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BRIEF REPORT

General Medicine



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Standardized evaluation of hand-off documentation of ICU boarders in the emergency department

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Abstract

Objective: The boarding of ICU patients in the emergency department (ED) represents a considerable risk to patient safety. This study aims to describe the generation of a rubric to ensure the fidelity of vital, written hand-off between ED teams.

Methods: We performed a mixed methods design to develop a scoring rubric to evaluate written hand-off communication of medical ICU boarders between ED teams during the COVID-19 pandemic. The primary outcome was the quality of the written hand-off as agreed upon by the inter-user agreement. Our secondary outcome included variability in written quality as a function of the number of separate and distinct ED teams at the point of the transition of care.

Results: There was a moderate inter-user agreement with rubric scoring ($\kappa = 0.70$ [95% confidence interval, 0.66–0.75]). The overall trend noted that several key elements, including code status, performed interventions, and contingency planning, were infrequently documented.

Conclusions: We effectively created a quality assurance tool for ED ICU boarders that ensures relevant and vital information is relayed between ED teams. Our analysis demonstrated that all relevant information is only sometimes present in the hand-off.

KEYWORDS

health care quality assurance, patient hand off, quality improvement

1 | INTRODUCTION

that no such relationships exist.

1.1 | Background

Communication failure is a significant cause of medical errors and inhospital morbidity and mortality. It is well documented that hand-off is one of medicine's most high-risk events.^{1,2} Hand-off is associated with

an increased risk of mortality and morbidity, which can be exacerbated by prolonged emergency department (ED) boarding.³ ED boarding has dramatically increased relative to pre-pandemic levels,^{4,5} leading to an increasing number of hand-offs between emergency physicians. Of particular concern is the increased volume of ICU patients boarding in the ED, necessitating increasing transitions between care teams.

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1.2 | Importance

Successive hand-off between ED teams represents a potential for miscommunication that may affect patient outcomes, including mortality, morbidity, and prolonged in-hospital length of stay.^{1–3,6–8} Ensuring the fidelity of information transferred between ED teams concerning the most complex and critically ill patients is paramount.

1.3 | Goals of this investigation

In this study, we illustrate the formulation of a standardized rubric to assess the quality of written hand-offs between emergency medicine physician teams specific to patients admitted to the ICU who are boarding in the ED.

2 | METHODS

2.1 Study design and setting

This study was a combination of mixed methods designed to develop a scoring rubric to evaluate the written hand-off communication in the "MD Comments" of a convenience sample of medical ICU boarders in the ED. It was deemed exempt by the institutional review board at Beth Israel Deaconess Medical Center.

"MD Comments" is a text box within the electronic medical record that serves as a hand-off tool between ED teams and provides asynchronous sign-out from ED to non-ICU level inpatient teams.⁹ The written communication in "MD Comments" is a standardized handoff tool. It includes a brief history, pertinent physical exam, one-line assessment and plan or medical decision-making, and disposition. "MD Comments" are written by the primary team caring for the patient and are updated by each successive team responsible for the patient's care.

To formulate the rubric, we followed a modified Delphi method.¹⁰ We convened an expert panel of faculty in March 2022, with 8 faculty members with experience in clinical operations, quality assurance, ED observation, and medical education. Academic rank spanned from Instructor to Associate Professor. This panel represented approximately 60 years of combined experience in clinical process improvement. We extensively reviewed the available literature and focused narrowly on relevant studies.^{2,6,11-21} We convened a workgroup to discuss the elements. After 2 iterative rounds, we obtained consensus by unanimous vote.

This process generated an objective rubric with written hand-off features vital to safe and appropriate transfer documentation of ICU patients boarding the ED (Figure 1). We assigned dichotomous values to enable scoring and descriptive statistics, with 1 being present and 0 being absent. Process validity was ensured by piloting the rubric against a convenience sample. The reliability of data extraction was

The Bottom Line

Hand-offs between emergency department teams for boarded patients is a high-risk area, especially for ICU cases. The researchers looked at a scoring rubric for such hand-offs that could ensure inclusion of all relevant vital information. The opportunity was found particularly in code status, performed interventions, and contingency planning elements often missed.

verified via a sampled review. We followed the guidelines to reduce bias in emergency medicine chart review studies by using systematic data collection with a trained abstractor and ensuring necessary data were available within reviewed charts.²²

2.2 Selection of participants

We used quality assurance functions within the electronic medical record to obtain a data set of all ICU admissions during the COVID-19 pandemic, extracted in March 2022. This included operational metrics such as admissions to the ICU, length of stay, number of physician teams involved, time from admission request to transfer to ICU, and the final "MD Comments." We excluded ICU boarders involving a subspecialist or surgical team that co-manages their ICU patients. Therefore, our study population only included ED medical ICU boarders, with more than 2 emergency physician teams involved in their care. All data were anonymized at the point of extraction.

We used a convenience sample of ED ICU boarders during the COVID-19 pandemic that included periods of low (April 1 to May 31) and high (August 1 to September 30) boarding volume that reflected internal and national trends.^{4,23,24} These periods differ in the total number of medical ICU admissions at our institution, ED length of stay, and the volume of medical ICU boarders.

