

**REDUCING EMERGENCY DEPARTMENT LENGTH OF STAY USING RAPID CLINICAL EXAMINATION
MEMORIAL MEDICAL CENTER**

Publication Year: 2013

Summary:

Implementation of the Rapid Clinical Examination (RCE) model based on process change and use of queuing theory through computer discrete event simulation techniques for patient flow and provider resource optimization.

Hospital: Memorial Medical Center

Location: Springfield, IL

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Category:

- A: Arrival
- B: Bed Placement
- C: Clinician Initial Evaluation & Throughput
- D: Disposition
- E: Exit From the ED

Key Words:

- Lean Six Sigma
- Patient Satisfaction
- Queuing
- Scribes
- Rapid Intake
- Triage
- Wait Times

Hospital Metrics:

- Annual ED Volume: 70,000
- Hospital Beds: 507
- Ownership: Community Based, Not-For-Profit
- Trauma Level: 1
- Teaching Status: Yes

Tools Provided:

- Exhibit A
- Exhibit B
- Exhibit C
- Exhibit D
- Exhibit E
- Exhibit F

Clinical Areas Affected:

- Ancillary Departments
- Emergency Department
- Fast Track
- Registration
- Triage

Staff Involved:

- Administrators
- Consult Services
- ED Staff
- IT Staff
- Nurses
- Physicians

Innovation

Implementation of the Rapid Clinical Examination (RCE) model based on process change and use of queuing theory through computer discrete event simulation techniques for patient flow and provider resource optimization.

The project focused on reducing the length of stay (LOS) for patients treated and released from our emergency department that provides nearly 70,000 patient care visits per year. Approximately 80% of patient visits are discharged back to the community after their visit, with only 20% being admitted for inpatient care. While decreasing length of stay for the majority of patients was the primary focus, the organization additionally wanted to decrease the number of patients who left without treatment (LWOT), decrease the door to provider time, and improve the overall efficiency of treatment for patients presenting with lower acuities of illness.

The RCE process was chosen in partnership with Emergency Department physicians based on the need to address the discharged patient length of stay. Using Lean Six Sigma DMADV: methodology and discrete event computer simulation techniques (using the Simul8 software system), the entire patient flow of the ED was evaluated to help identify the bottlenecks and waste in the existing care delivery model.

DMADV
D: Define
M: Measure
A: Analyze
D: Design
V: Verify

The RCE model provided the organization with the best options based on current facility layout, feasibility of transition, and addressing the appropriate patient population.

Innovation Implementation

The team was comprised of: Charles D. Callahan, PhD, Vice President-Quality and Operations, Executive Sponsor, Drew Early, MHA, ED Administrator, Champion and Sponsor, Jen Davis, RN, ED Nurse Manager, Design Team Member and Process Expert, Scott Boston, MD, Emergency Medicine Physician, Physician Champion and Content Expert, Matt Johnston, MD, Emergency Medicine Physician, Physician Champion, Tim Harvey, MD, Emergency Medicine Physician, Physician Champion, Todd S. Roberts, MBA, CLSSMBB, System Director-Operations Improvement, Six Sigma Process Advisor and Queuing Model Design, Jim Wilkerson, MS, CLSSBB, Senior Lean Six Sigma Project Manager, Six Sigma Facilitation and Queuing Model Design, ED Staff, Process Owners and Experts.

Pilot

The RCE process was piloted on multiple days two consecutive weeks. Comparison data was collected and displayed to show the changes from baseline performance. The pilots proved the new process would meet organizational needs as indicated by the "A-B-A" model of performance displayed during periods on-pilot and off-pilot in the trial phase (**Exhibit A**), with statistically significant improvements in operational performance for discharged patient length of stay (mean 198 to 162 minutes, standard deviation 115 to 102 minutes ($p=0.000$) and door-to-provider time (mean 56 to 35 minutes, standard deviation 48 to 37 minutes ($p=0.000$)).

