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Patient Throughput Benefits of Triage Liaison Providers are Lost in a Resource Neutral Model: A Prospective Trial

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Abstract

Objectives—Patient throughput is an increasingly important cause of emergency department (ED) crowding. The authors previously reported shorter patient length-of-stay (LOS) when adding a triage liaison provider, which required additional personnel. Here, the objective was to evaluate the effect of moving a fast track provider to the triage liaison role.

Methods—This was a prospective observational before-and-after study design with predefined outcomes measures. A ‘standard staffing’ situation (where an advanced practice provider [APP] staffed treatment rooms in the fast track) was compared with an APP performing the triage liaison staffing role, with no additional staff. Eleven intervention (‘triage liaison staffing’) days were compared with 11 matched control (‘standard staffing’) days immediately preceding the intervention. Total LOS was measured for all adult Emergency Severity Index (ESI) 3, 4, and 5 patients (excluding behavioral health patients), and results were compared using Wilcoxon rank sum and chi-square tests.

Results—A total of 681 patients registered on control days, and 599 on intervention days. There was no significant difference in total patient LOS: median 273 minutes, IQR 176 to 384 minutes on intervention days vs. median 253 minutes, IQR 175 to 365 minutes on control days (p = 0.20). There was no difference in LWBS rates (n = 48, 7% on control days vs. n = 35, 6% on intervention days; p=0.38). Secondary analysis of only ESI 3 patients showed no difference in total LOS between periods (median 284 minutes, IQR 194 to 396 minutes on intervention days vs. median 290 minutes, IQR 217 to 397 minutes on control days; p = 0.22). There was, however, significantly greater total LOS for ESI 4 and 5 patients during the intervention period (median 238 minutes, IQR 124 to 350 minutes on intervention days vs median 192 minutes, IQR 124 to 256 minutes on control days; p = 0.011).

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Conclusions—The previously reported benefits on patient LOS and LWBS rates after adding a triage liaison (resource additive) were lost when that provider was moved from fast track to the triage role (resource neutral). While the triage liaison provider role may be a way to improve ED throughput when additional resources are available, as evidenced by our prior study, the triage liaison model itself does not appear to replace the staffing of treatment rooms, as evidenced by this study.

INTRODUCTION

Emergency department (ED) crowding continues to worsen over time, likely related to increased intensity of the care provided during a patient's ED stay.[1] Crowding is known to affect the timeliness of care for patients.[2] Concerns about crowding and timeliness of care feed a desire to optimize operations and patient flow, particularly at the front end, or intake area, of the ED.[3,4] Two areas of particular interest include a dedicated fast track service line, and the placement of a practitioner at triage, referred to as the triage liaison provider model.

Although triage liaison models have been described in the literature, different models have been used with varied results. Many studies,[5–13] including our own,[14] demonstrated improved patient length-of-stay (LOS) and/or decreased left without being seen (LWBS) rates with triage liaison models. However, other published reports have failed to show a benefit.[15–17]

Because we did not have the resources to continue staffing the additional provider that we used in our previous model,[14] we tested a different and resource-neutral model. In this study, we moved our fast track provider to the triage liaison role and measured the effect on patient LOS and LWBS rates.

METHODS

Study Design

This was an observational cohort before-and-after study with predefined outcome measures. The institutional review board approved the study, and granted exemption from informed consent requirements.

Study Setting and Population

The study ED is located in Saint Mary's Hospital, an academic tertiary care hospital and Level I trauma center, part of the Mayo Clinic in Olmsted County, Minnesota (population 141,360). The ED at Saint Mary's Hospital has approximately 73,000 patient visits per year and a hospital admission rate of 30%.

All adult Emergency Severity Index (ESI) level 3, 4, and 5 patients who registered in the ED during hours when the intervention was being conducted were considered for this study. We excluded pediatric patients since dedicated providers see our pediatric population in a separate area of the ED during intervention hours. We also excluded ESI level 1 and 2 patients because these patients typically bypass the triage assessment area and are taken immediately to a resuscitation area where dedicated providers evaluate the patients and

initiate treatment and diagnostics within minutes. We also excluded any behavioral health patients because these patients are evaluated in our behavioral health area and do not undergo formal triage assessment in the main triage area. All remaining adult ESI level 3, 4, and 5 patients were included in the study, regardless of whether they arrived by ambulance or private vehicle.

