DECREASING TIME TO CT IN ED WALK-IN STROKE PATIENTS:

USING LEAN METHODS AND MULTIDISCIPLINARY APPROACH TO MEET THE 25 MINUTE GUIDELINE IN A JOINT COMMISSION CERTIFIED COMPREHENSIVE STROKE CENTER

ALEKSAARDS KALNINS, MD, MBA
DAISHA MARSH, BS, RT, CT
CHRISTOPH ZORICH, RT, CT
WAIMEI TAI, MD

NIRALI VORA, MD
MARY BRETHOUR, PhD, APN, NP
STEPHANIE CASAL, MS, RN, CNS
GENNETTE OLALIA, RN, BSN, CEN
AKHILA PAMULA, MD

KANDICE GARCIA, MS, BSN
DAVID LARSON, MD, MBA
KEVIN VANTREES, MBA, ARRT
MAX WINTERMARK, MD, MBA, MAS

STANFORD RADIOLGY

DISCLOSURES

• WAIMEI TAI, MD: COMMITTEE MEMBER, BOEHRINGER INGELHEIM GMBH
• DAVID B. LARSON, MD, MBA: INTELLECTUAL PROPERTY LICENSE AGREEMENT, BAYER AG POTENTIAL ROYALTIES, BAYER AG
• MAX WINTERMARK, MD, MBA: GE NFL ADVISORY BOARD
**PURPOSE: BACKGROUND**

- **TO MAINTAIN STROKE CENTER CERTIFICATION, HOSPITALS MUST MEET** 
  GUIDELINES DEFINED BY THE JOINT COMMISSION (TJC) AND THE AMERICAN HEART ASSOCIATION/AMERICAN STROKE ASSOCIATION (AHA/ASA).

![Diagram showing TIMI (Thrombolysis in Myocardial Infarction) Scale](image)


**PURPOSE: BACKGROUND**

- **QUALIFYING STROKE PATIENTS SHOULD RECEIVE TISSUE PLASMINOGEN ACTIVATOR (tPA) IN LESS THAN 1 HOUR FROM EMERGENCY DEPARTMENT (ED) DOOR ARRIVAL TIME ("DOOR TIME").**
- **ACUTE STROKE PATIENTS WHO PRESENT TO THE ED WITHOUT AMBULANCE PRENOTIFICATION ("WALK-IN") OFTEN DO NOT RECEIVE CARE WITHIN THE MANDATORY TIMEFRAME.**
- **THE RADIOLOGY DEPARTMENT PLAYS A CRITICAL ROLE IN THE EARLY COMPONENTS OF THIS PROCESS, INCLUDING OBTAINING A NONCONTRAST HEAD CT SCAN WITHIN 25 MINUTES OF DOOR TIME AND DOOR TO CT INTERPRETATION WITHIN 45 MINUTES.**
PURPOSE: GOAL

- The project goal was to use lean process improvement methods to increase the percentage of ED walk-in stroke code patients who meet door to CT time within 25 minutes in a Comprehensive Stroke Center to over 90% in a 5 month period.

METHODS: TEAM

- Members of Emergency Medicine, Neurology, Radiology and Radiology Quality Improvement departments formed a multidisciplinary team.
- The team learned lean process improvement through a guided curriculum, Radiology Improvement Team Education (RITE) over 5 months (11/2014 - 03/2015).
**SUMMARY**

- **20 WEEK PROGRAM**
  - 10 CLASS SESSIONS
  - ALL TEAM MEMBERS ATTEND
  - MEETS EVERY OTHER FRIDAY 11AM-1PM
  - PRESENTATIONS
  - CLASS DISCUSSION
  - GROUP WORK AND ACTIVITIES

- **ONLINE TUTORIALS**
  - REVERSE CLASSROOM STYLE
  - TUTORIALS AVAILABLE ON YOUTUBE

- **8 MULTIDISCIPLINARY TEAMS**
  - FACULTY, FELLOWS, RESIDENTS, TECHNOLOGISTS, NURSES, STAFF

**METHODS: A3 PROJECT OUTLINE**

- A3 PROJECT OUTLINES WERE USED TO TRACK RESULTS, FOCUSED ON 7 COMPONENTS:
  - PROBLEM STATEMENT
  - BACKGROUND
  - CURRENT STATE
  - TARGET STATE
  - ANALYSIS
  - KEY DRIVERS/INTERVENTIONS
  - SUSTAIN PLAN
METHODS: A3 PROJECT OUTLINE

Project Title—What are we trying to improve?

