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EMERGENCY DEPARTMENT HOLDING ORDERS

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☐ **Abstract—Background: Holding orders help transition admitted emergency department (ED) patients to hospital beds. Objective: To describe the effect of ED holding orders. Methods: We conducted a single-site retrospective study of ward admissions from the ED to the hospital internal medicine (HIM) service over 2 years. Patients were classified based on whether the ED did (group 1) or did not (group 2) write holding orders; group 1 was subdivided into patients sent to the floor with only ED holding orders (group 1A) vs. with subsequent HIM admission orders (group 1B). Outcomes were ED length of stay (LOS), time from decision to admit to ED departure (D→D), transfer to a higher level of care within 6 h (potential undertriage), and discharge from admission ward within 12 h (potential overtriage). Results: There were 9501 admissions: 6642 in group 1 (2369 in group 1A and 4273 in group 1B) and 2859 in group 2. Reductions in mean LOS between groups (with 95% confidence intervals [CIs] of the differences) were as follows: group 1 vs. 2: 44 min (39–49 min); group 1A vs. 1B, 48 min (43–53 min); group 1B vs. 2: 27 min (22–32 min); group 1A vs. 2: 75 min (69–81 min). Mean D→D was shorter in group 1A than 1B by 43 min (40–45 min). Holding orders were not associated with increases in potential undertriage or overtriage. Conclusions: ED holding orders were associated with improved ED throughput, without evidence of undertriage or overtriage. This work supports the use of holding orders as a safe and effective means to improve ED patient flow.** © 2017 Elsevier Inc. All rights reserved.

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☐ **Keywords—holding orders; throughput; length of stay**

INTRODUCTION

The transition from emergency department (ED) bed to hospital bed is a crucial point in the continuum of care of patients who are admitted to the hospital. Delays in this transition are referred to as "access block," and can contribute to ED crowding (1,2). ED crowding is, in turn, associated with negative effects on ED throughput, ED outcomes, and patient perceptions of care (3–7).

A limited number of previous studies have described the use of ED holding orders to facilitate the transfer of patients to hospital beds (8–12). The use of holding orders is often controversial, with admitting services concerned about the possibility of both undertriage (admitting a patient to a ward bed when an advanced care bed is necessary) and overtriage (admitting a patient to a ward bed when discharge from the ED might be appropriate). Nonetheless, holding orders are an important component of the admission process in many hospitals, and both the American College of Emergency Physicians and the American Academy of Emergency Medicine have issued position statements on their use (13,14).

We reviewed 2 years of data at our facility to assess the impact of holding orders on the admission process, and report the association of holding orders with changes (or lack thereof) in length of stay, time from decision to

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admit to ED departure, potential undertriage, and potential overtriage.

METHODS

Study Design

This was a retrospective analysis of 2 years of routinely gathered operational data at a single facility from January 1, 2014 to December 31, 2015. This study was part of a quality-improvement initiative and was categorized as exempt from our Institutional Review Board process, with a waiver of the requirement for informed consent.

Study Setting and Population

The Mayo Clinic Arizona (MCA) ED is part of a tertiary care hospital in Phoenix, Arizona, and is staffed 24 h per day with board-certified emergency physicians. There were approximately 29,500 visits per year during the study period, and the admission rate was 33%. Of these admissions, approximately 50% were admitted to a ward bed on the Hospital Internal Medicine (HIM) service.

During the study period, the MCA hospital had 268 licensed beds. Mean occupancy, defined as the ratio of hospital patients to staffed beds (expressed as a percentage) and calculated daily at 6 AM was approximately 80%.

The ED has 24 individual treatment rooms, with 9 potential hallway treatment spaces that can be utilized when volume requires and nursing resources allow. There is no emergency medicine training program, although residents from other services perform rotations as ED providers, assisting in the evaluation of approximately 5% of patients. There is no ED observation unit and no "fast track."

