# An Implementation Science Guided Acute Stroke Nurse Pilot

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## Abstract

Background: Ischemic stroke treatment necessitates timely intervention, including intravenous thrombolysis (IVT) and mechanical thrombectomy (MT), to optimize patient outcomes. Increasing patient volumes and staffing challenges have contributed to deviations from acute stroke protocols. This quality improvement initiative evaluated the implementation of an acute stroke nurse (ASN) role at a comprehensive stroke center to enhance stroke alert coordination, post-thrombolytic monitoring, and patient care transitions.

Methods: A 12-week pilot program introduced the ASN role, focusing on acute stroke response and monitoring after IVT administration. Guided by implementation science frameworks, including the Consolidated Framework for Implementation Research (CFIR), Expert Recommendations for Implementing Change (ERIC), and the Implementation Research Logic Model (IRLM), the initiative assessed door-to-treatment times, post-thrombolytic monitoring compliance, and staff perceptions of the role. Quantitative metrics, validated scales for acceptability and appropriateness (AIM and IAM), and thematic analysis of feedback informed the evaluation.

Results: The ASN role was piloted with partial coverage (median 3.5 days per week). Although door-to-needle times for IVT did not improve, door-to-puncture times for MT decreased by 28.3% (mean 39.4 minutes compared to 55 minutes pre-pilot). Compliance with vital sign and neurologic monitoring improved by 40.4% and 11.1% respectively in the critical post-thrombolytic period. Staff surveys (n=45) demonstrated high acceptability (AIM=4.77) and appropriateness (IAM=4.81), with strong support for the role's expansion. Based on these findings, two full-time equivalent (FTE) positions were approved to sustain and expand the ASN role.

Conclusions: Our pilot demonstrated the ASN role's impact on enhancing monitoring compliance, reducing treatment times for mechanical thrombectomy, and improving staff satisfaction. These findings support the role's scalability and highlight the value of structured implementation science approaches in advancing evidence-based stroke care practices.

Keywords: Stroke, ischemic stroke, acute stroke, nursing, neurovascular nursing, neuroscience nursing, quality improvement, implementation science.

## Introduction

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Ischemic stroke leads to significant disability and financial burden.[1] Acute treatments, including intravenous (IV) thrombolysis and mechanical thrombectomy (MT) improve functional independence 90-days post treatment.[1] Nurses play a critical role in the acute care of ischemic stroke patients, particularly in ensuring timely and effective interventions.[2] Rapid treatment significantly improves patient outcomes, which is why the American Heart Association recommends achieving door-to-needle (DTN) times of 30 minutes or less.[1-3] Safely achieving this goal requires precise team coordination, with the neurovascular nurse responsible for conducting assessments, monitoring patients every 15 minutes in the critical first two hours post-treatment, and facilitating seamless care transitions.[1-3] As a result, some stroke programs have introduced dedicated stroke alert nurses whose primary role is to streamline stroke code responses and expedite transitions to MT suites.[2] Such initiatives have been shown to significantly reduce door-to-treatment (DTT) times and improve patient outcomes and may also decrease complications via early detection and treatment of neurologic and blood pressure changes.[2,4-8]

At an academic medical center in Western New York certified by The Joint Commission as a comprehensive stroke center, DTN times for IV thrombolysis had increased, and post-treatment monitoring compliance had decreased. Stroke committee meetings revealed concerns about the lack of a consistent expert to coordinate stroke alerts, contributing to a perception of chaos during stroke activations among residents, nurses, and other staff. Increasing patient volumes in the emergency department and staffing shortages further compounded these challenges. To address these gaps, a quality improvement initiative, guided by implementation science tools, was designed to evaluate the impact of a dedicated acute stroke alert nurse (ASN). The intent of this role was to manage stroke alerts and post-thrombolytic monitoring, and to facilitate rapid handoffs for MT. The aim of this initiative was to demonstrate acceptability, appropriateness, and impact of the ASN on efficiency and staff satisfaction to justify incremental full-time equivalents (FTEs) for hire to support the stroke program.

