

# Improving Emergency Room Performance by Reducing Patients' Length of Stay

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**Abstract.** Improving the performance of Emergency Room (ER) has become a major concern for both healthcare professionals and researchers. ER patients' length of stay is one of the most important indicators for performance monitoring as well as improvement. The main objective of this study is to evaluate the effects of enhancing ER information accessibility of nurses, through a special ER nurses training program, on reducing patients' length of stay. Data on 5,769 ER encounters were retrospectively retrieved and analyzed to compare ER length of stay and related intervals of the first quarter of 2015, after implementing the training program, to the first quarter of 2014, before implementing the program. There was a 25.5% improvement on "Arrival to Triage" interval, 17.7% improvement on "Triage to ER Bed", 16.1% improvement on "ER Bed Assigned to Doctor Examination" and 13.2% improvement on "Doctor Examination to Discharge" interval. The total ER length of stay was improved by 13.7%.

**Keywords.** Emergency Department, Hospitals, Improving Performance, Reducing Length of Stay.

## Introduction

Improving performance of Emergency Room (ER) has become a major concern for both healthcare professionals and researchers. ER crowding is a major barrier to receiving timely emergency care all over the world. Patients who present to ER face long waiting times to be treated and those under treatment face even longer treatment time till they are admitted to the hospital or discharged home [1]. One conceptual model of ER crowding could help to understand its causes and develop potential solutions. The model partitions ER crowding into three interdependent components: input, throughput and output [2]. Another model studying the ER length of stay divided this indicator into three sequential intervals; waiting time, treatment time and boarding time; for patients to be admitted. Using these conceptual models we can work on developing strategies and solutions to alleviate ER crowding [3].

Inadequate staffing, due to lack of physicians or nurses, low ER physicians and nurses' productivity, low efficiency of ER staff and shortages of treatment areas are commonly studied throughput factors that may cause ER crowding and prolonged length of stay [4]. Lower staffing levels or productivity of physicians and triage nurses predisposed patients to wait longer for care [5]. Competency of attending physicians in ER, in terms of skills and efficiency, and lack of, or slow, responsiveness of ER nurses has been associated, in many studies, with patients leaving without being seen. The use

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and/or delays of the ancillary services, including lab, radiology and other procedures, usually prolong the ED length of stay [6]. This study was designed to evaluate the effects of enhancing ER information accessibility of nurses, through a special ER nurses training program, on reducing ER patients' length of stay.

## 1. Methods

As a part of an ER performance improvement project at King Faisal Specialist Hospital and Research Center, Saudi Arabia, the medical and clinical informatics department in association with the information technology department and the Emergency Department installed multiple digital screens displaying a group of online performance indicators showing numbers of ER patients waiting and patients on beds under treatment, in addition to showing average waiting and treatment times. These digital screens were intended primarily to enhance accessibility of ER nurses to information in addition to their regular access to the hospital information system to check for new patients arriving or patients to be moved, admitted or discharged. A three days intensive training program for ER nurses was designed and administrated by twice at the beginning of January 2015 to orient nurses about the factors leading to increased ER crowding and prolonged ER length of stay and its related intervals in addition to highlighting the importance of timely accessing ER information. The training program focused on three main components; the importance of efficiently responding to the newly arriving patients at the ER waiting area, managing and moving patients from triage to beds to be examined by physicians and the final process of discharging patients from the ER to outside or to inpatient departments in case they are to be admitted. The nurses were trained on how to do the registration and checking of patients in and out electronically, on each step, on the hospital information system. As this was highlighted as an important tool to monitor and improve the performance of the service and the staff; nurses were also trained on how to respond promptly to system alerts which direct them to areas and patients that need their intervention e.g. triage of new patients, administering medications or transporting patients.