Based on these pilot results, lead physicians and mid-level providers, along with the nursing staff, championed the process change to their peers in order to secure buy in from all parties and provided real-time feedback on operational performance.

A major component of process change was redesigning the nursing triage function. The triage nurse became the Team Leader RN (TLRN) and a key process driver for RCE. Traditional triage criteria were replaced by a red-flag list.

Red-Flag List

The red-flag list was derived from physician and mid-level input and was based on patient symptoms and conditions presentation to drive the level of physician response urgency. The patients with emergent acuity (stroke, chest pain, trauma, etc.) would meet the red flag criteria and immediately go back to the Main ED.

Patients who did not meet the red-flag criteria would enter into RCE and be seen by a mid-level provider. This process change took the organization away from the traditional triage model of sequential extended nurse evaluation for every patient coming through the front door to an expedited flow for the most seriously ill/injured patients to the ED physician.

RCE ensures that for patients not identified as meeting red-flag criteria, they move to be seen by a mid-level provider within a very short time. This model reduces the traditional use of the waiting room as a "holding station" before the patient ever reaches a provider. In RCE, once a provider has assessed the patient, the provider then makes the decision on whether to send them to the intermediate side of the ER or to have them return to the waiting room.

Changes to the Waiting Room

The waiting room was also physically segregated into zones:

- Patients waiting to check in;
- Patients waiting tests to be performed; and
- Patients waiting for test results.

Overall the RCE model expedites care through a system that makes productive, active use of the waiting room space as a planned component of care, allowing for more efficient and effective use of finite ED treatment beds. Following initial implementation of RCE based on staffing model of 3 providers during the bulk of the treatment day, it became clear that additional refinements were necessary to meet patient demand fluctuations. Discrete event simulation models, based on queuing theory principles, were programmed, and ultimately lead to implementation of a 4 provider model that met our criteria of success and produced significant results in decreased LOS, decreased LWOT, and improved customer satisfaction.

Timeline

From the beginning of the planning process to full implementation with four providers, the project took approximately 22 months. The planning process for this innovation began in May of 2011 with a kickoff retreat. A one-day rapid action planning session with the primary stakeholders was held to determine the necessary components for the process and to develop a project plan and timeline.

Steps of the project plan included the following:

- Developing the operational processes for moving patients through the Rapid Clinical Examination model, including physician development of a "red flag" criteria to replace the traditional triage system, provider coverage models, and patient flow;
- Outlining roles and responsibilities and procuring scribes to work with physicians to expedite documentation;
- Pilot testing and process re-evaluation; and
- The scale up.

Results

Length of Stay (Not Admitted)

The 7 months leading up to the launch of RCE average LOS for non-admitted patients was 205 minutes; The first 8 months of running 3 rooms for RCE was an average of 179 minutes; Moving to 4 rooms in January dropped the average to 150 minutes through to date.

The upper control limits for the process over the same time period were 628 minutes for the 7 months prior baseline period, 270 minutes for the first 8 months post-implementation, and 232 minutes for the most recent 6 months (**Exhibit D**).

This is significant in that 99.7% of patients now are discharged within 232 minutes as opposed to 628 minutes (a 63% reduction in time).

Left-Without-Treatment

The daily LWOT percentage for the most recent 6 months has been 1.27% compared to the prior 15 month daily average of 2.57% (a 50% reduction), with an improvement of 1.5 standard deviations in daily variation (**Exhibit G**).

Length of Stay (Admitted)

Length of stay for admit patients (defined as from the time the order is written until the patient leaves the ED) has decreased to 107 minutes for the period of January 2013 to present from 330 minutes between October 2011 and January 2013 (Advisory Board 50th%ile = 268 minutes), a 68% improvement (**Exhibit E**).