Study Protocol

We conducted this intervention during predictably busy days and times, when an area of the ED would normally have been used as a fast track. We had recently evaluated a different intervention that showed patient throughput benefits in our setting when adding a triage liaison provider to the triage area of our ED.[14] We did not have immediately available resources to continue staffing this extra role in the ED. Rather, to further understand the effects of the triage liaison provider role in a resource-neutral environment, we chose a new, pre-specified set of intervention dates where we moved the fast track provider to the triage liaison provider role. The fast track provider was already scheduled six days a week (excluding Mondays), from 4:00 PM to 12:00 AM on weekdays, and 12:00 PM to 12:00 AM on weekends, so we used these hours for the study. The intervention dates were chosen as July 26 through 31 and August 2 through 6, 2011. To decrease the risk of observation bias, we chose control days of the week that were the same as the intervention days, and we chose dates immediately before the intervention dates by overlaying a calendar and selecting the same days of the week immediately preceding the study. The control dates were July 12 through 17, and 19 through 23, 2011. Because the study dates and times were fixed, we evaluated all patients who presented to the ED during the study times noted above. For control days, we used the times corresponding to the matching intervention day and time.

Details regarding the role of the triage liaison provider in our practice processes are described elsewhere.[14] Briefly, the triage liaison provider is asked to be present for at least part of a patient's triage assessment by nurses. The triage liaison provider may ask a limited number of questions and perform a very brief exam while the patient remains clothed. The triage liaison provider orders any blood tests or radiographic studies he or she feels appropriate for initial testing using the electronic ordering system used throughout the ED (ED PulseCheck, Picis Inc., Rosemont, IL). Of note, no electrocardiogram (ECG) or urine tests were ordered in triage, as there was no means to undress the patient or collect urine in an appropriate manner. The triage nurses controlled the flow of patients and, in collaboration with the triage liaison provider, facilitated rapid patient assessments. The triage liaison provider interacted with a clinical assistant in triage to coordinate performance of tests, e.g., sending the patient for x-rays after blood was collected. The triage liaison provider generally did not try to dismiss any patients. Like our previous study, the triage liaison provider role was staffed entirely by physician assistants (PAs).

All data were extracted from the electronic medical record and electronic ED tracking system. Adult ESI level 3, 4, or 5 patients who LWBS were included in the general study demographics but were excluded from LOS analysis because measures of their LOS could not be reliably estimated. We collected patient demographic information, ESI triage level, registration time, room time, and the time the patient left the treatment room.

Data Analysis

Continuous data are presented as medians with interquartile ranges (IQRs). Categorical data are presented as frequency counts and percentages. Statistical comparisons between intervention and control phases were conducted using the following tests: chi-square tests were used to compare differences in the proportions by sex, day of the week, and LWBS; a Cochran-Armitage trend test was used to compare ESI triage level; and Wilcoxon rank sum tests were used to compare differences in age, patient volume (total number of study-eligible patient registrations during the study dates and times), and LOS. Comparisons between intervention and control phases occurred for all ESI level 3, 4, and 5 patients. As level 3 patients are often more complex and require extensive laboratory and radiologic imaging when compared to ESI level 4 and 5 patients, we conducted an a-priori analysis of the effect of the triage liaison provider on these two subgroups: ESI 3 patients, and ESI 4 and 5 patients. The effect of intervention versus control days on LOS after adjusting for patient volume and triage level were evaluated using multiple linear regression models after transforming LOS using the square root to meet the linear regression normality assumption.[18] The effect of intervention versus control days on LWBS rates after adjusting for patient volume and triage level was evaluated using a multivariable logistic regression model. All hypothesis tests were two-sided, and p-values less than 0.05 were considered statistically significant. No adjustment was made to the overall significance level of 0.05 to account for multiple comparisons. Analyses were performed using SAS version 9.2.

RESULTS

There were 681 eligible patients who registered during control days and times, and 599 on intervention days and times. During the control period, 48 patients LWBS, leaving 633 patients available for analysis of overall ED throughput; during the intervention period, 35 patients LWBS, leaving 564 patients available for analysis of overall ED throughput.

