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Team triage increases discharges and decreases time to discharge without increasing test ordering

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Abstract

Objectives: Emergency department (ED) crowding is detrimental to patients and staff. During traditional triage, nurses evaluate patients and identify their level of emergency. During team triage, physicians and/or nurse practitioners (NPs) and physician assistants (PAs) place orders, laboratory results, intravenous lines (IVs), and imaging in triage. Team triage improves access to testing and decreases length of stay. However, ordering practices in team triage may lead to overtesting.

Methods: This is a retrospective review of patients seen before and after a team triage process was established. Percentage of patients receiving testing and the diagnostic yields of troponins, lactates, international normalized ratios (INRs), blood cultures, glomerular filtration rates (GFR), and head computed tomography (CT) images were studied.

Results: A total of 704 traditionally triaged patients and 862 team triaged patients met inclusion criteria. Comparing traditional versus team triaged patients, the proportion of patients discharged was 0.44 versus 0.53 ($P < 0.001$), and the length of stay to discharge was 417 versus 375 minutes ($P = 0.003$). Comparing traditional versus team triage, a head CT was obtained 12.5% versus 5.7% ($P < 0.001$) of the time with diagnostic yield 45.5% versus 52% (not significant), troponin was obtained 51.3% versus 45.9% (not significant) of the time with diagnostic yield 14.9% versus 13.9% (not significant), lactate was obtained 41.6% versus 32.1% ($P = 0.011$) of the time with diagnostic yield 18.4% versus 12.3% (not significant), INR was obtained 70.2% versus 55.8% ($P = 0.007$) of the time with diagnostic yield 15.8% versus 10.5% ($P = 0.042$), GFR was obtained 99.3% versus 98.4% (not significant) of the time with diagnostic yield 18.9% versus 13.7% ($P = 0.02$), and blood cultures were obtained 23.4% versus 7.3% ($P < 0.001$) of the time with diagnostic yield 7.3% versus 9.3% (not significant).

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Conclusion: Compared with traditional triage, the team triage process increased discharges and decreased time to discharge, but did not lead to increased testing or decreased diagnostic yield.

1 | INTRODUCTION

1.1 | Background and importance

Emergency department (ED) crowding is a growing problem globally and leads to increased morbidity and mortality, delays imaging of stroke patients, increases medical errors, decreases patient satisfaction, increases patient walk-outs, and decreases staff morale.[1-4]

Many solutions have been proposed to help alleviate ED crowding, including physical improvements, such as increasing the number of physicians and nurses; technological improvements, such as improving the electronic medical records system; and process improvements, such as using a team triage model.[5,6] This study concentrates on the team triage model, which has been known to be beneficial in reducing ED crowding. In this study, we focus on whether team triage results in over-ordering and decreases diagnostic yield of the tests being ordered.

Triage traditionally involves ED nurses evaluating patients for a short period of time and assigning a severity to each patient's emergency, which determines how fast the patient needs to be seen and in which part of the ED (ie, critical care vs fast track). The concept of team triage, on the other hand, includes physicians and/or nurse practitioners (NPs) and physician assistants (PAs), in the triage process along with ED nurses. During team triage, the patient is assigned a severity by the emergency nurse, orders are placed by physicians and/or NPs and PAs, laboratory results are collected by nurses, and radiologic studies may be ordered.[7]

Team triage has been shown to decrease ED crowding, improve wait times, decrease time from registration to physician presentation, decrease walk-outs, and decrease mortality.[8-10] However, there is concern that team triage results in the over-ordering of diagnostic laboratory tests and imaging anticipating that it is better for the downstream physician to have more information than less.[11-13]

1.2 | Goals of this investigation

This purpose of this study was to determine if team triage with NPs and PAs who ordered laboratory tests and imaging resulted in increased overall testing or change in diagnostic yield when compared with traditional ED nurse-only triage. In ED nurse-only triage, downstream NPs, PAs, and physicians ordered tests after the patient was seen by a nurse in triage. During team triage, NPs and PAs ordered tests during triage.

2 | METHODS

2.1 | Study design and setting

This study was performed in a large, suburban, academic, tertiary care hospital ED, with ≈100,000 annual visits in the United States. The ED had 57 adult beds, 9 pediatric beds, and 10 observation unit beds. The ED could accommodate an additional 20 to 30 patients in the hallways. This hospital adopted a team triage process in February 2017. This new process includes an NP or PA stationed in the triage area between 11 AM and 11 PM. They placed orders, and ED nurses or care assistants collected laboratory tests in triage on all walk-in patients not immediately triaged to the immediate care (fast track) area or critical care area. Radiologic studies could be ordered and performed from triage as well.

