class also added a question on what percentage of information the participant felt they had retained in the week since the class.

Quantitative Data

Pre-, post-, and 1-week post-class surveys were graded individually, and data was interpreted into mean, median, and standard deviation as shown in Table 2. Mean and median increased from pre- to post-class surveys. The mean decreased slightly from post-class to 1-week post-class surveys. The median remained the same from post-class to 1-week post-class surveys. The standard deviation was approximately 12.46 for pre-class survey grades, 10.84 for post-class survey grades, and 12.15 for 1-week post-class survey grades. This resulted in a 28% change in knowledge from pre-class to post-class and pre-class to 1-week post-class. Participants were able to maintain knowledge from immediate post-class to 1-week post-class with a 0% change in knowledge.

Table 2

Interpretation of Data: Pre-, Post-, and 1-week Post-Class Survey Grades

	Pre-Class Survey Grades	Post-Class Survey Grades	1-Week Post-Class Survey Grades
Mean	72.85	93.10	92.99
Median	77.14	100	100
SD	12.46	10.84	12.15

Pre- and post-class surveys were collected via paper surveys. One-week post-class survey data was collected via Qualtrics. The first quantitative question asked, “What are signs of a stroke?” in a select-all-that-apply format. Answer options were A. Facial Droop, B. Weakness on one side of the body, C. Dizziness., D. Headache, E. Blurred vision, F. Change in walk or becoming unsteady, G. Cough. The correct answers were A,

B, C, D, E, and F. Pre-class results showed that out of 40 usable responses, 16 answered the questions correctly with full credit. Out of the 24 responses who did not select all the right answers, seven incorrectly chose cough as a symptom of stroke, six missed the change in walk or becoming unsteady as a symptom of stroke, 11 missed dizziness, 11 missed headache, four missed weakness, and five missed blurred vision. Post-class results showed that out of 53 usable responses, 44 answered correctly with full credit. Out of the nine responses who did not select all the right answers, three incorrectly chose cough as a symptom of stroke, one missed weakness as a sign of stroke, four missed dizziness, four missed blurred vision, two missed change in walk or becoming unsteady, two missed headache, and one missed facial droop. One-week post-class results showed that out of 22 usable responses, 14 answered the question correctly with full credit. Out of the eight responses who did not select all the right answers, five incorrectly chose cough as a symptom of stroke, three missed dizziness as a symptom of stroke, two missed blurred vision, one missed headache, and one missed change in walk or becoming unsteady. This data can be viewed in Table 3.

Table 3

Interpretation of Data: Pre-, Post-, and 1-week Post-Class Select All That Apply Question

Answer	% of Participants Choosing Answer Pre-Class	% of Participants Choosing Answer Post-Class	% of Participants Choosing Answer 1-week Post-Class
Facial droop	100% (correct answer)	98.1%	100%
Weakness on one side of the body	90% (correct answer)	98.1%	100%

Answer	% of Participants Choosing Answer Pre-Class	% of Participants Choosing Answer Post-Class	% of Participants Choosing Answer 1-week Post-Class
Dizziness	72.5% (correct answer)	92.5%	86.4%
Headache	72.5% (correct answer)	96.2%	95.5%
Blurred vision	87.5% (correct answer)	92.5%	90.9%
Change in walk or becoming unsteady	85% (correct answer)	96.2%	95.5%
Cough	82.5% (incorrect answer)	94.3%	22.7%
% of Participants Choosing All Correct Answers for Full Credit	40%	83%	63.6%

The remaining four quantitative questions on the pre-, post-, and 1-week post-class surveys only had one correct answer. Of the 40 usable responses collected pre-class: (Question 2) 100% answered correctly that patients concerning for stroke should report to the emergency department instead of other medical offices, (Question 3) 100% answered correctly that calling 911/seeking medical care should be the primary concern when stroke symptoms arise, (Question 4) 17.5% answered correctly that 4.5 hours is the longest amount of time after stroke symptoms begin that clot-busting medication can be administered, and (Question 5) 62.5% answered correctly that the longest amount of time after stroke symptoms begin that a clot can be surgically removed is 24 hours. Of the 53 usable responses collected post-class: 98.1% answered question 2 correctly, 100% answered question 3 correctly, 86.8% answered question 4 correctly, and 84.9%

answered question 5 correctly. Of the 22 usable responses collected 1-week post-class: 100% answered question 2 correctly, 100% answered question 3 correctly, 90.9% answered question 4 correctly, and 81.8% answered question 5 correctly. This comparative data can be viewed in Table 4.