Overall Throughput

- Total ED hold hours (defined as the cumulative sum of time greater than 120 minutes per patient for ED admit length of stay) to a monthly total average of 492 hours for the period of January 2013 to present compared to 1,095 hour per month for fiscal year 2012 (October 1, 2011 to September 30, 2012), a 55% reduction.
- As a result of improving the throughput processes for RCE patients, the system as a whole was optimized resulting in a reduction in throughput time for the main side of the ED from 280 minutes prior to January, 2013, to 262 minutes after January 16 (a 6% improvement) with a downward shift in variation of 1 standard deviation (**Exhibit F**).
- Length of stay for the entire ED as whole dropped from 237 minutes prior to January, 2013 to 221 minutes since January 13 to present (a 7% improvement, with nearly 1 standard deviation reduction in variation (**Exhibit B**).

These improvements, taken together, represent a significant reduction in process variation, providing a more consistent, stable, repeatable performance model for patients and providers while greatly enhancing hospital throughput via the Emergency Department and improving Press Ganey patient satisfaction scores from the 70th%ile nationally prior to RCE implementation to the 99th%tile for quarter 3 of fiscal year 2013 (**Exhibit C**).

Cost/Benefit Analysis

Implementation included the training and hiring of scribes to aid in physician documentation. The cost of hiring, training, and maintaining scribes is placed at \$364,695 annually. Half of this cost is covered by Memorial Medical Center with the other half paid the by the physician group. With a contribution margin of \$205 per patient, the hospital will need to capture 890 additional patients annually to remain cost neutral. This could be accomplished by reducing the LWOT rate to 1.5% (actual results= 1.27%). Reducing patients who left without treatment (LWOTS) by 2.5% increases revenue for the Medical Center by \$500K annually. Physician allocation was adjusted from 5 providers in the "main" ED with 3 running the RCE model to 4 and 4. This leveling of the resources to the workflow was key to optimizing the system for throughput. No additional staff was hired. Additionally, as part of a previously planned redesign to create privacy and safety at the triage desk, a fourth Rapid Clinical Evaluation Treatment room was built. This was opportunistic to the RCE redesign as the remodel was already pre-planned. The total cost of the renovation of the triage area was \$209,061. Additionally, increased patient satisfaction from the 68%ile to the 97%ile nationally could lead to increased market shares and volumes over time.

Advice and Lessons Learned

- The operating model was initially launched with three RCE providers based upon 3rd party consultant recommendation. While the process itself reduced length of stay from 209 minutes to 177 minutes, the system was not running in an optimal state, as door-to-provider times were too long and the system was not performing at consistently high levels (excessive variation). Computer simulation modeling showed that four RCE providers are necessary at all times to make the model work for the organization. Organizations must analyze

and customize operational characteristics peculiar to their own organization and avoid "cookie cutter" approaches.

- Once the appropriate operating model has been statistically proven to achieve results, it must be executed consistently at all times to avoid entropy and increased variation due to competing processes. By staffing three providers at times and four providers at other times, overall variation in the process increased over time despite a long-term reduction in the mean. Mixed models do not deliver intended results.
- Organizations must practice "systems" thinking in their approach to performance improvement in the Emergency Department, recognizing the upstream and downstream effects of optimization (or sub-optimization) when implementing process improvements. While the stated intention of this innovation was to improve the operating characteristics for non-admitted patients, positive system optimization was realized by executing the work on the front-end of the intake process, including reduction in overall ED time (including admitted patients) and reducing ED hold hours for admitted patients.
- Lean Six Sigma is more about culture change than the use of statistical tools and techniques. The success of this ED intervention project was enhanced as it occurred within the context of an organization-wide lean six sigma deployment to enhance our overall culture of quality and safety. A key piece of this deployment was a close partnership with medical staff, visible support of senior leadership, and transparent sharing of results.