We reviewed all admissions to a ward bed on the HIM service during the study period. The HIM service is a dedicated, hospitalist-run service that admits all general medicine patients. It is staffed 24 h per day by attending physicians, with support from internal medicine resident physicians, nurse practitioners, and physician assistants. We did not review admissions to the intermediate care unit (a level of nursing acuity higher than that of a general ward bed but less than that of an intensive care unit [ICU]), as the ED does not write holding orders on this group. We also did not review admission to the ICU, as the ED does not write holding orders on these patients and they are admitted to a separate, dedicated ICU service. Finally, we did not review admissions to specialty medical services (such as cardiology) or surgical services.

Study Protocol

At our facility, ED holding orders consist of a brief set of orders to transition the patient's care to a hospital bed. Holding orders direct general nursing care, attest to several patient characteristics, and identify the responsible admitting service and attending physician. The components of these holding orders are presented in Table 1. Many of the data fields in this order set are prepopulated, reducing the amount of work needed to complete them, and we estimate that entering these orders requires approximately 1 minute of work on the part of the emergency physician.

The ED writes holding orders on approximately 70% of eligible patients, and there are many reasons why a provider might not write holding orders. If the emergency physician believed that the patient might need intermediate-level care, the patient would be evaluated by HIM in the ED. If such a patient was ultimately deemed appropriate for a ward bed, the usual workflow would be for HIM to write full admission orders without the ED writing holding orders. Individual ED provider practice also varied significantly; during the 2-year study period, the rate at which individual providers wrote holding orders on eligible patients ranged from 26% to 97%. Another reason was time of day; by agreement, the ED does not write holding orders on patients seen overnight if the HIM service believes that they (the HIM service) have insufficient resources to evaluate a patient expeditiously once the patient arrives to the floor.

Whether or not the ED writes holding orders, HIM may begin evaluating patients in the ED immediately after the initial ED−HIM discussion in which agreement to admit is reached. HIM may begin or complete full admission orders while the patient is in the ED. When the ED does not write holding orders, the patient can only be transferred to a ward bed after HIM has written admission orders. By agreement, patients are not to be held in the ED solely so that HIM can complete an evaluation. This workflow was in place for at least 2 years before

Table 1. Holding Orders and Patient Characteristics Entered by Emergency Department

Patient Characteristics	Holding Orders
Disposition: admit	Admit diagnosis
Vital signs	Patients condition
Neurology checks	Admitting physician
Cardiac monitoring/telemetry	Admitting service
Activity	Level of care
Diet	Isolation (yes/no)
Enteral tube care	Transplant (type)
IV access	Confused (yes/no)
Call provider for questions	Sitter required (yes/no)
Emergency department insert Foley	Medicated drip
Consult respiratory/breathing treatment	Stable for Transfer (yes/no)
Oxygen therapy	Current oncology patient (yes/no)
Respiratory-driven protocols	

the beginning of the study period, and did not change during the study period.

Our workflow creates two distinct categories of patients admitted to a ward bed on the HIM service: those for whom the ED writes holding orders (group 1), and those for whom it does not (group 2). The first group can be further divided into 2 subgroups: those who are admitted based only on ED holding orders (group 1A), and those who are admitted after HIM has completed their evaluation and written admission orders (group 1B). Of note, our categorization is based on outcome, not intent. If, for example, an emergency physician writes holding orders with the expectation that a patient will be transferred expeditiously to a hospital bed, but that patient is held (for whatever reason) in the ED until HIM has written admission orders, the patient would be classified as group 1B.

Measurements

All data were extracted directly from the electronic medical record (Cerner, Kansas City, MO), from customized reports based on the electronic medical record, or from internal hospital operations reports.

Baseline Subject Characteristics

For each admission, we ascertained patient age, sex and Emergency Severity Index (ESI) score; time of day (shift) of registration; number of plain radiographs, cross-sectional imaging studies (ultrasound, computed tomography, and magnetic resonance imaging), laboratory tests, and IV medications and fluids ordered; 6 AM hospital census; and daily ED volume. Many of these factors have been previously associated with longer ED length of stay (LOS) (15–17).

Primary Endpoints

LOS was defined as the time from registration to the time of ED departure or the time at which the patient was placed into holding status, and is reported in minutes. Patients are generally placed into holding status if a hospital bed is not assigned within 4 h of the decision to admit, and is made independently of ED holding order or HIM service admission order status. The criteria for placing a patient into holding status did not change during the study period. Holding was recorded daily at 6 AM, and occurred infrequently during the study period (18 of 730 days; 2.5%). On days in which patients were held, the mean number of holds was 3.6 (range 2–8).