Table 4

Interpretation of Data: Comparison of Quantitative Questions 2-5

	% of Participants Answering Correctly Pre-Class	% of Participants Answering Correctly Post-Class	% of Participants Answering Correctly 1-week Post-Class
Question 2	100%	98.1%	100%
Question 3	100%	100%	100%
Question 4	17.5%	86.8%	90.9%
Question 5	62.5%	84.9%	81.8%

Qualitative Data

Participants were asked to rate how comfortable they felt with knowing the signs of a stroke on a scale of 1-10 with 1 being the least comfortable and 10 being the most comfortable, pre-, post-, and 1-week post-class. Results can be viewed in Table 5.

Participants were asked post-class and 1-week post-class if they felt this class helped them to better understand strokes and the signs of a stroke. Post-class results were Yes (52), and No (1). One-week post-class results were Yes (22), and No (0).

Participants were asked post-class and 1-week post-class to name one or more things that were learned by taking this class. Common themes in post-class surveys

included: different types of strokes, medications that can be given for stroke, remembering when symptoms start, time restraints on stroke intervention, time is brain and intervention is time sensitive, 4.5 hours for clot-busting medications, signs of a stroke, prevention of a stroke, FAST. Common themes in 1-week post-class surveys included: FAST, time is important, medication is time-sensitive, clot removal is an option in some cases, remember the time symptoms started, and do not delay going to the ER.

Participants were asked 1-week post-class how much information they felt they retained in one week. Out of 22 participants, the results were 0-25% (0), 26-50% (1), 51-75% (6), and 76-100% (15).

Table 5

Interpretation of Data: How Comfortable Participants Felt Recognizing Signs of Stroke on a Scale of 1-10

Number on a Scale of 1-10	Number of Participants Choosing this Answer Pre-Class	Number of Participants Choosing this Answer Post-Class	Number of Participants Choosing this Answer 1-week Post-Class
1	1	0	0
2	3	0	0
3	0	0	0
4	2	0	0
5	9	0	1
6	5	1	0
7	3	7	2

Number on a Scale of 1-10	Number of Participants Choosing this Answer Pre-Class	Number of Participants Choosing this Answer Post-Class	Number of Participants Choosing this Answer 1-week Post-Class
8	6	7	2
9	1	15	8
10	7	20	9
No Answer Chosen	3	3	0

Process Improvement Data

The outcomes of this project were reaching 97 members of the community and increasing their knowledge of strokes and stroke symptoms. Knowledge improved from pre-class to post-class and the majority of responses on the 1-week post-class surveys showed that knowledge was retained 1-week after attending the community class. This project could potentially be sustained by EMS and offered as community education as needed. Surveys could be used in the future to judge baseline knowledge and knowledge gain.

Overall, mean data showed improvement from pre-class knowledge to post-class knowledge with a 20.25% change increase. Participants were able to maintain this knowledge increase at the 1-week post-class survey, indicating the educational session may have been beneficial in encouraging the retention of stroke knowledge.

One area where knowledge decreased was for question 2 related to when potential stroke patients should seek medical care. This was a less than 2% decrease from pre-class

(100%) to post-class (98.1%). The participants who chose incorrectly either chose urgent care or primary care/family doctor instead of correctly choosing an emergency room. This could delay treatment so is important to readdress and why it would be beneficial to have these classes continued and taught periodically instead of only once. Interestingly, results for this same question did increase back to pre-class levels of 100% on the 1-week post-class survey results. This may have been attributed to the project leader answering questions that were asked at the end of class by participants after the surveys were collected or may have been attributed to the participants conducting their own research.

Pre-class to post-class knowledge and post-class to 1-week post-class knowledge improved or stayed the same in all areas except for the select all that apply question 1 with stroke symptoms and question 5 dealing with how long stroke patients have to have a clot surgically removed if they are a candidate. Question 5 data improved by 22.4% from pre-class (62.5%) to post-class (84.9%) and decreased by 3.1% from post-class to 1-week post-class (81.8%) data. Question 1 data improved by 43% from pre-class (40%) to post-class (83%), and then decreased by just under 20% from post-class to 1-week post-class (63.6%) data. Overall, pre-class to 1-week post-class data for question 1 did still show an increase in knowledge by 23.6%. While this data did still show an increase in knowledge, scores were still not optimal indicating that reeducation on a routine basis may be an indicated need so that knowledge is not forgotten, and stroke symptom recognition is not potentially delayed.