Sustainability

The project was led and facilitated by a Lean Six Sigma Black Belt from the operations improvement department. In addition, a Lean Six Sigma Master Black Belt was involved in building and interpreting the computer models for discrete event simulation. The aforementioned scribes were employed to assist physicians in documentation and improve provider efficiency. Going forward, additional provider staff will be required to maintain the four provider model on a 24/7 basis to ensure the emergency department is meeting the needs of the community. Finally, a process owner in the emergency department will be assigned to continue to monitor and measure performance and provide remediation as necessary.

Tools to Download

- [Exhibit A](#)
- [Exhibit B](#)
- [Exhibit C](#)
- [Exhibit D](#)
- [Exhibit E](#)
- [Exhibit F](#)

Reducing Emergency Department Length of Stay Using Rapid Clinical Examination in a 500-Bed, Academically-Affiliated, Tertiary, Level I Trauma Medical Center

Exhibit A

Pilot Data-ED Door-to-Provider Time (Day 1)

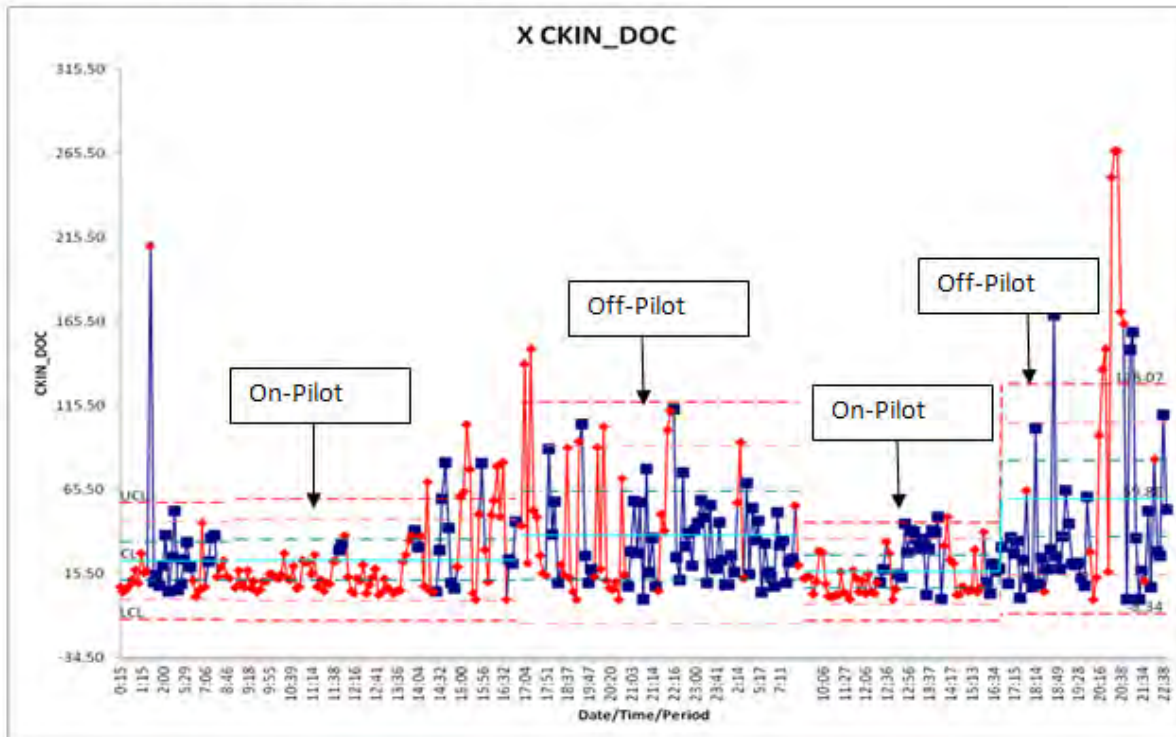


Exhibit B

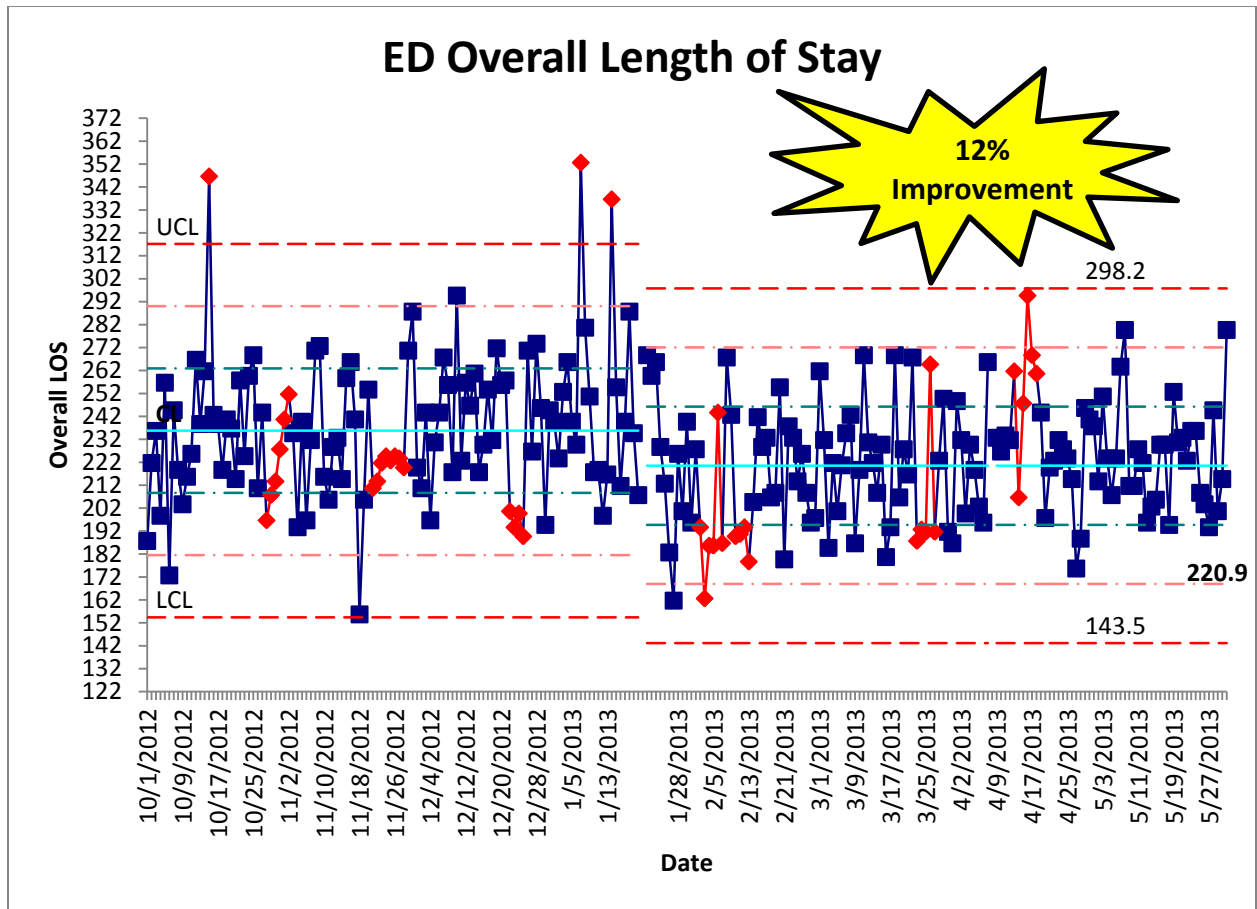


Exhibit C

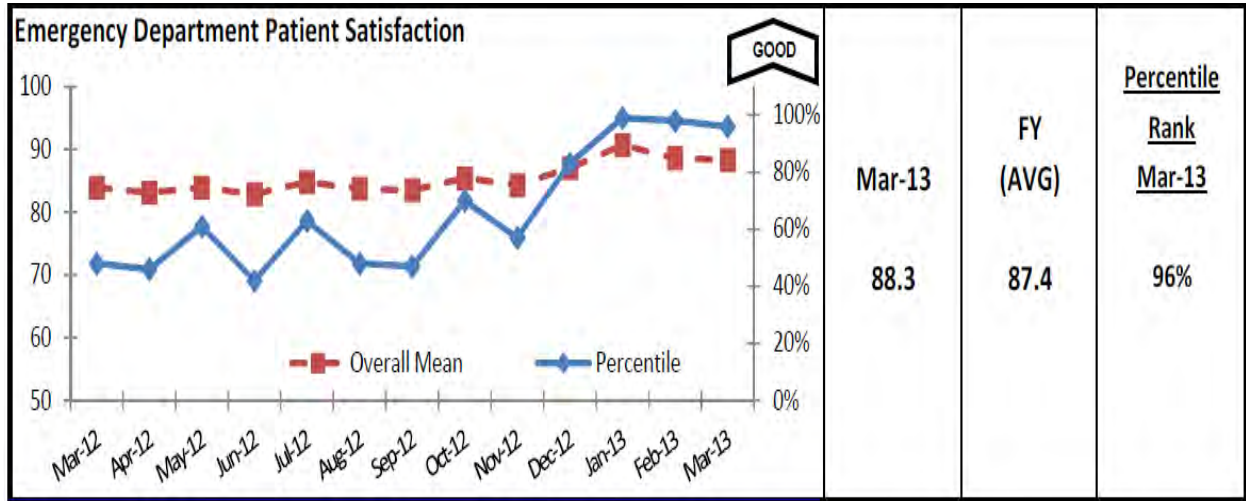


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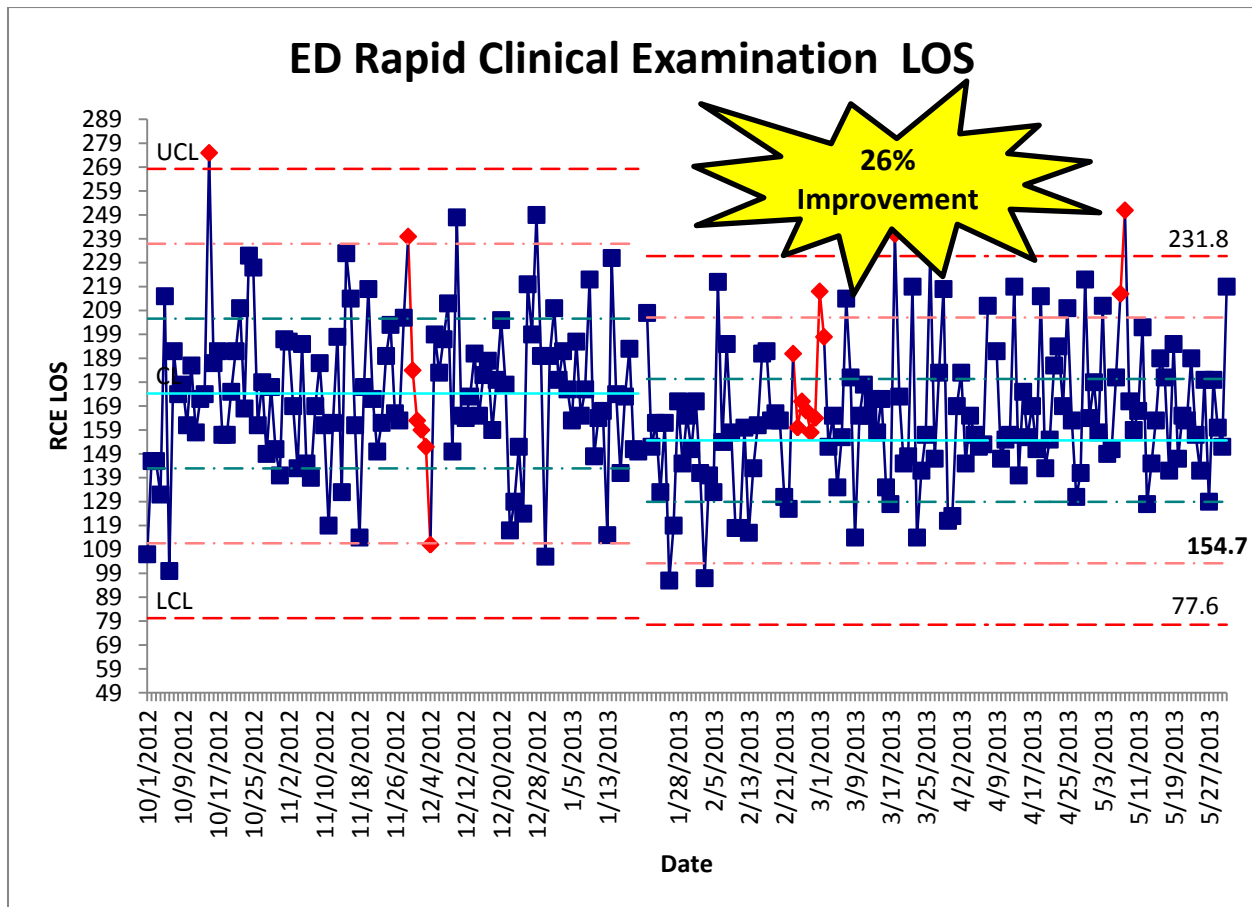


