A Systems Approach to Front-End Redesign With Rapid Triage Implementation

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Abstract
The most common site for hospital sentinel events due to care delays, secondary to waiting and/or inefficient processes, occurs in the emergency department (ED). Decreasing patient length of stay in an ED is a key initiative for many hospitals in order to maximize both quality and efficiency. The purpose of this practice improvement project was to (1) standardize front-end processes across a 6-hospital health system, (2) move non-sorting-related clinical questions out of triage, and (3) improve door-to-triage and door-to-provider times. The project occurred within a 6-hospital East Coast health system. This was a continuous quality improvement initiative utilizing the Donabedian theoretical model, plus the DMAIC method, for process improvement. A system-wide performance work team was formed including ED leaders and staff; site-specific implementation teams were also formed. Rapid triage implementation was effective in producing statistically significant improvement in door-to-triage, door-to-provider, and ED length of stay for discharged patients at 3 of the 6 sites. Further performance improvement projects in this area are needed to better understand the generalizability of this process in other EDs. Furthermore, from a leadership perspective, additional investigation is needed into the cost savings as well as shared labor opportunities that may

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- The purpose of this practice improvement project was to (1) standardize front-end processes across a six-hospital health system, (2) move non-sorting-related clinical questions out of triage, and (3) improve door-to-triage and door-to-provider times.
- The primary outcome of this practice improvement project was statistically significant improvement in door-to-triage, door-to-provider, and ED length of stay for discharged patients.
- Key implications for emergency nursing practice based on this project include the value of standardized policies/processes across a health system as well as the impact of a streamlined triage process to improve door-to-provider times.

INTRODUCTION

Problem Description

The emergency department (ED) is the most common site for hospital sentinel events due to care delays secondary to waiting and/or inefficient processes (Murrell, Offerman, & Kaufman, 2011). The Joint Commission maintains a “Quick Safety” issue reinforcing the negative impact delays have on patient care and outcomes (The Joint Commission, 2015). Some EDs have maintained antiquated processes, with bottlenecks resulting in these care delays. One such outdated process is the inclusion of mandatory screening questions and other data collection queries as part of the triage process (Foley & Durant, 2011). This process occurs at some sites even when there are available patient treatment spaces in the department as well as a qualified medical provider ready to see the patient.

An East Coast six-hospital faith-based health system embarked on a 4-year journey to rightsized the organization for optimum quality care at the most efficient cost. The health system comprises 1,928 certified hospital beds, 790 nursing home beds, and approximately 18,400 employees. Its six EDs care for more than 228,000 annual visits; each ED’s annual volume ranges from 21,644 to 85,208 visits. Although left without being seen rates were below 2% at every site, lengths of stay (LOSs) were an identified area of performance improvement across the entire system, as was the arrival-to-provider time metric at certain sites.

A system-wide service line assessment identified wide variations in both facility triage policies and practices. The health system set out to standardize and improve the arrival-to-provider process.

Available Knowledge

All six EDs utilize the Emergency Severity Index (ESI) as its triage stratification tool (Gilboy, Tanabe, Travers, & Rosenau, 2020). Three months of preintervention throughput metrics and volumes for each site are detailed in Table 1.

Four sites conducted a comprehensive data collection process in a triage booth for all patients arriving by means other than ambulance; ED1 already utilized a rapid triage process. ED6 utilized a two-step triage process prior to bed placement.

Rationale

There are many approaches to improving the door-to-provider metric including, but not limited to, the provider-in-triage method (Pierce & Gomley, 2016), immediate bedding (Howard, 2011), and split flow (Bish, McCormick, & Otegbeye, 2016), among
表 1. 前干预指标