Time from decision to admit to departure from the ED (D→D) was defined as the time from when the emergency physician indicated his or her intent to admit the patient (as indicated by placing holding orders) to the time at which the patient left the ED or was placed into holding status. This was reliably captured only for group 1 patients, and is reported in minutes.

We defined transfer to a higher level of care within 6 h (HLC-6) as occurring when a patient was admitted to a ward bed but transferred to an intermediate care unit or ICU bed within 6 h of arrival to the ward bed. We used HLC-6 as a measure of potential undertriage. HLC-6 is reported as frequency and percentage.

We defined discharge from the hospital within 12 h (D-12) as occurring when a patient was discharged from a ward bed within 12 h of arrival to that bed. We used D-12 as a measure of potential overtriage. D-12 is reported as frequency and percentage.

Analysis

We use descriptive statistics, including number of observations, mean and standard deviation for quantitative variables, and counts and percentages for qualitative or categorical variables. We compare continuous variables via univariate analysis, unadjusted group comparisons via Student's *t*-test with unequal variance, and categorical variables via the Pearson χ^2 test.

We performed simple comparisons for multiple groups (1 vs. 2, 1A vs. 1B, 1B vs. 2, and 1A vs. 2) with respect to outcomes for all eligible admissions, as well as multivariate regressions (when possible) in an attempt to control for differences in baseline subject characteristics between groups. We report results for all eligible admissions, as well as for the subset of total admissions who presented to the ED with the chief complaint of chest pain. We analyzed the latter group to better understand the role (if any) that patient type might play in outcomes.

Statistical analyses were performed using SAS Studio, version 3.4 (SAS Institute, Cary, NC).

RESULTS

Characteristics of Study Subjects

There were 9612 admissions to a ward bed on the HIM service during the 2-year study period. We excluded 104 admissions for missing ESI score and 7 for illogical LOS (LOS of 0 or <0). This left 9501 total admissions available for analysis: 6642 in group 1 (2639 in group 1A and 4273 in group 1B), and 2859 in group 2. There were 994 admissions to a ward bed on the HIM service that presented to the ED with chest pain: 712 in group 1 (242 in group 1a and 470 in group 1b), and 282 in group 2. The baseline characteristics for these groups are presented in Table 2.

Table 2. Patient and Facility Characteristics

Characteristics	Group 1	Group 1A	Group 1B	Group 2
All admissions				
Age, years, mean (SD)	68.0 (17.3)	68.1 (17.2)	67.9 (17.3)	67.5 (17.3)
Sex (% female)	52.5	52.7	52.3	52.4
ESI, %				
1	0.2	0.1	0.3	0.1
2	18.7	19.0	18.5	23.0
3	80.0	79.7	80.2	75.8
4	1.1	1.2	1.0	1.1
5	0	0	0	0
Shift, %				
Day	53.4	53.7	53.3	37.8
Evening	36.9	37.2	36.7	47.5
Night	9.7	9.1	10.0	14.7
X-ray study, %				
0	33.0	33.6	32.7	34.6
1	58.0	57.8	58.2	56.3
2 or more	8.9	8.6	9.1	9.2
Advanced imaging, %				
0	54.8	56.5	53.9	51.9
1	35.4	34.7	35.7	37.0
2 or more	9.8	8.8	10.3	11.2
Laboratory tests, n, mean (SD)	14.1 (7.4)	14.3 (7.4)	13.9 (7.3)	13.8 (2.7)
IV medications and fluids, n, mean (SD)	2.4 (2.1)	2.1 (2.0)	2.5 (2.2)	2.7 (2.3)
Hospital occupancy, %, mean (SD)	79.3 (9.8)	78.9 (9.7)	79.6 (9.9)	79.6 (9.5)
Daily ED volume, mean (SD)	82.9 (12.4)	82.8 (12.6)	82.9 (12.3)	83.3 (12.4)
Admissions presenting with chest pain				
Age, years, mean (SD)	66.1 (14.0)	66.2 (14.7)	66.1 (13.6)	67.6 (15.2)
Sex (% female)	54.4	55.0	54.0	51.4
ESI				
1	0	0	0	0
2	19.7	20.2	19.4	25.5
3	80.1	79.3	80.4	74.5
4	0.3	0.4	0.2	0
5	0	0	0	0
Shift, %				
Day	50.0	50.4	49.8	31.9
Evening	35.3	35.5	35.1	42.6
Night	14.7	14.0	15.1	25.5
X-ray study, %				
0	8.4	5.8	9.8	10.3
1	87.8	88.0	87.7	82.3
2 or more	3.8	6.2	2.6	7.4
Advanced imaging, %				
0	75.4	75.6	75.3	70.6
1	21.1	22.3	20.4	22.7
2 or more	3.5	2.1	4.3	6.7
Laboratory tests, n, mean (SD)	13.1 (6.3)	13.8 (7.3)	12.7 (5.6)	12.8 (7.0)
IV medications and fluids, n, mean (SD)	0.8 (1.3)	0.7 (1.2)	0.8 (1.4)	1.2 (1.6)
Hospital occupancy, %, mean (SD)	79.7 (10.2)	79.2 (10.8)	79.9 (9.8)	79.4 (9.7)
Daily ED volume, mean (SD)	83.2 (11.7)	83.0 (11.0)	83.3 (12.0)	83.3 (12.0)