Exhibit E

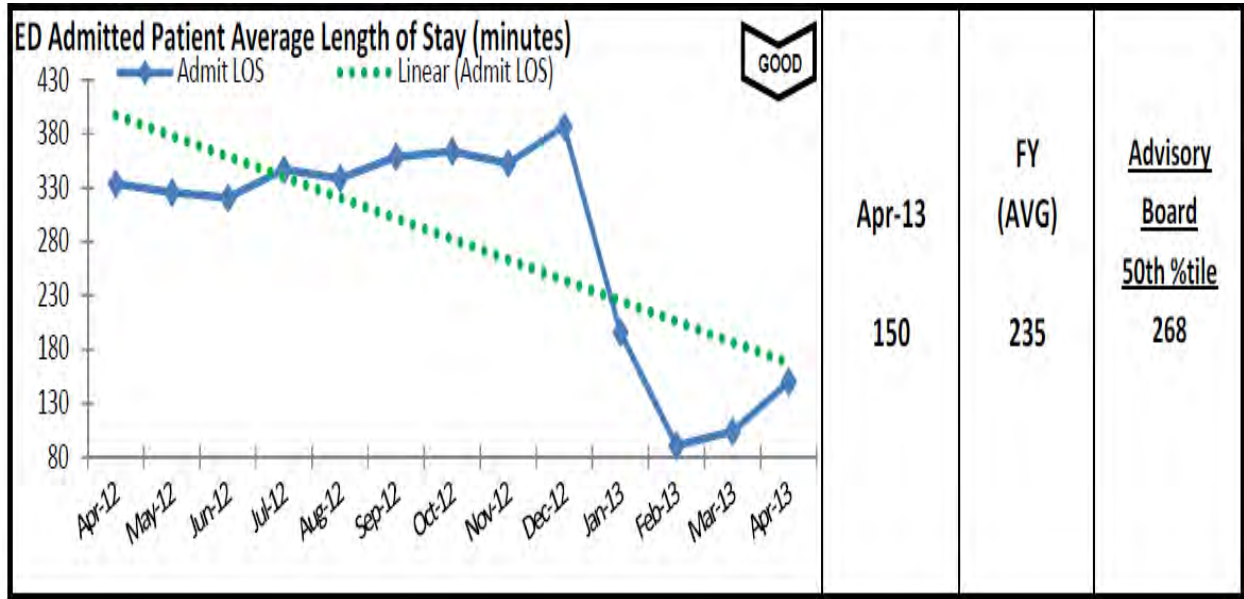


