GOING TO THE GEMBA: USING LEAN SIX SIGMA TO OPTIMIZE ED TO INPATIENT CARE TRANSITIONS

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Areas of Focus
Patient Safety
Quality Improvement
Patient Experience
Performance Improvement
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Dear Hospital Quality Institute Vanguard Award Selection Committee:

It is my honor to support the “Going to the Gemba: Using Lean Six Sigma to Optimize ED to Inpatient Care Transitions” project for consideration of the 2016 HQI Vanguard Award 2016.

Martin Luther King, Jr. Community Hospital is a new, private, non-profit, safety-net hospital, operated by the Martin Luther King, Jr. - Los Angeles Healthcare Corporation (MLK-LA), a 501(c)(3) organization. The 131-bed community hospital opened in May 2015 and serves approximately 1.35 million residents of South Los Angeles regardless of their insurance status or ability to pay. The hospital’s goal is to provide compassionate, innovative, high quality care.

The following award application highlights one of many current performance improvement projects at Martin Luther King, Jr. Community Hospital to create innovative, data-driven, standardized processes to ensure the delivery of high-quality, safe care for one of California’s most underserved patient populations.

Thank you for your consideration.

Sincerely,

Medell Briggs-Malson, MD, MPH, MSHS
Senior Medical Director of Quality
Martin Luther King, Jr. Community Hospital
Executive Summary

As a new hospital, quality and efficiency of the hospital’s patient flow was identified by executive leadership as a top priority to ensure high quality patient care. Between January and February 2016, the median time from ED arrival to ED departure for admitted patients (ED-1b) was 470 minutes, while the median time from admit decision to the departure from the ED for admitted patients (ED-2b) was 132 minutes and steadily rising. A multidisciplinary Lean Six Sigma team was created to identify and address processes that were impeding safe and efficient patient flow. The team developed several solutions, including 1) a centralized bed control process controlled by Care Management to oversee the care transition process, 2) the use of a standard checklist between the ED care manager and inpatient charge nurse when giving report for the newly admitted patient, and 3) the use of the patient’s call light by the transporting team to notify the inpatient nursing staff of the patient’s arrival on the unit. Following the interventions, the ED-1b time decreased from 470 minutes to 365 minutes (22% decrease) and ED-2b decreased from 132 minutes to 93 minutes (30% decrease). The interventions also increased team collaborations and patient experience.

Background and relevance of the problem

As a new hospital, quality and efficiency of the hospital’s patient flow was identified as a top priority by the hospital’s executive leadership and Board of Directors. The leadership wanted to set a precedent of collaborative, multidisciplinary teamwork to prevent unsafe patient boarding conditions in the Emergency Department (ED). Initially, all processes that impact patient flow from the ED to patient discharge from the inpatient units were examined. However, the focus was narrowed to the admission processes between the ED and inpatient units due to the steadily increasing amount of time required to transition patients from the ED to their respective inpatient units once the admit decision was made. This proved to also be a worthy problem to solve given the Centers for Medicare and Medicaid Services (CMS) and Joint Commission’s regulatory mandate for hospitals to optimize their processes to ensure timely and safe care transitions of admitted ED patients and reduce unnecessary wait times in the ED.

Describe the effort, including the scope, process, strategies and tactics utilized, challenges encountered and how they were addressed

Between January and February 2016, the median time from ED arrival to ED departure for admitted patients (ED-1b) was 470 minutes, while the median time from admit decision to the departure from the ED for admitted patients (ED-2b) was 132 minutes. In late March 2016, a cross-functional Lean Six Sigma team, including representation from the ED, Care Management,
Environmental Services, Health IT, Medical-Surgical, and Telemetry departments, was formed to identify and address processes that were impeding safe and efficient patient flow and care transitions from the ED to inpatient units. The scope of the project was to examine the critical inputs ($x$‘s) that impact patient flow from the ED to inpatient units ($y$). The team was led by the hospital’s performance improvement specialist who provided them with education and guidance on the utilization of basic performance improvement tools and statistical analyses, and project planning to ensure the project was completed by its estimated completion date of May 30, 2016. A nurse champion from Care Management was identified and assisted with project planning and researched best practices for patient flow that would be later utilized in the project. The strategies and implementation of the Lean Six Sigma (Define, Measure, Analyze, Improve, Control: DMAIC model) were as follows:

**Define**

The first step was to develop a high level process map using the Suppliers, Inputs, Process, Outputs, and Customers (SIPOC) format (Figure 1) and develop output metrics.