2.2 | Selection of patients

In this study, we compared ED team triage (which was open from 11 AM–11 PM) with traditional, nurse-only, triage (from 11 AM–11 PM). All patients who were walk-in adult patients (age >18) not triaged to fast track arriving between 11 AM and 11 PM were included in the study. Patients who went through team triage were generally Emergency Severity Index (ESI) levels 2 and 3. Although fast track patients may have gone through traditional triage or team triage, they are not included in this study because they generally do not get the orders studied in this study, such as head computed tomography (CT) and laboratory tests. Institutional review board approval was obtained for this study.

2.3 | Measurements

Data were extracted from the electronic medical record database for the last 2 weeks of November 2016 and the last 2 weeks of March 2017. These time periods were selected because they fell before trials of the new process (November 2016) and a month after full implementation (March 2017). We compared patient age, sex, ESI levels, patient dispositions, and length of stay between the November 2016 and March 2017 groups. ED length of stay was calculated as time of triage to time of disposition (discharge, admission, or placement on ED observation).

In November 2016, nurses triaged patients arriving in the ED without ordering any tests and downstream NPs, PAs, and physicians placed

the orders for tests. In March 2017, NP or PA in team triage placed orders, and nurses inserted intravenous lines (IVs) as well as collected laboratory result in triage from 11 AM to 11 PM. In this study, we were interested in evaluating the ordering rate and diagnostic yield for the tests ordered downstream NPs, PAs, and physicians from nurse-only triage compared with NPs and PAs in team triage.

A total of 4 independent researchers (2 nurses, a resident physician, and a medical student) performed a retrospective chart review and extracted patient ESI levels, patient dispositions, and length of stay. Two independent researchers, a resident physician and a medical student, extracted patient sex, age, tests that were ordered, and the results of the tests.

2.4 | Outcomes

We studied tests ordered in the ED that could change a patient's disposition and would be important to order early in a patient's ED visit. Head CT scans were categorized as normal, acute strokes, intracranial hemorrhage, intracranial mass, or other; troponins were categorized in the ranges of <0.01 ng/mL, 0.01 to 0.03 ng/mL, or ≥ 0.04 ng/mL; serum lactates were categorized in the ranges of 0 to 2 mmol/L, 2.1 to 4 mmol/L, or > 4 mmol/L; and international normalized ratios (INRs) were categorized in the ranges of 0 to 1.3 or >1.3. The researchers also recorded and categorized blood cultures as negative, contaminated, or positive, and glomerular filtration rates (GFRs) in the following ranges: > 60 mL/minutes, 30 to 60 mL/minutes, or < 30 mL/minutes. GFRs were included in this study because they are regularly used to decide whether to order other downstream tests, such as CT imaging with contrast.

2.5 | Analysis

A χ^2 analysis (with $\alpha = .05$) was used to evaluate if there was a significant difference between the traditional triage and team triage groups and also if there was a significant difference between the proportion of patients being admitted, discharged, and placed on ED observation in November 2016 compared with March 2017. Wilcoxon rank sum test (with $\alpha = .05$) was used to evaluate if there was a significant difference between the lengths of stay for admitted, discharged, and patients placed on ED observation in November 2016 compared with March 2017. Microsoft (Redmond, WA) Excel 2016 and Stata 16.1 (StataCorp, College Station, TX) were used for statistical analysis.

3 | RESULTS

A total of 1,566 patient charts were reviewed, with 704 from November 2016 and 862 from March 2017 meeting the previously mentioned inclusion criteria.

Comparing November 2016 (nurse-only triage) versus March 2017 (team triage), the average ESI levels were 2.64 versus 2.56, the

The Bottom Line

A retrospective review of >1,500 patients before and after the implementation of a team triage process showed a significant increase in discharges and a decrease in length of stay to discharge without evidence of increased testing.

average age was 54.80 versus 56.66, and the proportion of men was 0.43 versus 0.48, respectively (Table 1). The proportion of patients who were discharged in November 2016 was 0.44 compared with 0.53 in March 2017 (P < 0.001). The proportion of patients who were admitted in November 2016 was 0.37 compared with 0.36 in March 2017 (P = 0.309). The proportion of patients who were placed on ED observation in November 2016 was 0.19 and 0.12 in March 2017 (P < 0.001) (Table 1).

The median length of stay of discharged patients in November 2016 was 378 minutes and in March 2017 was 342 minutes (P = 0.001). The median length of stay of admitted patients in November 2016 was 359 minutes and in March 2017 was 316 minutes (P = 0.023). The median length of stay of patients placed on ED observation in November 2016 was 198 minutes and in March 2017 was 244 minutes (P = 0.038) (Table 1).