Table 1 compares patient demographics, the number of patients, ESI triage level, and LWBS rates between intervention and control periods. There was no significant difference in age, sex, or the number of patients registered according to the day of the week between intervention and control periods. However, the total patient volume was significantly lower, and a greater proportion of ESI 3 patients were seen, during the intervention period.

When performing unadjusted comparisons between intervention and control data, there was no significant difference in total patient LOS (median 273 minutes, IQR 176 to 384 minutes on intervention days vs. median 253 minutes, IQR 175 to 365 minutes on control days; $p = 0.20$) (Table 2). For LWBS rates, there were 35 patients (6% of registered patients) who left on intervention days vs. 48 patients (7% of registered patients) on control days ($p = 0.38$) (Table 1). The waiting room LOS was significantly longer during the intervention period (median 99 minutes, IQR 22 to 198 minutes) than the control period (median 68 minutes, IQR 20 to 142 minutes) ($p < 0.001$); while the median treatment room LOS was significant shorter for the intervention period (median 148 minutes, IQR 85 to 239 minutes) vs. control period (median 167 minutes, IQR 97 to 246 minutes) ($p = 0.023$) (Table 2).

In the predefined secondary analysis, these time metrics were also analyzed for ESI 3 patients only, and for ESI 4 and 5 patients only (Tables 3a and 3b). There was a significantly greater total LOS for ESI 4 and 5 patients during the intervention period (median 238, IQR 124 to 350 minutes) than on control days (median 192 minutes, IQR 124 to 256 minutes) ($p = 0.011$). The findings of shorter treatment room LOS and longer waiting room LOS seen in the full study population were also observed when patients were analyzed according to the two ESI groups.

As our patient demographics analysis revealed significant differences between control and intervention periods for patient volume and ESI distribution (Table 1), we examined the effect of control vs. intervention days on LOS metrics after adjusting for these two variables using multiple linear regression models (after transforming LOS using the square root to meet the linear regression normality assumption). We observed similar changes in LOS between the intervention and control periods even after this multivariable adjustment, leading us to conclude that the results we observed univariately were not confounded by patient volume and ESI level. In particular, after multivariable adjustment we observed no change in total LOS ($p = 0.46$), a significant decrease in treatment room LOS ($p < 0.001$), and a significant increase in waiting room LOS ($p < 0.001$) for intervention compared with control periods. Similarly, the lack of change in LWBS rates on intervention compared with control periods was maintained after adjusting for patient volume and triage level using multivariable logistic regression models ($p = 0.68$).

DISCUSSION

We evaluated whether a resource-neutral reallocation of personnel from a fast track to a triage liaison provider model was beneficial for patient throughput. We observed a non-significant 20 minute longer total LOS ($p = 0.20$) in all patients eligible to be evaluated by the triage liaison provider and a nonsignificant 1% reduction in LWBS rates ($p = 0.38$). This is in contrast to our previous study that demonstrated a 41-minute reduction in LOS and a reduction in LWBS rates from 9.7% to 1.4% in a resource-additive model where incremental staff performed the triage liaison provider model duties.

Although the change in total LOS with the intervention population was not significant, the subset of ESI 4 and 5 patients did have a longer total LOS. Subgroup analyses revealed that the increased wait times were most pronounced in the ESI level 4 and 5 patients. The median waiting room time for ESI level 4 and 5 patients almost doubled during the intervention. This is likely due to the fact that in the absence of a fast track provider who would have preferentially seen ESI level 4 and 5 patients, these patients were now triaged below the ESI level 3 patients and experienced a marked increase in waiting room times. Thus, although there was a decrease in the treatment room times for the entire population and the two ESI subgroups, the increased waiting room times with the loss of a fast track provider more than negated this effect. It is possible that extending the intervention would have equalized the patient volumes, and/or brought the difference in total LOS into statistical significance. When we reviewed the predetermined intervention dates and control dates, however, we felt the data did not warrant continuing this staffing model.

Operations research continues to address the call by the 2006 Institute of Medicine report for adoption of operations management principles to improve patient flow in the ED.[19] This has led the American College of Emergency Physicians (ACEP) to publish a summary of potential ED front-end operational improvements.[4] Triage liaison providers are one such recommendation.