Once the team gained a high level understanding of the process, it was time to go to the gemba. A gemba walk was performed in the ED to observe the processes that contributed to the flow of patients from the ED to an inpatient unit.

**Figure 1:**

**SIPOC**

<table>
<thead>
<tr>
<th>Suppliers</th>
<th>Inputs</th>
<th>Process</th>
<th>Outputs</th>
<th>Customers</th>
</tr>
</thead>
<tbody>
<tr>
<td>Patient Access/Registration</td>
<td>Patient MRN</td>
<td>Patient Checks In</td>
<td>% of duplicate Medical Record Numbers (MRNs)</td>
<td>Patient Access/Registration</td>
</tr>
<tr>
<td>ED RN</td>
<td>Patients’ medical information</td>
<td>Triaged</td>
<td>Average patient wait time (Median)</td>
<td>ED RN</td>
</tr>
<tr>
<td>Physician</td>
<td>Patients’ medical diagnoses and treatment plan</td>
<td>Treatment</td>
<td>Average time from order of medication/examination to administration (Interval data)</td>
<td>Patient, ED RN, ED Care Management</td>
</tr>
<tr>
<td>ED RN</td>
<td>Discharge plan/education from ED</td>
<td>Disposition</td>
<td>Average time from order for disposition to when it’s carried out</td>
<td>ED Care Management</td>
</tr>
<tr>
<td>ED Care Management</td>
<td>Patients’ medical diagnoses and treatment plan</td>
<td>Bed Availability</td>
<td>Average time from bed request to bed assigned</td>
<td>Inpatient RN</td>
</tr>
<tr>
<td>Physician, ED Care Management; Physician</td>
<td>Patient; Patients’ Belongings</td>
<td>Transport</td>
<td>ED-1b and ED-2b</td>
<td>Inpatient RN</td>
</tr>
<tr>
<td>Inpatient RN</td>
<td>Center; ED Records</td>
<td>Admission</td>
<td>Average time RN starts admission assessment to completion</td>
<td>Physician</td>
</tr>
<tr>
<td>Physician</td>
<td>Patients’ medical diagnoses and treatment plan</td>
<td>Treatment</td>
<td>Average LOS based on patients’ acuity/MCG</td>
<td>Inpatient Care Management</td>
</tr>
<tr>
<td>Inpatient Care Management</td>
<td>Patients’ discharge plan</td>
<td>Discharge</td>
<td>Average time from discharge order to whom patient lefts</td>
<td>Receiving Transfer Institution (if applicable)</td>
</tr>
<tr>
<td>Receiving Transfer Institution (if applicable); Patient</td>
<td>Patients’ discharge information and education</td>
<td>Follow-Up</td>
<td>% of patients with follow-up appoints upon discharge</td>
<td>Patient</td>
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Measure

A cause-and-effect fishbone diagram (Figure 2) was used to identify the key drivers in the processes that serve as a bridge between the ED and inpatient units.

Figure 2: Cause-and-Effect Fishbone

![Cause-and-Effect Fishbone Diagram]

Given that there were many drivers and several processes that the team initially wanted to focus on, a cause-and-effect matrix (Figure 3) was used to narrow down the list and focus on the most critical factors (‘x’s) and process. To use the cause-and-effect matrix, the outputs and metrics from the SIPOC were incorporated into the tool and ranked on a scale from 1-10 for its overall importance to the processes. To identify the correlation between the inputs and outputs, the inputs were ranked against the outputs using a scale of 0, 1, 3, and 9.
By utilizing the cause-and-effect matrix, the team realized that the patient transition process was one of the most critical processes to focus on improving. In addition, the scope of the process directly impacted the performance on the ED-1b and ED-2b core measures.

To illustrate the priority of the input-output relationships, the team used Pareto analysis (Figure 4). The Pareto analysis allowed the team to focus on at least 80% of the drivers. In addition, the Pareto analysis confirmed that the patient transition process was among the most critical processes to improve for safe and efficient patient flow. This also confirmed that delays in patients’ arrival to the units needed to be addressed. The team conceded on a target goal of 400 minutes for ED-1b and 150 minutes for the ED-2b core measure, which were the internal goals previously set by the Office of Quality and Performance Improvement for the hospital’s first year of operation. These target goals would be later used in the project to perform a capability analysis.
A process capability study was performed using the existing data for ED-1b and ED-2b core measures. The study examined if the current process was capable of producing the target goals of 400 and 150 minutes respectively. The process capability study showed that the current process was not capable of consistently producing an average of 400 minutes for ED-1b, nor was it capable of consistently producing an average of 150 minutes for the ED-2b core measure. In fact, Figure 5 illustrates that the data points from January to February were far from the target goal and exceeded upper specification limits, further supporting the need to redesign the current process.
Figure 5: Histogram of Process Capability Analysis
**Analyze**