|                          | ED1     | ED2     | ED3     | ED4     | ED5     | ED6     | Combined |
|--------------------------|---------|---------|---------|---------|---------|---------|----------|
| 前端出院访问量           | 14,491  | 5,372   | 5,704   | 3,727   | 3,681   | 2,885   | 35,860   |
| 前端入院访问量           | 6,117   | 2,133   | 2,286   | 1,529   | 2,884   | 4,269   | 19,218   |
| 总访问量                 | 21,302  | 7,864   | 8,431   | 5,411   | 6,800   | 7,283   | 57,091   |
| 实际年访问量（Aug 18-Oct 19）| 85,208  | 31,456  | 33,724  | 21,644  | 27,200  | 29,132  | 28,364   |
| 平均门到分诊时间（min）    | 3.4     | 1.7     | 11.7    | 8.8     | 4.5     | 4.9     | 5.3      |
| 平均门到提供者时间（min）  | 22.8    | 24.6    | 32.0    | 43.0    | 21.8    | 32.9    | 27.5     |
| 平均ED出院LOS（min）      | 239.9   | 234.6   | 280.6   | 210.2   | 212.5   | 319.8   | 246.1    |
| 平均ED入院LOS（min）      | 599.3   | 440.1   | 582.4   | 589.5   | 467.5   | 627.4   | 565.3    |
| 平均LOS所有患者（min）     | 352.2   | 293.4   | 363.0   | 321.3   | 326.3   | 499.9   | 358.5    |

注释：时间间隔四舍五入到小数点后10位。ED = 急诊部门；LOS = 疗程。Mean door-to-triage (min) = 平均门到分诊时间（分钟）; Mean door-to-provider (min) = 平均门到提供者时间（分钟）; Mean ED discharge LOS (min) = 平均ED出院LOS（分钟）; Mean ED admit LOS (min) = 平均ED入院LOS（分钟）; Mean LOS all patients (min) = 平均LOS所有患者（分钟）

除了 (Martin, 2012; Murrell et al., 2011)。在这种情况下，一个标准化的过程是必要的，它可以在不同规模的ED中工作，并且不影响患者和终末事件。

The intent was to significantly reduce the collection of information during triage that is not relevant to the act of sorting. Wolf et al. (2018) described cautionary trends when implementing a rapid triage process. They described hospitals triaging patients without any physiological data, subsequently raising concerns about the impact on patient outcomes. For the purposes of this project, the team remained conservative in its approach to what was collected during triage; full vital signs collection, among other queries, continued on all patients during triage.

**Specific Aims**

The specific project aims were to improve door-to-triage and door-to-provider times. This was to be achieved through moving non-sorting-related clinical questions out of triage. This project also focused on consolidating site-specific front-end policies into one system-wide policy.

**METHODS**

**Context**

This project was completed using the “structure-process-outcome” framework described by Donabedian (1988). This model has been frequently utilized by researchers as well as those in public policy to map out the mechanics of a particular situational process. The continuous quality improvement initiative utilized the DMAIC method for process improvement. DMAIC stands for Define, Measure, Analyze, Improve, and Control (Moran, Burson, & Conrad, 2017). A system-wide team of ED nursing leaders, ED physicians, clinical educators, clinical informaticists, and other key stakeholders was formed to (1) consolidate the six triage policies into one system-wide policy with intended processes, and (2) redesign the electronic health record (EHR) components while keeping rapid triage in mind.

Site-specific performance work teams were subsequently formed to design the individual site-specific process mechanics of the redesigned approach. Participation and frequency of meetings varied by site to the degree of change that was needed in each ED. Because ED1 already utilized a rapid triage approach, the impact only consisted of educating the nurses about the forthcoming EHR changes, which were more intuitive to the process already in place. Conversely, this was a major undertaking for ED3, ED4, and ED5. These teams were much larger and involved more staff-level participation, including physicians and advanced practice providers.
**Intervention(s)**

As part of the intervention, the EHR was parsed into the three distinct groups described in Table 2:

- “Primary triage” is completed upon patient arrival.
- “Screenings” is completed by a registered nurse (RN) at the earliest opportunity after the primary triage. If another patient is waiting for triage, this part is deferred for completion at a later time, likely after bed placement.
- “Primary assessment” is completed by an RN at the earliest opportunity after the patient is placed in his or her treatment space; this is most often completed by the primary RN.

Utilization of routine metric sharing with staff and the intentional desire of using the Hawthorne effect as a positive change catalyst were also woven into the leadership implementation strategies.

**Measures**

The measures chosen for studying the process outcomes included the door-to-triage, door-to-provider, and ED discharge LOS time intervals. ED admission LOS and overall LOS data were also collected. However, it is hypothesized that LOS metrics were not directly impacted by the front-end process redesign due to the numerous extraneous variables.