To evaluate the effects of this ER nurses training program and enhanced information accessibility on patients' length of stay; data on ER patients' encounters of the first quarter of 2015, representing performance after implementing the training program, as well as data on ER patients' encounters of the first quarter of 2014; before the program, were retrospectively retrieved for comparison. A total of 5,769 encounters were included in this study. The mean of the ER length of stay and the mean of its related intervals; "Arrival to Triage", "Triage to ER Bed Assigned", "ER Bed Assigned to Doctor Examination" and "Doctor Examination to Discharge", were also calculated for each of the 3 months of the first quarters of 2015 and 2014 and for the quarters.

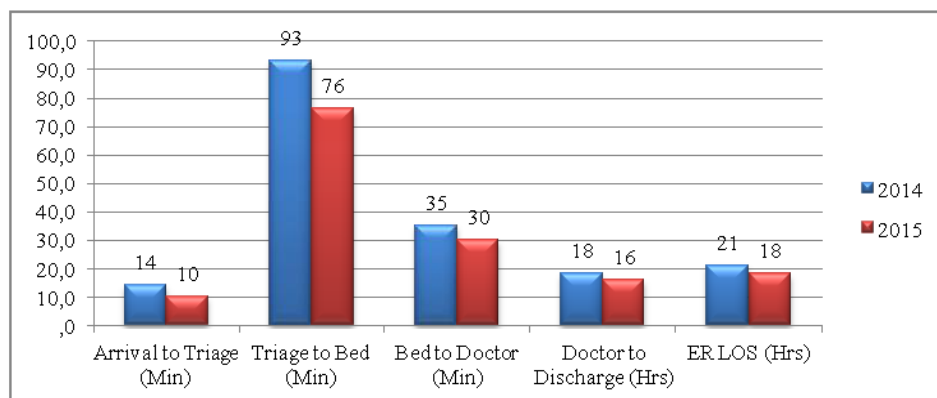
## 2. Results

SPSS software was used in the analysis, with descriptive as well as inferential statistics conducted and reported regarding the average (mean) of the ER length of stay and the averages of its related indicators; the four described time intervals, comparing 2015 and 2014 first quarters. There was a 25.5% improvement (reduction) on the "Arrival to Triage" interval, 17.7% improvement on the "Triage to ER Bed Assigned" interval,

16.1% improvement on the “Bed Assigned to Doctor Examination” interval and 13.2% improvement on the “Doctor Examination to Discharge” interval. The total ER length of stay was improved by 13.7%, from 21 to 18 hours. Comparing respective months of 2015 and 2014 first quarters; March 2015 achieved the best improvement compared to March 2014.

**Table 1.** ER LOS and related intervals of the first quarter of 2015 compared to the first quarter of 2014.

Measure	Arrival to Triage Mean (Min)	Triage to Bed Mean (Min)	Bed to Doctor Mean (Min)	Doctor to Discharge Mean (Hrs)	ER LOS Mean (Hrs)
January 2014	11	89	33	20	22
February 2014	19	98	33	16	19
March 2014	12	91	40	18	21
<b>2014 Quarter 1</b>	<b>14</b>	<b>93</b>	<b>35</b>	<b>18</b>	<b>21</b>
January 2015	10	87	35	21	23
February 2015	11	83	30	15	18
March 2015	10	62	26	13	14
<b>2015 Quarter 1</b>	<b>10</b>	<b>76</b>	<b>30</b>	<b>16</b>	<b>18</b>
<b>Improvement %</b>	<b>25.5%</b>	<b>17.7%</b>	<b>16.1%</b>	<b>13.2%</b>	<b>13.7%</b>



**Figure 1.** ER LOS and related intervals of the first quarter of 2015 compared to the first quarter of 2014.

Independent samples T-Test was also used for identifying statistically significant difference between the ER length of stay and its related indicators of the first quarter of 2015 compared to the first quarter of 2014. The p-value of the test was less than 0.05, and statistically significant, for each of the three intervals; “Triage to ER Bed Assigned”, “ER Bed Assigned to Doctor Examination” and “Doctor Examination to Discharge” as well as for the total ER length of stay. The only interval that was not significantly different between 2015 and 2014 was the “Arrival to Triage”.

