Improving the Performance of Door-to-Needle Times for the Emergent Treatment of Acute Ischemic Stroke

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Introduction

- **Problem Statement:** In the first two quarters of 2022, the rate of excessive delays in administration of intravenous thrombolytics for acute ischemic stroke in the emergency department at the University of Missouri Hospital increased to 30%, higher than in the two previous calendar years.

- **Aim Statement:** To improve the proportion of stroke patients treated with an IV thrombolytic beyond the 60-minute window from 30% to less than 25% within 10 months.

- **Scope:** This project will focus the care of patients that arrive within the Emergency Department for the care of suspected stroke like symptoms. The process begins with patient’s arrival and ends with the administration of IV-TPA.

- **Timeline:** Baseline data was collected from the calendar year 2022 through March of 2023. Interventions occurred on April 4th, 2023 and formal remeasurement occurred in June 2023.

Synthesis of Evidence

Databases searched: CINHAL, PubMed, Google Scholar, ASA recommended citations, and articles referenced in articles

Keywords: Lean Six Sigma, Stroke, Nursing, Physician, Door-to-Needle

**Themes:** Task and Role Standardization, Data Visualization, Temporal Expectations, Human Computer Interface

Theory, Change, EBP & QI Models

**Theory:** System of Profound Knowledge (Deming, 1998).

**Change Process:** Ottawa Model of Research Use (Logan and Graham, 1998).

**Evidence-Based Practice Model:** The ARGC Model (Moinly & Fireout-Overholt, 2005).

**Evidence Improvement Models:** Lean Six Sigma (Milia, W., and Carnell, 2001).

Model for Improvement (Langley et al., 2009).

Methods

Time-motion studies were developed and completed to analyze the proportion of tasks that were completed in the care of an ED Code Stroke Protocol that were wasteful.

Spaghetti diagrams were developed following observations to highlight environmental and process barriers leading to time metric variations.

Process mapping sessions were undertaken with 4 physicians and 3 registered nurses identifying 151 individual actions taken to achieve thrombolytic administration.

Staff interviews were completed with 4 neurology residents, 3 registered nurses, 1 pharmacist, and 1 patient care technician identifying themes: communication barriers, data harvesting delays, and gaps in knowledge of performance metrics.

Interventions

- EMR Code Stroke form that pulls historically charted data.
- Standardized Code Stroke reporting template.
- Code Stroke Timer within the EMR.
- Tailored education to all involved clinical team members.
- Mobile Code Stroke Workstation

Analysis

- Welch’s Test for Unequal Variances was utilized to compare the pre-post outcomes data with a significance level of 5% (p<0.05).

Results

**Instruments and Outcomes**

- Data collection of process and outcome time metrics were completed by the Stroke Program Coordinator and validated by a multidisciplinary review group when discrepancies occurred.
- Door-to-Needle
- Door-to-Weight
- Door-to-Lab Login
- Automatic abstracted time stamps were exported to a PowerBi dashboard.
- Compliance requirements with the protocol and paging etiquette were completed by the Performance Improvement Professional.
- The System Usability Scale (Brooke, 1996) was utilized to assess the usability of the EMR Code Stroke Form in a simulated and practical environment.

Discussion

This quality improvement project demonstrates the roles that standard work and data visualization play in the daily management of multiple multidisciplinary teams within ED. Task and role standard work within modern healthcare delivery increasingly includes evaluation of the human-computer interface. Incorporation of direct care clinical usability of these solutions proved critical to the successful development of a comprehensive stroke code indication checklist. A single source of data entry, enhanced clinical decision-making functionality, automatic retrieval of historical structured data, and temporally based role aligned goals allowed for streamlined access to clinical quality feedback.

The use of lean six sigma methodologies allowed for the association of charted time metrics to be tied to key clinical waypoints within the code stroke process. Measuring, assessing, and controlling bottlenecks and variances within the physician-nursing workflows allowed for the targeted development of interventions seeking to improve the identified subintervals. Highlighting the performance of each subinterval and its components allowed the multidisciplinary group to uncover barriers within the expected workflow of clinicians where previously analysis of outliers in outcome metrics dominated discussions around improvement ideas. Targeted, data-driven decisions resulting from these process level reviews ultimately lead to the removal of 10 minutes of wasted time per code stroke event within the ED.

Limitations:

- Pre-evaluation of the SUS scores were done within a simulated clinical environment which may explain the 11-point difference upon re-measurement.
- Financial and physical limitations regarding rearrangement of computer-based workstations and medication redistribution within automatic dispensing cabinets were prohibitive of improving motion-based waste.

Healthcare Implications:

- Evaluation of clinical workflows should include usability testing and incorporate best practice recommendations for human-computer interfacing.
- Team-based performance can be improved with the integration of data-driven clinical feedback on actionable performance metrics.
- Process and outcome metrics evaluation should be coupled with process confirmation and observation.

References

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Figure 1: Code Stroke Protocol

Figure 2: EMR Code Stroke Form

Figure 3: Door-to-Needle X-Bar Chart

Figure 4: Pre-Post Process Intervals

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