Background: Why is this problem area of importance?

What: What not "what" - Do not include goals or desired outcomes.

Methods: Current State

Current State: Identify, Target / Actual / Gap

- Current state was defined by the team through careful observation ("gemba") of ED stroke workflow among actual and mock stroke patients without ambulance pre-notification.
- Between September 2013 and October 2014, 110 walk-in stroke codes presented to the ED, which represented 34% of all ED stroke codes.
- Of these walk-in patients, 39% met the door to CT time of ≤ 25 minutes.
- Mean stroke code to CT time was 20.82 minutes.
METHODS: CURRENT STATE

- At baseline, 10 steps consistently occurred in the stroke code workflow between patient arrival and noncontrast head CT scan.

1. Patient Arrival
   a) Patient Triage
   b) Patient Registration
   c) Patient Weight

2. Stroke Code Activation

3. Wristband Placement

4. ED Room Assignment

5. Stroke Order Set Placed and Signed

6. Physical Examination
   a) National Institutes of Health Stroke Scale (NIHSS)

7. Lines and Labs
   a) IV Line Placement
   b) Lab Draw

8. Fingerstick Glucose

9. EKG

10. Head CT
    a) Patient Transport to CT
    b) CT Scan Performed

METHODS: ROOT CAUSE ANALYSIS

- Root cause analysis of delays was illustrated in a fishbone diagram organized by predefined categories:
  - Environment
  - Materials
  - Machines
  - People
  - Methods
METHODS: ROOT CAUSE ANALYSIS

METHODS: KEY DRIVER ANALYSIS

- Shared observations and discussion at multidisciplinary team meetings defined key drivers in the process:
  - Rapid identification of stroke code
  - Availability of timely, actionable, accessible data
  - Well-defined roles/responsibilities
  - Standardization of process prior to CT
  - Ease of tracking process stages
  - Improved access to materials
  - Staff education of standard process
METHODS: KEY DRIVER ANALYSIS

<table>
<thead>
<tr>
<th>Key Drivers</th>
<th>Interventions / Countermeasures</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Identify that an acute stroke code needs to be called for a patient</td>
<td>Define acute stroke (1)</td>
</tr>
<tr>
<td></td>
<td>Recognize acute stroke (BE-FAST symptoms) (1)</td>
</tr>
<tr>
<td>2. Timely, actionable, accessible data</td>
<td>Clear definition of the door (2)</td>
</tr>
<tr>
<td></td>
<td>Identify data source(2)</td>
</tr>
<tr>
<td>3. Define roles/responsibilities</td>
<td>Make data more accessible(3)</td>
</tr>
<tr>
<td></td>
<td>Standardized process for calling a code (3)</td>
</tr>
<tr>
<td>4. Keeping track of stage in process</td>
<td>Visibility/6: minimal roles of key players (4)</td>
</tr>
<tr>
<td>5. Standardize process prior to or at CT</td>
<td>Visibility of time on door, transparency (5)</td>
</tr>
<tr>
<td>6. Access to materials</td>
<td>Standardize lines, labs, CHR, registration to minimize time to CTb</td>
</tr>
<tr>
<td>7. Educate staff of standard process</td>
<td>Elimination of unnecessary steps or delay (6)</td>
</tr>
<tr>
<td></td>
<td>Optimizing EPIC order set (6)</td>
</tr>
<tr>
<td></td>
<td>Standardized CT stroke protocol (6)</td>
</tr>
<tr>
<td></td>
<td>Attendance of all key players (6,7)</td>
</tr>
</tbody>
</table>