Raw data were sent by health system information technology personnel to a third-party vendor via a HIPAA-compliant analytics platform. Data were obtained from the platform in both aggregate and raw formats; none of the data for the throughput metrics had unique patient identifiers.

Visits were excluded if they met any of the following criteria:

- Negative ED LOS;
- Cases where facility name, discharge disposition, time of ED disposition, or time of arrival are null; and

**Table 2. Updated EHR documentation configuration**

| Primary triage                     | Screenings         | Primary assessment |
|------------------------------------|--------------------|--------------------|
| Arrival Info<sup>a</sup>           | Sepsis screen      | Primary assessment |
| Arrival Doc<sup>a</sup>            | Stroke screen      | OB/GYN             |
| Chief compliant<sup>a</sup>        | Abuse indicators   | Breastfeeding      |
| Triage assess                      | HIV testing        | History            |
| Vitals<sup>a</sup>                 | Tetanus status     | Medications taken  |
| Pain assessment<sup>a</sup>        | SBIRT screening    | PTA                |
| OB/GYN status                      | Advanced directives| Outside meds       |
| Height/weight<sup>a</sup>          |                    | Fall risk          |
| Allergies<sup>a</sup>              |                    | Implants           |
| Suicide risk                       |                    | External medical   |
| Respiratory screen                 |                    | Care everywhere    |
| Travel screen<sup>a</sup>          |                    | Triage interventions|
| ED triage notes                    |                    | Orders             |
| ESI/destination<sup>a</sup>       |                    | Order sets         |
| LWBS or to L&D                     |                    |                    |

*Note. ED = emergency department; EHR = electronic health record; ESI = Emergency Severity Index; L&D = labor and delivery; LWBS = left without being seen; PTA = prior to arrival.*

<sup>a</sup>Denotes a policy/process required field in triage.
Invalid time exclusions: Any record where the time of arrival is after the triage time or physician contact time.

Operational Definitions
Comprehensive data collection is defined as collecting information that is not relevant to the act of sorting. Examples of this include, but are not limited to, lethality screening, tuberculosis screening, obtaining a medication history not related to the chief complaint, fall risk, immunization status, and domestic violence victim screening among others (Foley & Durant, 2011). Because of triage processes varying on the basis of setting, location, and situation, this project focused on triage operations in U.S. EDs during normal operations; that is, operations that do not include disaster situations, mass casualty situations, and pandemic situations.

Front-end process refers to an institution’s specific process implemented to receive, register, triage, and initiate provider evaluation. Although the terminology refers to a process as opposed to a time interval, the process start and ending points are synonymous with the door-to-provider interval.

Assurances of Data Completeness
Analytics platform information is received from the EHR via a data transfer; this represents the complete data for a specific time frame and as such no sampling techniques were utilized. Analytics platform data were refreshed daily and viewable in both daily and monthly formats.

Ethical Considerations
This performance improvement project did not meet the definition of research under 45 C.F.R. 46.102(d). Access to relevant patient data occurred through a HIPAA-compliant analytics platform.

RESULTS
The postintervention metrics are detailed in Table 3. The t-test correlation coefficient was used to establish the presence or absence of statistical significance with this project. The t-test calculations at a 95% confidence interval are further detailed in the “Discussion” section. Key outcomes are graphed in Figure 1.

The preintervention exclusionary cases included 164 cases with negative LOS or null components, as previously identified. Additionally, 156 cases were excluded because of invalid times. Thus, 320 of 57,411 cases were excluded, or 0.56%.

The postintervention exclusionary cases included 181 cases with negative LOS or null components, as previously identified. In