Implementation science is a particular approach that focuses on evaluating the process of implementing innovative and evidence-based strategies into routine clinical care.[9] Two frameworks, The Consolidated Framework for Implementation Research (CFIR) and the Expert Recommendations for Implementing Change (ERIC) framework, guided the initiative.[10-11]

There are five domains incorporated into CFIR, including, 1) innovation or the thing to be implemented, 2) outer setting where the targeted practice area exists, for example the hospital or hospital system, 3) inner setting, which is the targeted area where the innovation is implemented, 4) individuals domain, or the characteristics of the individuals involved, and 5) implementation process, such as activities and strategies to implement the innovation.[10]

The ERIC framework provides a systematic approach to selecting the most appropriate strategies for site-specific contexts. ERIC aids in developing effective and tailored plans that align with the project's goals and available resources, increasing the likelihood of successful implementation.[11] For this project, the focus was on implementing an innovative ASN within one hospital setting in a multi-site academic medical center. Here we will report outcomes from a 12-week pilot program, the process by which

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implementation occurred, and the experience of those within the local context.

## Methods

A pilot test was chosen as the main implementation strategy due to available resources and the need to establish feasibility as well as evaluate implementation barriers and adapt process and role expectations. The Implementation Research Logic Model (IRLM) was used to map project design and evaluation incorporating contextual evaluation using CIFR and implementation strategies guided by ERIC (Figure 1). The IRLM can be used in practice change initiatives to incorporate specific aspects of implementation science including determinants, strategies, and outcomes, and was designed to enhance the incorporation of evidence-based interventions into healthcare settings.[12]

The ASN responsibilities included response to acute stroke alerts during working hours, coordination of the acute stroke process, assistance gathering history and treatment contraindications, facilitating actual weights, medication accuracies, and administration of IV thrombolysis per orders. Patients who received IV thrombolysis were monitored for 2 hours by the ASN followed by a warm handoff to the emergency department or inpatient nurse. In cases of MT the ASN facilitated transfer and handoff to the operating room. During the acute phase the ASN also performed bedside dysphagia screening, initiated patient and caregiver education, and acted as an expert resource to patients, caregivers, and staff. Role expectations were formalized prior to implementation and can be found in figure 2.

The following measures were utilized to evaluate the initiative. We evaluated trends in DTT times before and after the 12-week practice change, adherence to post-thrombolytic monitoring pre and post implementation, and documentation of reasons for delay. Additionally, process measures were evaluated with validated implementation science focused measures of acceptability and appropriateness of the initiative in the practice setting. A brief survey was sent to practitioners within the setting for feedback. Thirteen investigator generated items were administered, including three free-text items, to understand attitudes and perceptions related to the ASN role. Acceptability was evaluated using the Acceptability of Implementation Measure (AIM) and appropriateness was measured using the Intervention Appropriateness Measure (IAM).[13] Each are 4-item scales tailored to the specific intervention, in this case ASN, with responses ranging on a 5-point scale from “completely disagree” to “completely agree” with higher scores indicating more favorable responses.[13] Measures took less than 5 minutes each to complete. Additionally, the time allocated to acute stroke response and monitoring by the ASN over the 12 week period was measured.

Data were analyzed using measures of central tendency, frequency, percentage, median, and range. Open-ended responses were evaluated thematically to summarize feedback to inform future larger scale implementation. As a QI initiative per the University of Rochester’s Guideline for Determining Human Subject Research our pilot did not meet the definition of research according to 45CFR46. Support for implementation science education and DNP-PhD collaboration in project design and manuscript development was funded by the University of Rochester School of Nursing Pamela and Dr. Jeremy A. Klainer Entrepreneurship Endowed Fund Award. The manuscript adheres to the SQUIRE 2.0 guidelines for QI reporting.[14]

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## Figure 1: Implementation Research Logic Model