During traditional triage, 12.5% (95% confidence interval [CI], 10.0%–14.9%) of the patients studied received head CTs, with 45.5% (95% CI, 35.1%–55.9%) of those studies showing a positive finding

TABLE 1 The average Emergency Severity Index level, proportion of women and men, and average age are listed for November 2016 and March 2017

	November 2016	March 2017	P
Emergency Severity Index level	2.64	2.56	
Men, n (%)	305 (43)	418 (48)	
Age, y	54.8	56.66	
Discharged, n (%)	310 (44)	462 (53)	0.0004
Admitted, n (%)	262 (37)	303 (35)	0.3097
ED observation, n (%)	132 (19)	107 (12)	0.0003
Length of stay: discharged patients, median (interquartile range)	378 (196)	342 (205)	0.0012
Length of stay: admitted patients, median (interquartile range)	359 (271)	316 (239)	0.0233
Length of stay: ED observation patients, median (interquartile range)	198 (203)	244 (165)	0.0383

The proportion of patients discharged, admitted, and placed on ED observation in November 2016 and March 2017 are presented; a χ^2 test was performed to determine the P values. The median length of stay with interquartile range (in parentheses) in minutes for patients discharged, admitted, and placed on ED observation in November 2016 and March 2017 are listed; a Wilcoxon rank sum test was performed to determine the P values. ED, emergency department.

(acute strokes, intracranial hemorrhage, intracranial mass, or other). During team triage, 5.7% (95% CI, 4.0%–7.4%) of the patients studied received head CTs, with 52.4% (95% CI, 37.3%–67.5%) of those studies showing a positive finding. There was a significant decrease in CTs ordered using team triage ($P < 0.001$), but no significant change in diagnostic yield.

During traditional triage, 51.3% (95% CI, 47.7%–55.0%) of the patients studied received troponins, with 14.9% (95% CI, 11.2%–18.6%) of those studies showing a positive finding ($P > 0.01$). During team triage, 45.9% (95% CI, 42.4%–49.6%) received troponins, with 13.9% (95% CI, 10.2%–17.6%) of those studies showing a positive finding. There was no significant change in either troponins ordered or the rate of positive troponins between the traditional and team triage patients.

During traditional triage, 41.6% (95% CI, 37.9%–45.2%) of the patients studied received lactates, with 18.4% (95% CI, 13.9%–22.9%) of those studies showing a positive finding (> 2 mmol/L). During team triage, 32.1% (95% CI, 28.7%–35.5%) of the patients studied received lactates, with 12.3% (95% CI, 8.1%–16.5%) of those studies showing a positive. There was a significant decrease in ordered lactates using team triage ($P = 0.011$), but no significant change in diagnostic yield.

During traditional triage, 70.2% (95% CI, 66.9%–73.6%) of the patients studied received INRs, with 15.8% (95% CI, 12.5%–18.9%) of those studies showing a positive finding (>1.3). During team triage, 55.8% (95% CI, 52.2%–59.4%) received INRs, with 10.5% (95% CI, 7.6%–13.5%) of those studies showing a positive finding. Both ordered and positive yield of INRs decreased significantly with team triage ($P < 0.001$ and $P = 0.04$, respectively).

During traditional triage, 23.4% (95% CI, 20.3%–26.5%) of the patients studied received a blood culture, with 7.3% (95% CI, 3.3%–11.2%) of those studies showing a positive finding. During team triage, 7.3% (95% CI, 5.5%–9.2%) received blood cultures, with 9.3% (95% CI, 1.5%–16.9%) of those studies showing a positive finding. Similar to CTs and lactates, there was a significant decrease in the number of blood cultures ordered using team triage ($P = < 0.001$), but no significant difference in diagnostic yield.

During traditional triage, 99.3% (95% CI, 98.7%–99.9%) of the patients studied received GFRs, with 18.9% (95% CI, 15.9%–21.9%) of those studies showing a positive finding (<60). During team triage, 98.4% (95% CI, 97.4%–99.3%) of the patients studied received GFRs, with 13.7% (95% CI, 11.2%–16.2%) of those studies showing a positive finding. There was no statistical difference between the triage groups for GFRs ordered, but a significant decrease in diagnostic yield of GFRs ($P = 0.02$) in the team triage group.

4 | LIMITATIONS

There are some potential limitations. This is a single-center study of a large, academic, suburban, tertiary care hospital ED in the United States, which limits the study's generalizability. Ordering practices in this academic ED might be different from those in community EDs. In addition, this was a retrospective chart review. This study looked at 2 weeks in each of the months studied, and there is a chance for vari-

ability based on different months of the year. Although team triage orders were placed by NPs and PAs, patients were seen after traditional triage by attending physicians, resident physicians, NPs, and PAs, which could introduce some practice variability. This study was conducted in the United States and may not be generalizable to other countries. This study also did not compare the use of order sets by nursing or NPs and PAs in triage. Robust multicentered studies are needed to confirm the findings in this study.