Mean and median scores improved from pre- to post-class survey data. The mean did decrease slightly from post-class to 1-week post-class by a marginal 0.11. The median stayed the same from post-class to 1-week post-class. Qualitative data showed

that participants felt more confident in their abilities to identify stroke and proved that they had learned new information in these classes, and they could recall and name specific information 1-week later. Participants' perceptions of their own knowledge of stroke and stroke symptoms improved from pre-class to post-class and 1-week post-class which correlated with their improved test scores from pre-class to post-class and 1-week post-class. The data overall showed an increase in knowledge from pre-class to post- and 1-week post-class ranging from 19.3-73.4% varying by question. These findings reflect previous literature on this subject, including studies that emphasize the need for comprehensive educational programs to increase awareness of strokes since limited awareness could lead to failure to identify the early warning signs of a stroke and seeking appropriate timely help (Murthy et al., 2019). Studies that suggest stroke education programs in healthcare systems should incorporate all employees, not just nurses, to lead to a positive social change through increased health literacy through the distribution of stroke information to all community members (Gribko, 2019).

Process objectives for this project were: five classes held with 5-30 participants each; questionnaires provided to all participants pre-class, post-class, and 1-week post-class to assess education level and evaluate retention of education. This project consisted of five community classes held that ranged in size from 5-30 participants. Questionnaires were provided to all participants pre-class, post-class, and 1-week post-class and were evaluated to assess education level and retention of education. Pre-class and post-class questionnaires for one of the five classes were unfortunately not able to be counted in the data due to the second page of the surveys being left out when handed out to the participants. Outcome objectives included: 75% of participants would show a 25%

increase in knowledge of stroke symptoms in the immediate post-class knowledge as compared to pre-class knowledge; 1-week after attending the class, 65% of participants would maintain the 25% increase in knowledge of stroke symptoms compared to pre-class knowledge. These outcome objectives were met as shown by the increase in data as discussed previously. These process and outcome objectives may have been limited by: lack of motivation or unwillingness to participate, lack of understanding or did not ask for clarification, education level, inability to read or write, or forgetfulness to participate.

Limitations of this project included non-generalizable findings and survey procedure concerns. Areas of improvement included: taking up the pre-class surveys immediately after completion to reduce the potential for changing answers and skewing data; making sure the entire survey is included and handed out so as not to leave out any data or skew data; converting to all electronic surveys to reduce potential human errors such as handwriting legibility and data misinterpretation; encouraging or incentivizing all questions being answered. Potential issues and limitations are some participants not having access to smartphones or technology, human refusal to answer every question, and lack of participation.

Stroke was identified as a major cause of morbidity and disability in Cleveland County. This project identified the potential to educate the community on stroke and stroke symptoms to improve knowledge on the subject and potentially help community members identify symptoms of stroke earlier and seek emergency medical care faster. Community classes were conducted and pre-, post-, and 1-week post-class surveys were distributed. Survey data found that knowledge improved from pre- to post-class and knowledge was maintained 1-week post-class. Community participants voiced via

surveys that they felt more comfortable identifying symptoms of stroke and felt the classes helped them with their understanding of stroke. The results of this project indicated community education may be an effective method to increase knowledge of stroke symptoms, and this knowledge may persist after the initial education. Future projects could focus on long-term monitoring of knowledge retention, pairing pre-survey and post-survey data, and longitudinal data on the effects of community education on stroke outcomes in the county. This project was a cost-effective intervention consisting of a pre-made PowerPoint, pre-made pre- and post-class surveys, and visual aid flyers from the American Stroke Association to aid in knowledge retention. Project costs are limited to the cost of the project leaders' time and the cost of paper and ink for any hard copies made of visual aid flyers and questionnaires. Costs could be further decreased if pre- and post-class surveys are converted to online surveys. Other ways to improve and expound upon this project may include bringing this project to local high schools to help sustain and promote positive outcomes. This is also supported by the literature such as in a study conducted by Khan et al. (2021) that showed the awareness of stroke risk factors and management among high school and college students can be significantly improved with regular educational interventions and help decrease the prevalence of stroke. Studies conducted by Williams et al. (2018) and Nemade et al. (2020) show that educating children in middle and even elementary school about stroke and the signs of stroke can help improve community stroke knowledge and preparedness and increase chances for stroke patients to receive treatment in a timely manner. This project achieved its goal of improving health, health literacy, and lives of the residents of Cleveland County by improving the knowledge base of these residents. The hope is that this project will

continue and help to educate more residents and re-educate the same residents to maintain education and knowledge in the future.

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