### 3. Discussion

Timeliness is considered an essential quality indicator for many healthcare services, especially for emergency conditions [7]. An Institute of Medicine report defines six domains of quality of care: safety, patient-centeredness, timeliness, efficiency, effectiveness, and equity. The effect of emergency department (ED) crowding on these domains of quality has not been comprehensively evaluated. ED crowding is associated

with increased mortality or complications and morbidity in patients with time sensitive conditions such as pneumonia. At least two domains of quality of care, safety and timeliness, are compromised by ED crowding [8]. Many studies investigated the association between increased hospital occupancy rates and the increased ER crowding and prolonged ER length of stay [9-11]. There are many other studies that confirm the importance of increasing the productivity and efficiency of work at the ER [12].

Our study examined the positive effects of enhancing information accessibility through a special training program for ER nurses, which proved to be significantly effective in reducing the ER length of stay. The study had two main limitations; 1) The effect of enhancing information accessibility through the digital screens; showing new patients arriving or treated patients ready for discharge, was not examined separately from the effect of the training on responding to the hospital information system alerts; directing nurses to the intended areas and patients, this needs a separate study. 2) The numbers of patients visiting the ER during March 2015 was slightly (11%) less than patients visiting the ER during March 2014; this might have had a positive effect on reducing the ER length of stay, especially the big improvement noticed on March compared to the improvement on January and February 2015, where the number of ER patients was the same as 2014. The number of ER nurses and their working shifts was the same on both periods.

## References

- [1] I. Higginson, Emergency department crowding, *Emergency Medicine Journal* **29** (6) (2012), 437-443.
- [2] B. R. Asplin, D. J. Magid, K. V. Rhodes, L. I. Solberg, N. Lurie, C. A. Camargo, A conceptual model of emergency department crowding, *Annals of emergency medicine* **42** (2) (2003), 173-180.
- [3] R. Ding, M. L. McCarthy, J. S. Desmond, J. S. Lee, D. Aronsky, S. L. Zeger, Characterizing waiting room time, treatment time, and boarding time in the emergency department using quantile regression, *Academic Emergency Medicine* **17** (8) (2010), 813-823.
- [4] J. L. Wiler, C. Gentle, J. M. Halfpenny, A. Heins, A. Mehrotra, M. G. Mikhail, D. Fite, Optimizing emergency department front-end operations, *Annals of emergency medicine* **55** (2) (2010), 142-160.
- [5] S. M. Schneider, M. E. Gallery, R. Schafermeyer, F. L. Zwemer, Emergency department crowding: a point in time, *Annals of Emergency Medicine* **42** (2) (2003), 167-172.
- [6] S. K. Polevoi, J. V. Quinn, N. R. Kramer, Factors associated with patients who leave without being seen, *Academic Emergency Medicine* **12** (3) (2005), 232-236.
- [7] R. M. Mayberry, D. A. Nicewander, H. Qin, D. J. Ballard, Improving quality and reducing inequities: a challenge in achieving best care, *Proceedings (Baylor University. Medical Center)* **19** (2) (2006), 103.
- [8] S. L. Bernstein, D. Aronsky, R. Duseja, S. Epstein, D. Handel, U. Hwang, B. R. Asplin, The effect of emergency department crowding on clinically oriented outcomes, *Academic Emergency Medicine* **16** (1) (2009), 1-10.
- [9] A. J. Forster, I. Stiell, G. Wells, A. J. Lee, C. Van Walraven, The effect of hospital occupancy on emergency department length of stay and patient disposition, *Academic Emergency Medicine* **10** (2) (2003), 127-133.
- [10] N. R. Hoot, D. Aronsky, Systematic review of emergency department crowding: causes, effects, and solutions, *Annals of emergency medicine* **52** (2) (2008), 126-136.
- [11] J. C. Moskop, D. P. Sklar, J. M. Geiderman, R. M. Schears, K. J. Bookman, Emergency department crowding, part 1—concept, causes, and moral consequences, *Annals of emergency medicine* **53** (5) (2009), 605-611.
- [12] Emergency Nurses Association, *Emergency Nurses Association position statement: Staffing and productivity in the emergency care setting*, 2003.