5 | DISCUSSION

In this study, the time periods of November 2016 and March 2017 were chosen because they were before and after a team triage process was implemented in this ED setting. Comparing November 2016 and March 2017, the ESI levels (2.64 vs 2.56), average age (54.80 vs 56.66), and the proportion of men (43% vs 48%) were similar between the 2 time periods.

The proportion of patients who were discharged in March 2017 (0.53) was significantly greater than the proportion of patients who were discharged in November 2016 (0.44) ($P < 0.001$). There was no difference in the proportion of patients admitted in November 2016 versus March 2017. However, the proportion of patients placed on ED observation in March 2017 (0.12) was significantly lower than in November 2016 (0.19) ($P < 0.001$). This is likely because workups (laboratory tests, imaging) were started earlier in team triage, which may have decreased the need for patients to be placed on ED observation. Patients are often placed on ED observation for repeat laboratory tests (such as troponins) and pending imaging.

The median length of stay of discharged patients in March 2017 was 342 minutes, a significant decrease compared with the length of stay of discharged patients in November 2016 (378 minutes) ($P = 0.001$). This is in line with other studies that have shown that team triage can decrease the length of stay of patients being discharged from the ED.[8–10] The median length of stay of admitted patients in March 2017 was 316 minutes, a significant decrease compared with that of admitted patients in November 2016 (359 minutes) ($P = 0.023$). There is likely a decrease in length of stay after the implementation of team triage for patients being discharged or admitted because these patients get their laboratory tests and imaging earlier in their ED stay, and they have their results earlier than during the nurse-only ED triage.

The median length of stay to ED observation in March 2017 was 244 minutes, a significant increase compared with the length of stay of admitted patients in November 2016 (198 minutes) ($P = 0.038$). This may be because patients who traditionally would go to ED observation for laboratory tests and imaging received these earlier and had a quicker disposition (ie, admission, discharge). Patients who needed a prolonged workup or needed special services that were delayed, such as delayed consults, physical therapy, and advanced imaging (ie, imaging that may only be performed during certain times of the day, such as CT coronary arteries and echocardiography) may have gone to ED observation during team triage.

Previous studies[11–13] showed concern that team triage may over-order certain tests with the belief that more information earlier might

be helpful for downstream NPs, PAs, and physicians. The data from this study show that, in this ED setting, team triage ordered fewer of every test studied—head CT, troponin, lactate, INR, blood culture, and GFR compared with the non–team triage setting. For head CT, lactate, INR, and blood culture, these decreases were statistically significant.

During this study, team triage NPs and PAs were allowed to order any studies that they thought the patient needed based on their assessment. It is likely that there were fewer head CTs, troponins, lactates, INRs, blood cultures, and GFRs ordered during team triage because only the most pertinent tests for the patients were ordered. By the time the downstream NPs, PAs, and physicians had seen the patients, the team triage tests likely resulted, and the cause of the patient's symptoms may have been found through laboratory tests or imaging from team triage. This likely decreased the need to add on more tests. Before team triage, NPs, PA, and physicians may have ordered more tests, even those that might not have been immediately pertinent to the patient's chief complaint, because they did not want the patient to wait for repeat imaging and blood work, especially after the patient had already waited (sometimes many hours) to be seen.

This study showed that the diagnostic yield was only significantly lower in team triage for INR and GFR. This was likely attributed to many patients needing these tests ordered before receiving certain imaging, procedures, or medications. For example, GFR is needed before ordering many types of CT imaging and magnetic resonance imaging for patients. In addition, INR is often needed for patients who are currently on anticoagulation, might need anticoagulation, need surgery, or need a special procedure.

6 | CONCLUSION

In summary, this study found that team triage, where NPs and PAs order tests and nurses place IVs and collect laboratory results in triage, did not increase testing and led to increased discharges, decreased time to discharge, and decreased time to admission. However, team triage resulted in decreased ED observation placement and increased time to ED observation.

CONFLICTS OF INTEREST
The authors declare no conflict of interest.

AUTHOR CONTRIBUTIONS
SMH, EJM, and AF have made substantial contributions to conception and design. SMH, EJM, AF, RC, KS, and GMP made contributions to the acquisition, analysis, and interpretation of data. SMH, EJM, CK, AR, AF, PV, RC, KS, and GMP were involved in drafting the manuscript as well as revising it with important intellectual content, and gave final approval of the version to be published.

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