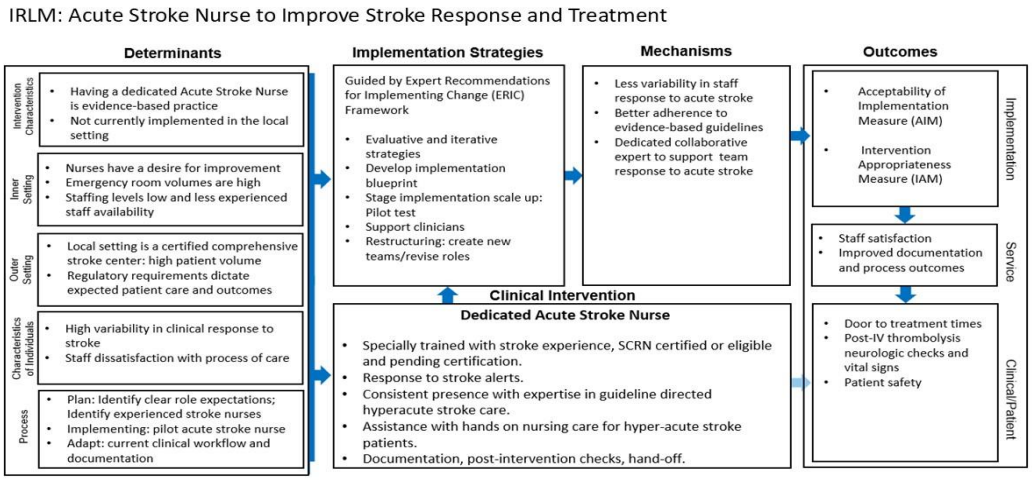


*Figure 1: Implementation Research Logic Model Adapted from Smith, JD, Li, D, & Rafferty (2020)*

## Figure 2: Stroke alert nurse role and expectations.

Acute Stroke Alert Nurse Pilot Expectations

Objective: Creation of an Acute Stroke alert Nurse (ASN), staffed by a specially trained stroke RN, to help facilitate acute stroke treatment. The ASN will facilitate the movement of suspected stroke patients through the acute stroke process and treatment if indicated. Goals will be to improve door to treatment times, compliance with post-intervention monitoring, and patient and family education.

Responsibilities:

1. Responds to all acute stroke alerts (Emergency as well as in-patient) during available hours and collaborates with the Acute Stroke Team as well as EM/primary team for appropriate triage and treatment.
2. Assists in collecting information from patient, family, chart, and other available resources for the triaging of acute stroke patients for timely evaluation to determine eligibility for acute stroke inventions.
3. Assists with transport and facilitation of imaging such as CT/CTA/hyperacute MRI as well as ensuring appropriate transfer from imaging to scale stretcher to obtain accurate weight for acute interventional purposes.
4. Facilitates stroke treatment planning and delivery such as administration of IV Thrombolytic and transfer to OR for endovascular therapy.
5. Educates the patient and family throughout the acute stroke process and provides anticipatory guidance as what to expect throughout hospitalization.
6. Documentation of history, interventions, and acute care monitoring when appropriate.
7. General knowledge of current research trials to identify appropriate patients for referral to Clinical Research Coordinator.
8. Provide care during the immediate post-treatment phase of monitoring for select patients, particularly those who receive thrombolytic therapy.
9. Ensure a thorough hand off is completed with the nurse/unit who will ultimately be receiving the patient, if known, as well as the nurse immediately assuming care of the patient.
10. Ensure acute treatment is based upon current guidelines and document to support Comprehensive Stroke Center performance measures.
11. May assist in other aspects of stroke admission such as completion of admission history, performance of bedside swallow screening, initiation of stroke education and identification of acute patient needs (safety, comfort, wound care, etc) as able.
12. Acts a resource to patient, family and staff as the expert in stroke care.

