Reducing Troponin Turnaround Time Through the Application of Lean/Six Sigma Processes and Evaluating Public Response Time to Heart Attack Symptoms

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Background
- Time plays a significant role in management of myocardial infarction (MI) from the patient initially recognizing the onset of symptoms and accessing medical care, to efficiency of troponin turnaround time in the Emergency Department (E.D.) and Laboratory, to the importance of prompt reevaluation.
- Cardiovascular disease is the primary cause of death for men and women in the United States, 47% of MI deaths occur before individuals access medical care.
- Lean/Six Sigma originated as an efficiency improvement method in manufacturing. In recent years, it has been applied to the health care industry. Lean optimizes processes to make them more efficient and Six Sigma eliminates defects by reducing variation in processes.
- Troponin-T (TnT) testing is a key diagnostic marker for heart disorders, including MI, replacing creatine kinase MB fraction. Shorter turnaround times earlier patients to be treated quicker.

Hypotheses
- Disparities will exist between actual wait times to seek treatment and anticipated wait times for seeking medical care when experiencing heart attack symptoms for specific age groups and genders.
- Application of Lean/Six Sigma in the E.D. and clinical laboratory would reduce troponin turnaround time.

Methodology
Community Survey
11-question survey was developed and distributed online, by mail, and by hand with 1,225 responses. The purpose was to assess public knowledge of MI symptoms and risk factors, and length of time individuals predicted they would wait to seek medical care for MI symptoms for themselves, family members, or strangers.

Chart Review
A retrospective chart review was completed to identify duration of MI symptoms before patients present to the Emergency Department. A random sample of 350 records from 2000 and 2006 chest pain/MI patients were reviewed. Responses were analyzed and compared to surveys to identify potential disparities.

Troponin Turnaround Time Lean/Six Sigma Interventions
Assessed E.D. and Lab to identify opportunities for improvement. Lean/Six Sigma tools were used to develop and implement improvements affecting troponin turnaround time. Pre-and post-intervention data were collected using lab informatics and evaluated for turnaround time improvements.

Emergency Department Interventions
- Standardized registration label location — registrar delivers registration labels to patient room.
- Redesigned specimen labeling process including location and equipment used to print specimen labels.
- Draw a second small green-topped tube of blood to allow for parallel processing of specimens.

Laboratory Interventions
- Implement standardized process for communicating and processing stat chemistry tests within the laboratory.
- Process TnT on e411 analyzer instead of Cobas 6000
  - Use first green tube to run non-stat chemistry on Cobas 6000 analyzer.
  - Use second green tube for parallel processing of TnT on e411

Results
Community Survey
- Symptom presentation includes: Dizziness, Breathlessness, Discomfort in Arm, Neck, Back, or Jaw.
- Analysis:
  - Discomfort in Arm: 30.2%, 30.5%, 30.7%
  - Breathlessness: 36.8%
  - Discomfort in Jaw: 33.5%
  - Dizziness: 8.8%

Conclusions
Community Survey and Chart Review
Comparison of surveys with chart reviews validated disparities between self-reported anticipated wait times before seeking treatment and actual wait times when experiencing heart attack symptoms. Data indicate individuals identify symptoms associated with heart attack, with exception of indigestion. Subjects anticipated seeking care within minutes, but in sharp contrast, chart review identifies an approximate mean seek treatment time of 4 days (p < 0.001). Women wait substantially longer than men for most age groups.

Troponin Turnaround Time Lean/Six Sigma Interventions
Confirming the hypothesis, application of Lean/Six Sigma significantly reduced troponin turnaround time in the E.D. and laboratory. Enhanced process changes in the E.D. and lab resulted in increased efficiency and improved reporting times for stat troponin, reducing the mean total turnaround to 61 minutes, which surpasses national and system benchmarks. Timeliness of troponin result reporting can impact the outcome of patients experiencing chest pain/MI and improves patient throughput following when ruling out diagnoses. Lean/Six Sigma can be an effective tool in improving healthcare processes and enhancing care management.

Recommendations
Community Survey and Chart Review: Future studies with a larger sample, and refined demographic selection criteria (for community survey and chart review) could validate the findings for a broader population. Increased public awareness efforts can help reduce the disparity between actual and anticipated wait times for seeking treatment for heart attack symptoms.

Troponin Turnaround Time Lean/Six Sigma Interventions: Additional data collection is necessary to evaluate the sustainability of the effects of implementation of Lean/Six Sigma processes. Additional cycles of refinement can be implemented and studied to further reduce troponin turnaround time. It is highly recommended to apply Lean/Six Sigma techniques to additional healthcare processes and organizations.