ED = Emergency Department; ESI = Emergency Severity Index; SD = standard deviation.
Mathematical relationships may appear imprecise due to rounding.

Main Results

Data for LOS, HLC-6, D-12, and D→D (for group 1A and group 1B) are presented in Table 3. Intergroup comparisons, including percentage changes from the regression model for LOS and D→D, are presented in Table 4. Results include the percent change and 95% confidence interval (CI) for the change. Significance was set at 0.05.

All variables noted in Table 2 were included in the multivariate regression analyses for LOS and D→D. The multivariate model did not show any lack of fit; R^2 was 0.27 and R^2 adjusted was 0.26. We transformed the coefficient estimates to the original scale LOS, and present these results in Table 4.

The low event rates for HLC-6 and D-12 precluded a meaningful regression analysis for these outcomes.

Table 3. Results (Primary Endpoints)

All	Group 1 (n = 6642)	Group 1A (n = 2369)	Group 1B (n = 4273)	Group 2 (n = 2859)
LOS, min, mean (SD)	290 (105)	259 (97)	307 (105)	334 (112)
D→D, min, mean (SD)	NA	82 (43)	125 (70)	NA
HLC-6, n (%)	69 (1.04)	30 (1.27)	39 (0.91)	28 (0.98)
D-12, n (%)	90 (1.36)	30 (1.27)	59 (1.38)	84 (2.94)
Chest pain patients	**Group 1 (n = 712)**	**Group 1A (n = 242)**	**Group 1B (n = 470)**	**Group 2 (n = 282)**
LOS, min, mean (SD)	259 (86)	227 (72)	275 (88)	300 (100)
D→D, min, mean (SD)	NA	75 (32)	120 (57)	NA
HLC-6, n (%)	2 (0.28)	0 (0)	2 (0.43)	1 (0.35)
D-12, n (%)	27 (3.79)	10 (4.13)	17 (3.62)	34 (12.06)

D→D = admission decision to departure; D-12 = discharge within 12 h; HLC-6 = transfer to higher level of care within 6 h; LOS = length of stay; NA = not applicable; SD = standard deviation.

DISCUSSION

As ED operations management has matured, a growing number of interventions have been reported to improve ED flow. Most focus on the "front-end" of ED operations, as these processes are usually owned in their entirety by the ED. Such interventions have been reviewed elsewhere and include (among others) the use of a fast track, bedside registration, physician in triage, and patient streaming (18,19).

There are fewer reports of process improvements in ED throughput and output, which often involve external stakeholders and can be harder to implement. Reported successes in this area include reducing laboratory processing time (in both a central laboratory and with point-of-care testing), using a bed supervisor to assure timely discharge from critical inpatient units, using an "emergency journey coordinator," and using a short text message reminder to encourage consultants to complete ED evaluations (20–24).