Previous studies have shown mixed results when testing triage liaison provider modeling for patient flow. When evaluating previous publications on triage liaison provider modeling in U.S. EDs, some studies add personnel in order to implement the model,[7,10,12,14] and some reallocate existing resources.[9,13,16,20] Li and colleagues published the only data where the triage liaison provider model failed to improve patient throughput, and this was in a pediatric ED with a resource neutral model. Also, some institutions that have evaluated the role have different capabilities at triage. We chose our protocol based upon our own capabilities. This kept us from being able to collect ECGs or urinalyses in triage. Also, the triage liaison provider had limited ability to dismiss patients from triage, due to a lack of adequate space, charting capacity, and nursing resources needed to complete the discharge process.

LIMITATIONS

This was a before-and-after study. Because the control period was immediately before the intervention period, we do not know of any co-interventions that were introduced during the study periods, and the risk that other confounding factors might explain the differences observed between intervention and control periods is low. This was a single-center study and our findings may not readily generalize to other practice settings. Several published studies on this subject use minor differences in staffing and modeling, which may limit external generalizability. For example, some studies order ECGs or urinalyses in triage, and some focus on discharging patients from triage. We did not have adequate facilities to implement these processes. Also, we only tested the model with PAs, because PAs were already scheduled for fast track in our setting. Our ED has considerable experience with using PAs across a variety of acuity levels, and this may not be true at other centers.

CONCLUSIONS

Our previously reported benefits on patient length of stay and left without being seen rates after adding a triage liaison provider (resource additive) were lost when we moved a provider from fast track to the triage liaison provider role (resource neutral). While the triage liaison provider role may be a way to improve ED throughput when additional resources are available, as evidenced by our prior study, the triage liaison provider model itself does not appear to replace the staffing of treatment rooms, as evidenced by this study.

Supplementary Material

Refer to Web version on PubMed Central for supplementary material.

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Table 1

Demographics of Study Patients

Feature	Control n=681	Intervention n=599	P-value
Age (years)	50 (31–67)	49 (31–66)	0.70
Total patient volume during study days/times	62 (49–87)	53 (48–76)	<0.001
Sex			0.49
Female	355 (52)	323 (54)	
Male	327 (48)	276 (46)	
Patients per day of week			0.74
Tuesday	110 (16)	80 (13)	
Wednesday	108 (16)	101 (17)	
Thursday	107 (16)	105 (18)	
Friday	95 (14)	89 (15)	
Saturday	172 (25)	148 (25)	
Sunday	89 (13)	76 (13)	
ESI level			0.016
3	445 (65)	425 (71)	
4	224 (33)	170 (28)	
5	12 (2)	4 (1)	
ESI level			0.032
3	445 (65)	425 (71)	
4/5	236 (35)	174 (29)	
LWBS	48 (7)	35 (6)	0.38

IQR = interquartile range; ESI = Emergency Severity Index; LWBS = left without being seen. Data are reported as median (IQR) or n (%)

Table 2

Length of Stay Data for All Included ESI Level 3, 4, and 5 Patients*

Feature	Control	Intervention	P-value
Total LOS (min)	253 (175–365)	273 (176–384)	0.20
Treatment room LOS (min)	167 (97–246)	148 (85–239)	0.023
Waiting room LOS (min)	68 (20–142)	99 (22–198)	<0.001

Data are reported as median (IQR)

* Sample sizes were 633 for control and 564 for intervention.

LOS = length of stay; IQR = interquartile range.

Table 3a

Length of Stay Data for Included ESI Level 3 Patients Only*

Feature	Control	Intervention	P-value
Total LOS (min)	290 (217–397)	284 (194–396)	0.22
Treatment room LOS (min)	208 (136–278)	177 (112–263)	0.002
Waiting room LOS (min)	69 (14–151)	81 (13–184)	0.11

Data are reported as median (IQR)

* Sample sizes were 419 for control and 411 for intervention.

LOS = length of stay; IQR = interquartile range.

Table 3b

Length of Stay Data for Included ESI Level 4 and 5 Patients Only*

Feature	Control	Intervention	P-value
Total LOS (min)	192 (124–256)	238 (124–350)	0.011
Treatment room LOS (min)	98 (60–144)	84 (27–137)	0.017
Waiting room LOS (min)	68 (31–128)	127 (65–221)	<0.001

Data are reported as median (IQR)

* Sample sizes were 214 for control and 153 for intervention.

LOS = length of stay; IQR = interquartile range.