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## Results

An ASN position was successfully piloted Monday through Friday from 8 am to 4pm for 12-weeks from June 12-September 1, 2023. The baseline comparison was 12 weeks prior to the pilot (March 20-June 9, 2023) and included only patients seen Monday through Friday from 8 am to 4 pm. Two RNs employed by the CSC with over a decade of experience in the care of stroke patients, one Stroke Certified Registered Nurse (SCRN) and one SCRN-eligible nurse with exam pending at the time of the pilot, shared responsibility for response to stroke.

Due to competing responsibilities with their full-time positions, illness, and vacations, some weeks did not have full coverage. During the pilot period coverage ranged from 2-5 days/week with a median of 3.5 days. The RNs spent 0.5-8 hours per day (mean 4, median 2.5) responding to stroke alerts, monitoring for 2 hours post-IV thrombolysis, and handing off to the operating room for MT. During the pilot the ASNs were involved in 5 IV thrombolytic cases and 7 MT cases, baseline included 4 IV thrombolytic and 13 MT cases.

Table 1 shows the comparison of DTT data with and without ASN and documentation of delays in treatment. While DTN times for IV thrombolysis did not improve with ASN presence, there was an improvement in appropriate documentation of DTN delays from 33% to 100%. Improvements were seen in DTP times with ASN presence.

Improvement in post-thrombolytic vital sign (VS) and neurologic checks was seen in patients with ASN involvement and was most notable in the first 2 hours post IV thrombolysis during every 15-minute checks. There was a 40.4% increase in completion of VS with involvement of the ASN (99%, n=11) when compared to patients in the pre-implementation and pilot period with no ASN involvement (70.5%, n=50). Neurologic checks had an 11.1% improvement with involvement of an ASN (98.1%, n=11) as compared to no ASN (88.3%, n=50). Improvements were also seen in the cumulative VS and neurologic checks in the first 24 hours post thrombolysis with 94% and 94.4% compliance with ASN presence (n = 11) compared to 80.6% and 85.3% without ASN (n=50) respectively. This reflected an improvement of 16.6% for VS and 10.7% for neurologic checks.

The post-pilot survey received 49 responses, four respondents displayed inconsistencies across survey questions and comments and were excluded from analysis. A total of 45 responses were included in the analysis with distribution of respondents as follows: 15 ED and 9 inpatient RNs, 4 nursing supervisors and 5 nurses in other areas, 3 responses each from vascular neurology attending physicians, advanced practice providers, and “other” position, and 1 response each from a neurology resident, vascular neurology fellow, and imaging sciences staff member. The scores for AIM and IAM of 4.77 and 4.81 respectively indicated high acceptability and appropriateness of the intervention. Survey results, seen in Figure 3, indicated a high degree of satisfaction with the position across domains of workload, patient safety, quality of care, and documentation.

Respondents were asked to comment on positive aspects and suggest improvements for the role. Positive aspects included ASN expertise and ability to anticipate barriers during the acute stroke process, improved