During the ‘Measure’ phase of the DMAIC model, the team narrowed down the most critical input-output relationships that was suspected to have the most impact on patient flow. Now, it was time to confirm the input-output relationships through data analyses. Data was collected from a sample size of 30 charts from January to March, 2016 and from different Inpatient units and different shifts (day versus night). A two-level, two factor Design of Experiments (DOE) was performed to determine if the units or shifts had the most impact on the outcome (patients arriving to the unit without delay).

The output (Figure 6: $p = .00$) showed that both the unit and the shift had an impact on the outcome. However, as shown in Figure 7, the unit had more of an impact on the outcome. What’s more, the interaction between the unit and the shift showed to have a significant impact on the outcome, as illustrated in Figure 8. In other words, the type of unit and shift has a significant impact on whether or not patients experience delays when being admitted to the hospital.

**Figure 6: Output from DOE**

<table>
<thead>
<tr>
<th></th>
<th>A: Shift</th>
<th>B: Unit</th>
<th>AB</th>
</tr>
</thead>
<tbody>
<tr>
<td>A: Shift</td>
<td>15.125</td>
<td>4.14314E-14</td>
<td>3.651E+14</td>
</tr>
<tr>
<td>B: Unit</td>
<td>128.875</td>
<td>4.14314E-14</td>
<td>3.111E+15</td>
</tr>
<tr>
<td>AB</td>
<td>-7.625</td>
<td>4.14314E-14</td>
<td>1.840E+14</td>
</tr>
</tbody>
</table>
Figure 7: Pareto Analysis from DOE

Pareto Chart of Coefficients for ED to Inpatient Care Transitions

Figure 8: Interaction Plot (Unit & Shift)
Given that the inpatient unit had the most impact on the outcome, it was important to learn which units were performing well and which had room for improvement. From the sample, the south-side of the Telemetry unit outperformed all other inpatient units, including the north-side of the Telemetry unit, with a median time of 259 minutes for ED-1b and 66 minutes for ED-2b. The conclusion was made that there was no standardized approach among the many units and shifts to transport patients from the ED to the units in a safe and efficient manner. This was confirmed with interviews from the nurses in various units.

**Improve**

The team realized that not only did the process need to be redesigned but there needed to be a standardized workflow for all departments and shifts to follow. The team redesigned the process with its desired state in mind. First, the team conducted a root cause analysis to gain a better understanding of why the current process was not standardized. They identified that there was a lack of clear communication regarding bed assignments between the ED staff and the inpatient charge nurse. They drilled down to discover that this was due to a lack of a centralized bed control process and failure to explicitly define the roles and responsibilities of all parties involved in moving patients out of the ED to the inpatient setting. With the help of the nurse champion from Care Management and other nurses who had direct involvement in the care transition process, the team developed a new, ideal process with major changes. Firstly, the team realized that there needed to be clear expectations and guidelines for all involved in the process. The director of care management developed these guidelines and disseminated them to the clinical managers and directors. Secondly, the team believed that there needed to be one centralized person in the ED facilitating the flow of communication between the ED primary nurse and the inpatient primary nurse. For the new process, the ED charge nurse would be the facilitator of communication between ED and unit nurses and would also coordinate the safe and accurate storage of patients’ valuables & belongings.

The team also realized that the process needed an objective set of eyes to coordinate all of the moving pieces in the process. Through his research on best practices in patient throughput, the Care Management nurse champion suggested the utilization of a centralized bed control process controlled by Care Management to oversee the entire patient care transition process. This process would allow ED care managers to effectively and efficiently assign patients to their care units once beds became available. This change in the process no longer leaves uncertainty about whether or not a patient “belongs” in a particular inpatient unit. One major solution for the new process was the implementation of a standard checklist between the ED care manager and inpatient charge nurse when giving report for the newly admitted patient. This checklist is a set of safety items ranging from patients’ isolation status to fall precautions. The team agreed that the utilization of the checklist will ensure safe care transitions.

Lastly, transporters were asked to press the call light in patients’ rooms when they arrive to the unit. This would alert the nurses and provide a timestamp of the patient’s arrival to the unit.
This was another safety measure incorporated in the process. Because of all of the proposed changes, the team performed a Failure Modes and Effects Analysis (FMEA) to identify possible safety risks and failures in the process even in its ideal state. The results of the FMEA indicated that the safety measures be built into the process to prevent possible adverse events in the future.