Holding orders (also known as interim orders, transfer orders, transition orders, or bridging orders) are another potential process change to improve ED flow. The American College of Emergency Physicians (ACEP) uses the term *transition orders* and describes them as "those written by the [emergency physician] as a means to facilitate the safe transition of the patient from the ED to the inpatient setting, until formal admitting orders are written by the responsible [admitting physician] (or designee)" (13). Importantly, ACEP also notes that "transition orders are skeletal by nature, and only cover basic patient maintenance, not inpatient evaluation, diagnosis and treatment." ED-written holding orders are not synonymous with formal admission orders, which would continue the responsibility of the emergency physician for the patient into the inpatient setting. The position statements of both ACEP and the American Academy of Emergency Medicine (which uses the term *holding orders*) imply that writing holding orders, but not admission orders, is a reasonable and acceptable practice (13,14).

Reducing LOS and components of LOS (such as D→D) are key goals in improving ED operations. There are, however, important countermeasures to consider. Any improvement in LOS that came at the expense of patient safety would be pyrrhic, as would a small improvement in LOS that was associated with a significant increase in resource utilization. With respect to resource utilization in particular, expensive decisions made by emergency physicians (such as the decision to admit) are likely to come under increasing scrutiny in the future (25).

We found that the use of holding orders at our facility was associated with improved ED throughput without deterioration in safety or resource utilization countermeasures. The use of holding orders was not associated with a statistically significant increase in the rate of transfers to a higher level of care within 6 h (which might reflect undertriage to a ward bed when a higher level of nursing care would have been more appropriate) or an increase in the rate of discharge from the hospital within 12 h (which might reflect overtriage to a hospital bed when discharge from the ED would have been more appropriate). We found these results not only in an analysis of all admissions, but in a subgroup analysis of admitted patients who presented to the ED with chest pain.

Our results are consistent with the (limited) previous literature in this area. We identified five previous studies that addressed the use of holding orders: three report both throughput outcomes and undertriage countermeasures, and two report throughput outcomes alone. None of these studies report on overtriage countermeasures (8–12).

Table 4. Intergroup Differences

	Group 1 vs. Group 2	Group 1A vs. Group 1B	Group 1B vs. Group 2	Group 1A vs. Group 2
All Admissions				
LOS*	**−44 (−49 to −39)**	**−48 (−53 to −43)**	**−27 (−32 to −22)**	**−75 (−81 to −69)**
LOS†	**−14 (−15 to −12)**	**−13 (−15 to −11)**	**−9 (−11 to −7)**	**−21 (−23 to −19)**
D→D*	NA	**−43 (−46 to −40)**	NA	NA
D→D†	NA	**−34 (−36 to −31)**	NA	NA
HLC-6, %	0.06 (−0.42 to 0.47)	0.35 (−0.15 to 0.94)	−0.07 (−0.56 to 0.38)	0.29 (−0.29 to 0.90)
D-12, %	**−1.58 (−2.31 to −0.95)**	−0.11 (−0.66 to 0.50)	**−1.56 (−2.31 to −0.87)**	**−1.67 (−2.45 to −0.90)**
Admissions presenting with chest pain				
LOS*	**−41 (−53 to −29)**	**−48 (−61 to −35)**	**−25 (−39 to −11)**	**−73 (−88 to −58)**
LOS†	**−11 (−16 to −5)**	**−14 (−20 to −8)**	**−7 (−13 to −1)**	**−18 (−24 to −12)**
D→D*	NA	**−45 (−53 to −37)**	NA	NA
D→D†	NA	**−38 (−43 to −32)**	NA	NA
HLC-6, %	−0.07 (−1.71 to 0.72)	−0.43 (−1.54 to 1.17)	0.07 (−1.58 to 1.22)	−0.35 (−1.98 to 1.24)
D-12, %	**−8.26 (−12.74 to −4.57)**	0.52 (−2.30 to 4.08)	**−8.44 (−12.96 to −4.53)**	**−7.92 (−12.63 to −3.25)**

D→D = admission decision to departure; D-12 = discharge from ward bed within 12 h; HLC-6 = transfer to a higher level of care within 6 h; LOS = length of stay; NA = not applicable.
Results presented as differences in means for LOS, D→D and percentages for HLC-6, D-12 with (95% confidence intervals of differences). Boldface indicates statistically significant differences. Mathematical relationships may appear imprecise due to rounding. See text for discussion of groups.
* Simple comparisons in minutes.
† Percent change in geometric means after regression analysis.