Exhibit F

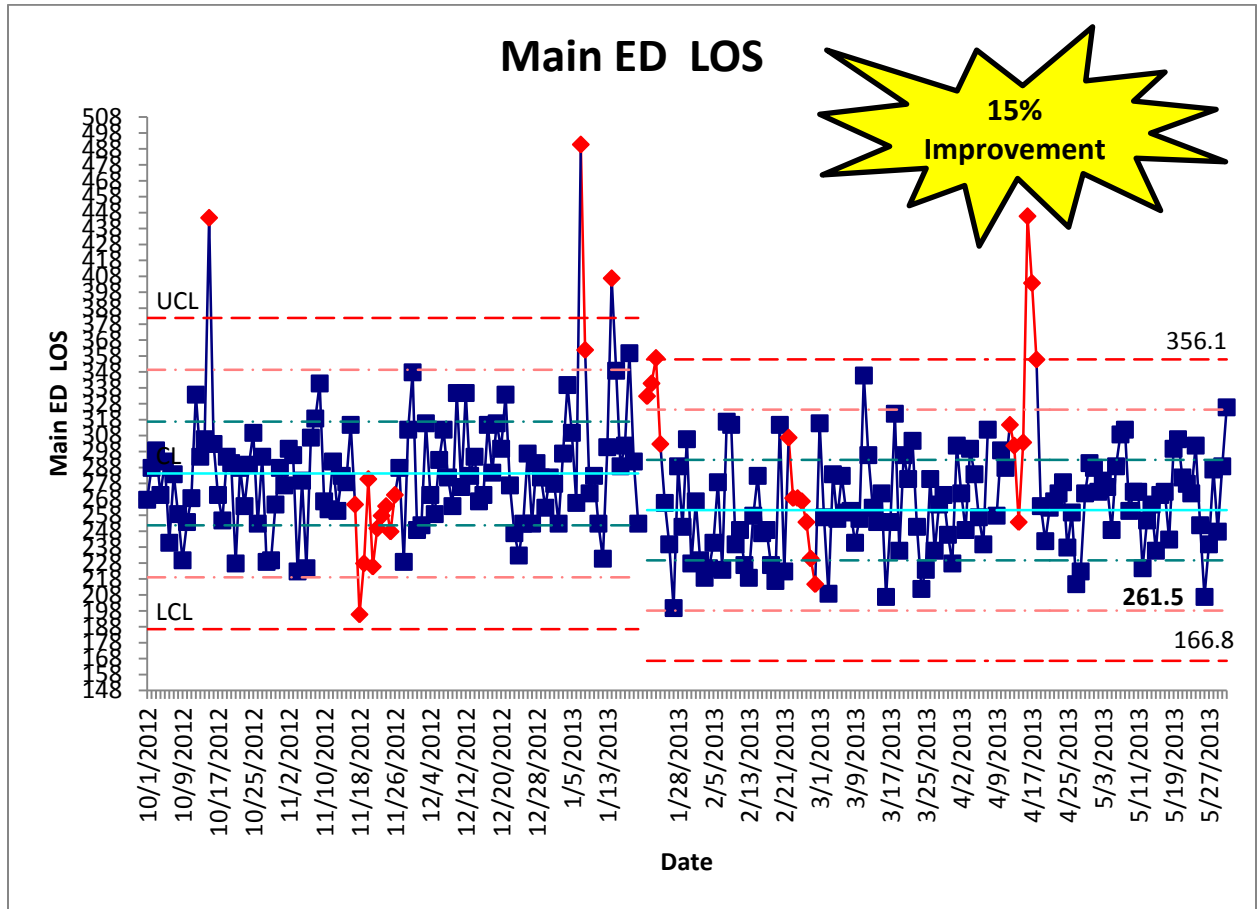


Exhibit G