A flow diagram of the new process was developed and the team used the Lean technique, standard worksheet, to gain approval of the process from executive sponsorship. Once approval of the new process was granted, the team trained their employees and implemented the process.

Results of the effort

As a result of this effort, the ED-1b core measure decreased from an average of 470 minutes between January and February to 365 minutes by June, indicating a 22% decrease. Additionally, the ED-2b core measure decreased from an average of 132 minutes between January and February to 93 minutes by June, indicating a 30% decrease (Figure 9: ED-1b and ED-2b Dashboard; Figure 10: ED-1b Run Chart; Figure 11: ED-2b Run Chart).

Figure 9: ED-1b and ED-2b Dashboard

<table>
<thead>
<tr>
<th>Clinical Care Core Measures</th>
<th>Regional Benchmark</th>
<th>Target Goal</th>
<th>Jan</th>
<th>Feb</th>
<th>Mar</th>
<th>Apr</th>
<th>May</th>
<th>Jun</th>
</tr>
</thead>
<tbody>
<tr>
<td>ED-1b Median Time from ED Arrival to ED Departure for Admitted ED Patients – Reporting Measure</td>
<td>448</td>
<td>400 min</td>
<td>441</td>
<td>498</td>
<td>425</td>
<td>445</td>
<td>408</td>
<td>365</td>
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<tr>
<td>ED-2b Admit Decision Time to ED Departure Time for Admitted Patients – Reporting Measure</td>
<td>173</td>
<td>150 min</td>
<td>107</td>
<td>158</td>
<td>134</td>
<td>127</td>
<td>93</td>
<td>93</td>
</tr>
</tbody>
</table>
Figure 10: ED-1b Run Chart

Figure 11: ED-2b Run Chart
6. **Discuss the significance of the results**

The results from the statistical analyses suggested that ED performance for patient flow is not solely dependent on the ED. Rather, all clinical units play a significant role in safely and efficiently moving patients out of the ED and to their respective units.

Also, there are clear safety implications as a result of this project. Timely patient flow from the ED to inpatient units ensures that patients are treated for their medical conditions in a timely manner in the best setting. In addition, the implementation of the new process brings unification among departments and also aids in increasing revenue. Lastly, optimizing patient flow and team collaborations enhances patient experience.

7. **Describe sustainability and scaling of the achievements**

**Control**

The ‘Control’ phase is arguably the most important phase of the DMAIC model because it allows teams to brainstorm ideas on how to sustain improvements. One way improvements have been sustained is by the display of the ED-1b and ED-2b results on the units’ performance.
improvement boards and during the monthly Interprofessional Performance Improvement Committee (IPIC) meetings. IPIC is a multidisciplinary committee of physician, nursing, and ancillary staff leaders that meet monthly to review quality and patient safety data and performance. Performance transparency will ensure that the departments are held accountable for maintaining the scores. In addition, the development of the standardized workflow is a method of sustainability because it ensures that there is little variation in the process. Standardized workflows allow teams to monitor performance and identify areas for continuous improvement.

Another method that was used to sustain and scale achievements was to develop a performance metric for each department that has direct involvement in the new patient transition process. This is a major shift from just using the ED-1b and ED-2b core measures to measure patient flow performance. Since patient throughput from the ED is a multidisciplinary effort, it is fitting to monitor how the performance of each department impacts the performance of the overall process.

Lastly, the Office of Quality and Performance Improvement (OQPI) has monitored the data on a monthly basis and will perform Statistical Process Control (SPC) using control charts to track small and large shifts of variation in the process. By performing SPC on a monthly basis, the team will know if these shifts in variation are “normal” to the process or “abnormal”. Furthermore, it will aid in immediately addressing abnormalities to prevent instability in the process.

8. Describe key lessons learned and any advice to colleagues who might try to undertake a similar effort

One lesson from this undertaking is to utilize a proven performance improvement methodology such as Lean Six Sigma to identify and correct abnormalities in processes. Another lesson learned is to effectively plan for large-scale, hospital-wide projects. A point person, preferably the performance improvement advisor, should estimate, plan, and manage timelines and due dates to complete tasks. If this is not done early on in a large-scale project, tasks and solutions will likely not be completed. In addition, the voice and involvement of front line staff and physicians is key. Directors and managers may be too far removed from the day-to-day processes to identify the process challenges and develop innovative “ideal state” solutions. Lastly, engaging executive sponsorship and gaining their buy-in early on is imperative to the success of the project.