Four of the five studies that reported throughput outcomes found a statistically significant improvement with holding orders (8,9,11,12). In one study, the mode of time from first physician contact to admit request improved by 47 min (8). In another, the mean time from ED decision to admit until the patient arrived on the medical service improved by 129 min (9). In a third, time from disposition decision to patient departure improved by approximately 120 min and overall LOS improved by approximately 90 min, even though the time from patient arrival to disposition increased modestly (11). In a final study, time from inpatient bed request to patient departure improved by 90 min, and time from inpatient bed request to receipt of admission or transition orders improved by 135 min (12).

Although the relatively large differences in throughput outcomes in these previous studies may be due to the heterogeneity of chosen measures, they may also be a function of differences in institutional admission processes. A recent study developed a 4-type model to describe admission policies, and inter-facility differences in the execution of these models likely produce countless variations (26).

Previous studies on holding orders have focused on potential undertriage, but assess undertriage differently. One study used either transfer to a higher level of care (ICU or operating room) within 24 h or clinical deterioration (defined as a drop in systolic blood pressure of 20 mm Hg, any systolic blood pressure < 90 mm Hg, need for intubation, need for ventilatory support, or cardioversion) (8). A second used mortality alone (9). A third used transfer (between units or to the ICU) within 48 h, mortality, and incident reports about patient condition (10). None found a difference in any of the chosen measures. One of the two studies that did not explicitly report on potential undertriage did report that the use of holding orders in the ED admission process did not result in an anecdotal increase in the number of patient safety events (11).

We believe that our results build on the findings of previous studies and add to the understanding of the impact and importance of ED holding orders. Although our observational design means that there is no before-and-after comparison, our workflow allows us to compare multiple groups, resulting in what we believe to be multiple insights. We also report on potential overtriage, which to our knowledge has not been addressed previously.

Our comparison of group 1 vs. group 2 demonstrates that the process of writing holding orders is associated with a shorter ED LOS, and our comparison of group 1B vs. group 2 demonstrates that this association is present even when transfer occurs only after the admitting service completes its work-up and places admission orders. In our facility, a bed search may begin in earnest only after orders (either holding orders or service admission orders) are placed; holding orders therefore begin this process earlier in the patient's encounter, which likely accounts for much of our observed reduction in LOS in these two comparisons. To the extent that such a workflow is relatively unique, this may limit the generalizability of our results; however, we believe that such a workflow is relatively common.

We acknowledge that there are interpretations for the observed differences between these groups other than the effect of holding orders. Differences in patient acuity

(as evidenced by the lower ESI scores for patients in group 2) or hospital occupancy (which affects bed availability) might influence LOS, but we accounted for these factors in our regression model and still found significant differences. It is also possible that complicated and time-consuming patients were more likely to be in group 2, but our analysis of a group of patients presenting with the same chief complaint (chest pain) yielded reductions in LOS nearly identical to our all-patient analysis, suggesting that type of patient was less likely to be a factor.

Our comparison of group 1A vs. 1B demonstrates that once ED holding orders are written, spending additional time in the ED (until service admission orders are written) prolongs LOS without improving metrics of potential undertriage or overtriage. The previously mentioned alternative explanations noted in the comparisons of group 1 vs. 2 and group 1B vs. 2 also apply here, as do the reasons why we believe that these alternative explanations are less likely.

Finally, our comparison of group 1A vs. group 2 approximates the differences between two extreme admission policies: one in which the ED writes holding orders and the admitting service does not fully evaluate the patient vs. one in which the ED does not write holding orders at all, waiting for the admitting service to place admission orders. This comparison yielded the largest difference in LOS (75 min) of any inter-group comparison, without any statistically significant increase in measures of potential undertriage or overtriage.

While we found that the use of ED holding orders was not associated with an increase in D-12, we did not find that D-12 was equal in comparisons between groups. For most comparisons, we found that the use of holding orders was associated with a lower rate of D-12. This finding surprised us, and may simply have been the result of HIM performing more testing earlier in patients with longer ED LOS, leaving less to do during the admission. We caution against any conclusion that emergency physicians overtriage at a lower rate than HIM physicians.