METHODS: INTERVENTIONS

- **INTERVENTION 1:**
  - The first project intervention was to decrease the maximum steps performed prior to the initial CT study from 10 to 5 by allowing the patient to go immediately to the CT scanner without being placed in an ED room, and delaying the placement of an IV line, drawing labs, or completing NIHSS until after the noncontrast CT.
METHODS: INTERVENTIONS

• INTERVENTION 2:
  – The second project intervention was to integrate the preliminary intervention into a standardized ED triage process with clearly defined roles and responsibilities for each participant in the stroke code.

RESULTS

• Stroke coordinator records were used to calculate CT times in non-prenotified ED stroke code patients before and after intervention.

• All cases were analyzed for drivers of excessive variability from the process.
RESULTS

• AT BASELINE, MEAN STROKE CODE TO CT TIME IN NON-PRENOTIFIED STROKE CODE PATIENTS WAS 20.82 MINUTES.

I CHART

RESULTS

• AFTER PROJECT INTERVENTIONS, MEAN STROKE CODE TO CT TIME IN NON-PRENOTIFIED STROKE CODE PATIENTS DECREASED FROM 20.82 TO 9.55 MINUTES.
## Results: Sustain Plan

<table>
<thead>
<tr>
<th>Activity to Sustain</th>
<th>Owner</th>
<th>Sustain Method and Frequency</th>
<th>Report To</th>
</tr>
</thead>
<tbody>
<tr>
<td>Visual reminder of minimal steps before CT scan can take</td>
<td>Team Leader</td>
<td>Creating a visual reminder to place in ED and CT</td>
<td>ED &amp; CT Management</td>
</tr>
<tr>
<td>place (2)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Visible, sharable, real-time Stroke Code performance data</td>
<td>Stroke NP’s</td>
<td>Creating electronic dashboard</td>
<td>Neuro Management</td>
</tr>
<tr>
<td>(1/2/3)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Ongoing educational activities for Neurologists, ED Nurses</td>
<td>ED, CT, Neuro Leaders</td>
<td>Workshops, in-services, onboarding.</td>
<td>Management through Stroke Code Monthly</td>
</tr>
<tr>
<td>and CT Technologist (1)</td>
<td></td>
<td></td>
<td>Meetings</td>
</tr>
</tbody>
</table>

**Reliability Level (1-3):**
1. **Individual:** Feedback, checklists, training, basic standards
2. **Procedures:** Embedded standard work, reminders, constraints
3. **System/Culture:** Process redesign, built-in quality, automated systems, fail safe, physical structure, social norms, “mindfulness”

---

### Results: Sustain Plan

- **An electronic dashboard with easily accessible real-time stroke code performance data was created to promote transparency and further process improvement efforts.**

---

**I Chart**

**Time Between Stroke Code and CT Scan for ED Patients**

- Code
- Process Mean
- Input
- O2
- O2

**Legend:**
- Control limits: 95% confidence intervals
- Special causes: Significant deviation from the process mean
- Common causes: Variability within the process
- Process stability: The process is stable
- Process improvement: The process is improving
RESULTS: SUSTAIN PLAN

• A mnemonic was created and displayed on visible billboards to facilitate learning and adoption of the new process.

CONCLUSION

• Using a team-based, multidisciplinary lean improvement process, mean stroke code to CT time decreased from 20.82 minutes to 9.55 minutes.

• The % of non-prenotified ED stroke code patients door obtaining a CT within 25 minutes improved from 13% to 64% in 5 months at our institution.
CONCLUSION

• The improvement process demonstrated that using a multidisciplinary team approach and lean process improvement principles, it is possible to significantly reduce delays to CT in non-prenotified ED stroke code patients.

ACKNOWLEDGMENTS

• Special thanks to Jake Mickelsen, Quality Improvement Education Manager, Stanford University Medical Center, for his help throughout the project.