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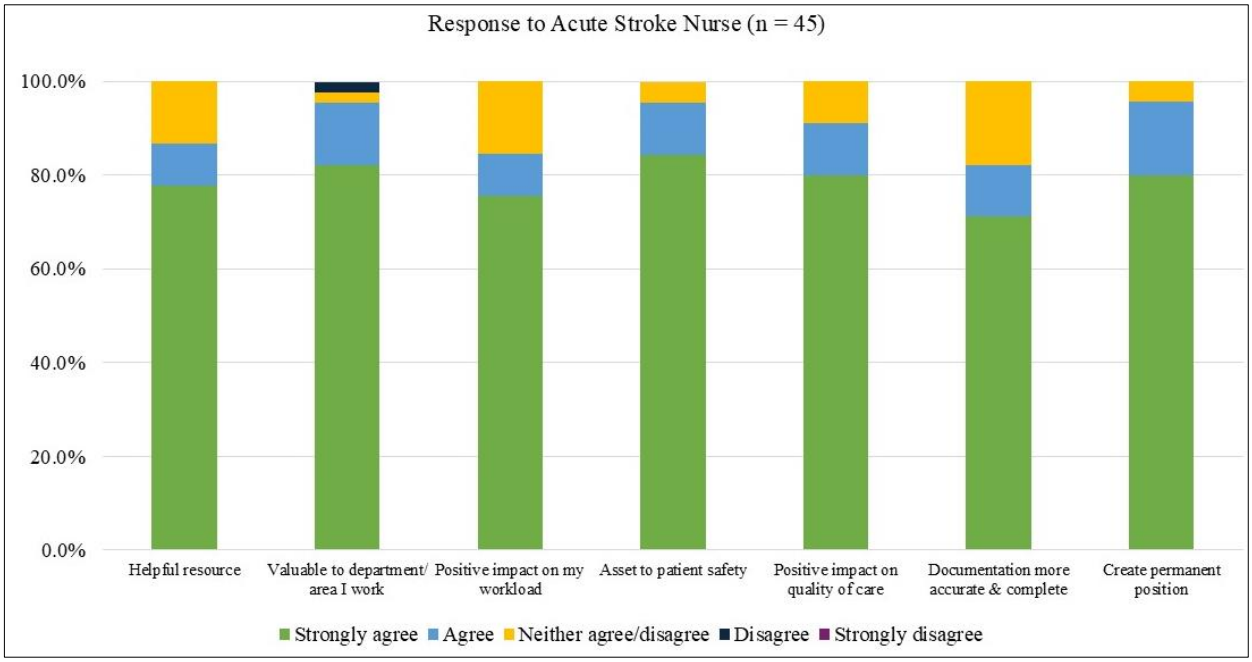
**Table 1**

| | Baseline DTN (n = 4) | Intervention DTN (n = 5) | Baseline DTP (n = 13) | Intervention DTP (n = 7) |
|---|---|---|---|---|
| **Range (minutes)** | 28-102 | 27-106 | 36-80 | 19-58 |
| **Mean (minutes)** | 54.5 | 60.8 | 55 | 39.4 |
| **Median (minutes)** | 44 | 49 | 52 | 39.4 |
| **% within 30 minutes DTN (medical delays excluded)** | 50% | 50% | | |
| **% within 45 minutes (medical delays excluded)** | 100% | 66.7% | | |
| **Percent within 60 minutes DTN/DTP transfer from outside hospital/MSU (medical delays excluded)** | 100% | 75% | 77.8% | 100% |
| **Percent within 90 minutes DTP direct to ED presentation** | | | 100% | 100% |
| **DTN delay documented appropriately** | 33.3% (1 treated within 30 min) | 100% (1 treated within 30 min) | | |

Comparison of pre and post intervention door to treatment times and appropriate documentation of medical delays to treatment for intravenous thrombolysis. DTN = door-to-needle in patients receiving intravenous thrombolysis, DTP = door-to-puncture in patients receiving mechanical thrombectomy.

**Figure 3: Staff Satisfaction Results**

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communication surrounding stroke treatment between physicians and nurses, improved transitions during and immediately following hyperacute evaluation and intervention, and the value of an expert stroke nurse facilitating acute care. Nurses specifically commented on workload and patient safety benefits in the critical care area of the ED and the interventional cardiology area. Multiple respondents commented on the improved consistency of care and adherence to the acute stroke process for more rapid and safer care. An additional benefit was recognition of the ASN as an educational resource. The common theme in suggestions for improvement was expanding availability of the ASN through evening and weekend hours and to make the role permanent. Additional comments included increasing education for staff awareness and expanding electronic handoff responsibilities.

## Discussion

The goal of our pilot program was to implement an evidence-based practice in the local setting to demonstrate acceptability, appropriateness, and impact on staff to garner approval of incremental FTEs for stroke program expansion. The use of implementation science frameworks guided us in ensuring that the local context and resources were incorporated into the implementation plan and that appropriate data were collected to support FTE justification. Using the results of the pilot two FTEs were approved and are pending hire. The nurses piloting the program have been able to take their experience and develop an "acute stroke navigator" job description novel to the CSC.