Limitations

We can comment on association but not causation, as ours are uncontrolled observational data. Although we have attempted to mitigate this limitation by performing a multivariate analysis incorporating multiple potential confounders for LOS and D→D, we cannot be certain that we have accounted for every significant factor.

Our analysis is not intervention-based; that is, there is no before-and-after analysis of the effect of instituting a holding order policy for ED patients. Rather, we analyzed routinely gathered data. Importantly, there may be a selection bias as to why physicians wrote holding orders on some patients but not others. While we attempted to account for this by performing a regression analysis incorporating patient, ED, and hospital characteristics, we acknowledge the limitations in this approach.

We relied heavily on systems-generated data extracted from the electronic medical record. We cannot be certain that every data point is accurate, and cannot verify that errors are random, rather than affecting one group more than another.

Ours was a single-facility study, which necessarily limits the external validity of our results. Although we believe that the problem of ED output is one that is faced by many facilities, and that holding orders seemed to mitigate this problem at ours, we cannot be certain that this solution would be appropriate for others.

Our workflow, in which the ED does not write holding orders on patients who may need care on our Intermediate care unit, is itself a likely source of confounding. We found an acuity bias, whereby patients in group 2 had a higher acuity (lower ESI score): 23.1% of the group 2, vs. 18.9% of group 1, had an ESI score of 1 or 2 ($p = 0.0009$). We attempted to mitigate this concern by incorporating ESI score as a factor in our regression analysis.

The fact that the ED is less likely to write holding orders overnight is another confounding factor, as ED throughput may be different at different times of the day. We attempted to mitigate this concern by including registration time in our regression model.

We chose transfers to a higher level of care (HLC-6) as a measure of undertriage. However, transfers to higher levels of care are process outcomes, not patient outcomes, and the degree to which such transfers are a signal of patient harm or adverse events is not known. Furthermore, although we could not find a statistical difference in HLC-6 between groups, we cannot conclude that a difference does not exist. Our data may simply lack the power to detect such a difference given the relatively low occurrence of HLC-6, and that a larger sample may have found a statistically significant (albeit relatively small) difference between the groups.

We chose discharge within 12 h of arrival to a bed (D-12) as a measure of potential overtriage, but note that this metric has limitations. Although this measure almost certainly captures patients evaluated on the ward and deemed to not need hospital-level care, it almost assuredly captures some patients for whom a brief observation period was appropriate. Insofar as our facility lacks an ED observation unit, many patients who require brief periods of observation might be appropriately admitted (into observation status) and discharged within 12 h. Importantly, categorization as D-12 does not necessarily imply excessive resource utilization; it may simply reflect vigilance for patient safety.

In our analysis of chest pain patients, we identified patients by chief complaint rather than admission diagnosis.

We chose this methodology because the admission diagnosis was sometimes entered by the ED provider only and sometimes by the HIM provider only, creating a significant source of variation. Chief complaint, however, was always documented by the same providers (triage nurses) for all patients.

CONCLUSIONS

In a single-facility study, the use of holding orders was associated with improved ED throughput without evidence of undertriage or overtriage. This work adds to the literature suggesting that holding orders deserve consideration as a means to improve ED patient flow.

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ARTICLE SUMMARY

1. Why is this topic important?

Interventions to improve patient flow without jeopardizing patient safety are of interest to every emergency physician. Holding orders (also known as interim orders, transfer orders, transition orders, or bridging orders) are used in many emergency departments (EDs), but there is little published experience to quantify their effect on length of stay or to examine the potential impact of holding orders on patient safety or resource utilization.

2. What does this study attempt to show?

The authors describe the impact of holding orders on patient length of stay, while also reporting on transfers to a higher level of care (as a measure of potential undertriage) and on early discharges from the hospital (as a measure of potential overtriage).

3. What are the key findings?

Holding orders were associated with a decrease in length of stay, without an increase in measures of undertriage or overtriage.

4. How is patient care impacted?

This work supports the use of ED-written holding orders as a safe and effective means to improve ED throughput.