Table 3. Postintervention metrics

| Aug–Oct 2019 | ED1 | ED2 | ED3 | ED4 | ED5 | ED6 | Combined |
|--------------|-----|-----|-----|-----|-----|-----|----------|
| Discharge visit volume | 13,776 | 5,142 | 5,751 | 3,351 | 3,539 | 2,846 | 34,405 |
| Admission visit volume | 6,137 | 2,075 | 2,436 | 1,756 | 2,827 | 4,782 | 20,013 |
| Total visit volume | 20,770 | 7,556 | 8,565 | 5,314 | 6,568 | 7,788 | 56,561 |
| Annualized volume (Aug 19–Jul 20) | 83,080 | 30,224 | 34,260 | 21,256 | 26,272 | 31,152 | 226,244 |
| Mean door-to-triage (min) | 3.3 | 2.2 | 8.3 | 7.7 | 3.3 | 3.3 | 4.4 |
| Mean door-to-provider (min) | 20.4 | 14.4 | 17.5 | 48.7 | 19.1 | 35 | 23.7 |
| Mean ED discharge LOS (min) | 250.9 | 241.3 | 246 | 213.7 | 202.6 | 283.5 | 242.8 |
| Mean ED admit LOS (min) | 713.5 | 418.2 | 595.6 | 645.7 | 384.5 | 514.7 | 567.3 |
| Mean LOS all patients (min) | 395.9 | 294 | 347.4 | 361.6 | 282.1 | 426.1 | 361.9 |

Note. Time intervals rounded to the tenth decimal. ED = emergency department; LOS = length of stay.

*Annualized volume is based on visits through February 29, 2020.
addition to this, 207 cases were excluded because of invalid times. Thus, 388 of 56,949 cases were excluded, or 0.68%.

**DISCUSSION**

**Summary**

There were no significant improvements at ED1; in fact, overall ED LOS significantly increased in all groups. ED2 demonstrated significantly longer door-to-triage times; however, the door-to-provider metric was significantly reduced ($p < 0.0001$). Statistically significant reduced door-to-triage times were seen at ED3 ($p < 0.0001$), ED4 ($p = 0.0175$), ED5 ($p < 0.0001$), and ED6 ($p < 0.0001$); ED3 and ED5 also had a significantly reduced door-to-provider times (each $p < 0.0001$). A statistically significant reduction in LOS of discharged patients was observed at ED3 ($p < 0.0001$), ED5 ($p = 0.00102$), and ED6 ($p < 0.0001$).

Analyzing all visits as an overall system, the project resulted in statistically significant improvements in the door-to-triage ($p < 0.0001$), door-to-provider ($p < 0.0001$), and ED discharge LOS ($p < 0.0185$) time metrics.

**Interpretation**

The lack of performance improvement at ED1 was secondary to the ED already having a rapid triage process in place. Furthermore, there was significant construction in the triage area during the postintervention measurement period. The construction may have led to inefficiencies that increased processing times throughout patient ED visits.

The results at ED2 interestingly show overall significant improvements in the door-to-provider metric but not the door-to-triage metric. It was identified in the preintervention period that patients queuing for triage may have not had properly back-timed arrival times. This was corrected through education, but the result of more accurate arrival times has lengthened LOS. Remarkably, the door-to-provider times were still shorter. This may be due to a Hawthorne effect and focus on improving those times; it may also be simply due to the fact that the time interval is longer and thus variations in 1 or 2 min did not impact overall calculations.

**Limitations**

This project represents a performance improvement initiative at six different sites within one organization; although it was an effective approach as a system, further investigation at other organizations is needed to determine its generalizability.

Furthermore, although these changes were an intense focus for the ED, performance improvement initiatives do not occur in a vacuum. There were many other concurrent
hospital improvement initiatives at each facility aimed at reducing throughput times throughout the organization. There is confidence that this intervention reduced door-to-triage and door-to-provider times; however, there are other potential extraneous factors that could have influenced discharge LOS, and it is highly probable that admission LOS and overall LOS had significant influence from outside factors, such as inpatient bed availability and staffing, among others.

CONCLUSION

The primary outcome of this practice improvement project was statistically significant improvement in door-to-triage, door-to-provider, and ED LOS for discharged patients at three of the six sites; the improvement was also statistically significant for the overall health system.

Key implications for the emergency nursing practice based on this project include the value of standardized policies/processes across a health system, as well as the impact of a streamlined triage process to improve door-to-provider times. Multidisciplinary staff-level involvement was a key strategy to designing a staff-owned process with buy-in. It is important for the emergency advanced practice provider to recognize the value of rapid and accurate sorting. Getting the patient to the qualified medical provider in this expeditious process accelerates patient care and throughput.

Further performance improvement projects in this area are needed to better understand the generalizability of this process in other EDs. Furthermore, from a leadership perspective, additional investigation is needed into the cost savings as well as shared labor opportunities that may exist when policies and processes are standardized across a system’s service line.

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