While all members of the acute stroke response team recognize the importance of rapid triage and treatment of acute ischemic stroke, staffing and system factors impact process of care. The implementation of the ASN resulted in several notable outcomes. While the pilot program did not reduce DTN times for patients treated with IV thrombolysis, there was an improvement in DTP times for those undergoing MT. The presence of an ASN can facilitate more efficient transitions for AIS patients. Additionally, achieving a 100% compliance rate with appropriately documented delays is an important improvement to understand reasons for delay and exclude those with medically indicated delays from overall performance measures. Post-thrombolytic compliance monitoring improved with the ASN, indicating that patients received closer monitoring and enhanced safety. This may be attributed to better nurse-to-patient ratios or the acute stroke knowledge and experience of the ASN, highlighting the importance of stroke nursing expertise.

The most common location for hyperacute stroke care is the ED. There is considerable dissatisfaction among ED nurses, with 1 in 3 dissatisfied with their job and almost half intending to leave their job within one year. In a content analysis of free text responses to why ED nurses in New York State and Illinois would not recommend their current work environment, themes and subthemes identified included unlimited patients with limited support, unanswered calls for help, and compromised quality of care.[15] This indicates that workload, safety, quality of care, and leadership support impact ED nurses' intent to stay in their positions. The results from our staff satisfaction survey demonstrate the ASN was perceived to positively impact patient safety, quality of care, and workload. In identifying potential

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ways to improve the attractiveness of EDs for nurses, the ASN could meet some of these needs for a subset of patients and demonstrate a commitment to improving patient care and staff support.

Along with favorable feedback from ED nursing staff in our pilot, the literature supports positive outcomes when the ASN was involved in the hyperacute evaluation process. In one study of the addition of a dedicated stroke nurse and nursing flowsheet to track time targets, authors saw a significant improvement in the percent of patients treated within 60 minutes of arrival from 28% to 52% (p=.005).[6] In a retrospective analysis evaluating the impact of system and patient factors on DTN times the presence of a stroke nurse was a significant predictor of DTN time (p=.022); patients without a stroke nurse present had a DTN time increase of 20.44 minutes.[4] The authors of a study evaluating stroke expertise found that SCRNs caring for patients in the ED had faster DTN times compared to non-SCRN nurses (p=.004).[5] Each of these groups found that incorporating a dedicated or certified stroke nurse into the care of AIS patients was associated with improvements in treatment times. Our pilot program incorporated components of each of these studies with a nurse dedicated to acute stroke response who was either an SCRN or pending SCRN examination. While we did not see a decrease in DTN times, we suspect that extended hours and involvement in a higher volume of patients may translate to improved times similar to the literature. The pilot ASNs felt they were effective not only due to experience in stroke nursing, but also knowledge of stroke performance metrics, thorough assessment skills, efficient workflow, and critical thinking skills.

Several limitations may have impacted the results. First, the number of patients receiving acute treatment during the pilot was small, making the lack of improvement in DTN times and improvement in DTP times difficult to interpret. The availability of the ASN during regular business hours may also have impacted results. This time frame is not only when the most resources are available in the hospital, but also hours that overlap with our Mobile Stroke Unit (MSU). The ASN played a key role in monitoring and transition to OR for MSU patients, but no role in DTN times as the patients arrived having already been treated. This is a single site initiative and may not be translatable to other hospitals with differing acute stroke response structure.

## Conclusions

Our ASN pilot successfully demonstrated acceptability and appropriateness of an ASN with a high degree of satisfaction from staff. With the pilot data we obtained approval for two FTEs to fulfill a new acute stroke navigator role. These RNs will be responsible for the ASN responsibilities with a goal of expanding coverage to evenings and weekends, and during down-time they will participate in acute stroke quality improvement, transitions of care, and act as an expert stroke nursing resource within the hospital. The use of implementation science frameworks to ensure incorporation of context and a pre-defined implementation plan provided guidance and structure that led to a successful business case for growth of stroke nursing resources within a CSC.

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