2.3 Outcomes

The primary outcome was evaluating the quality of written hand-off of medical ICU boarders between emergency physician teams using our expert panel-derived rubric that was scored by two separate individual reviewers. We scored the written sign-out based on rubric elements that were present or absent, as documented in the "MD Comments." We also performed a chart review for each visit, including code sheets, nursing documentation, clinical trigger documentation, and admission notes. This eliminated subjectivity when scoring specific parameters such as the documentation of status changes or interventions that may have occurred but were not documented in "MD Comments." This was made available to the scorers.

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Illness Severity (stable/unstable/critical)	 Point is assigned if language suggests the patient falls into one of these categories. No point is assigned if absent.
Code status	Point is assigned if present.No point is assigned if absent.
ICU indication	 Point assigned if clear indication. No point assigned if the indication is not clear.
Summary statement - some version of HPI/PE	 Point is assigned if there is a cogent summary statement. No point is assigned if the summary is absent or incomprehensible.
Interventions (intubation, chest tube, central line, blood products, vasopressors, anti-coagulation reversal, etc.)	 Point is assigned if there is an intervention, and it is documented. Point is assigned if there is no documented intervention and there is no intervention on chart review. No point is assigned if there is an intervention and there is no documentation of it.
Pending studies (if any) or clear language/inference that workup is completed	 Point is assigned if there are any documented pending studies in the hand-off, or if there is clear language or inference of a completed workup. No point is assigned if it is unclear that there is a completed workup.
Contingency planning	 Point is assigned if any contingency planning is noted. No point is assigned if there is no contingency planning.
Status changes/interventions post hand off if any	 Point is assigned if there is a status change, and it is documented. Point is assigned if there is no status change and no documentation of a status change on chart review. No point is assigned if there is a status change and there is no documentation of a status change.
Clarity	 Point is assigned if one can tell within reason why the patient is in the ED/being admitted within 30 seconds of reading the hand-off. No point is assigned if it is unclear, confusing, or superfluous.

FIGURE 1 Written hand-off features and rubric scoring.

We defined boarding as any patient who remains in the ED for greater than 120 minutes after an admission request has been placed. $^{\rm 3}$

Our secondary outcome was to study whether the quality of written hand-off, as reflected by rubric scoring, differed with more transitions between ED care teams.

2.4 | Analysis

After generating the rubric and scoring by 2 individual scorers, we performed a κ statistic to ensure inter-rater reliability. We performed an extreme κ to assess reliability at extreme rubric score values. To

TABLE 1 Results of the analysis of rubric elements and inter-user agreement.

	No. of elements present, N = 144	Cohen's <i>ĸ</i>	Cohen's κ if rubric score present <6	Cohen's <i>π</i> if rubric score ≥6
		Overall = 0.70 (95% Cl, 0.66-0.75)	Overall = 0.52 (95% CI, 0.42-0.61)	Overall = 0.76 (95% Cl, 0.71-0.80)
Illness severity	84% (95% CI, 78%-90%)	0.14 (95% CI, -0.04-0.31)	0.11 (95% CI, -0.04-0.26)	0.00 (95% Cl,1.00)
Code status	21% (95% CI, 14%-27%)	0.72 (95% CI, 0.58-0.86)	0.59 (95%Cl, 0.25-0.93)	0.75 (95% CI, 0.61-0.90)
ICU indication	90% (95% CI, 85%-95%)	0.51 (95% CI, 0.28-0.73)	0.56 (95%CI: 0.27-0.84)	0.31 (95% CI, -0.02-0.65)
Summary statement	94% (95% CI, 90%-98%)	0.37 (95% CI, 0.05-0.69)	0.46 (95% CI, 0.10-0.82)	-0.01 (95% CI, -0.04-0.01)
Interventions	74% (95% CI, 66%-81%)	(0.48 (95% CI, 0.31-0.65)	0.39 (95% CI, 0.10-0.68)	0.43 (95% CI, 0.20-0.65)
Pending studies	98% (95% CI, 96%-100%)	0.32 (95% CI, -0.17-0.81)	0.46 (95% CI, -0.17-1.00)	-0.01 (95% CI, -0.03-0.01)
Contingency planning	15% (95% CI, 9%-20%)	0.52 (95% CI, 0.34-0.70)	0.0.00 (95% CI, 1.00)	0.53 (95% CI, 0.34 -0.71)
Status changes	85% (95% CI, 78%-91%)	0.65 (95% CI, 0.47-0.83)	0.62 (95% CI, 0.33-0.90)	0.63 (95% CI, 0.38-0.88)
Rated clarity	78% (95% CI, 71%-85%)	0.23 (95% CI, 0.05-0.42)	0.03 (95% CI, -0.22- 0.28)	0.22 (95% CI, -0.05 -0.48)

evaluate the quality of written hand-off as a function of the number of teams involved in care transitions, we analyzed the median number of key elements using a Kruskal–Wallis or Wilcoxon ranked-sum test based on the number of groups being compared. We calculated 95% confidence intervals (CIs) using the modified Wald method,^{25,26} and if the upper bound of the CI exceeded 100%, it was limited to 100%. Data were analyzed using Stata version 17.1 (StataCorp LP).

3 | RESULTS

3.1 Characteristics of study subjects

For the study period, 269 patients were admitted to the ICU and 144 were boarded in the ED.

3.2 | Main results

The distribution of the number of elements present was a median of 7 (interquartile range [IQR], 6, 7) with a minimum of 1 and a max of 9. Across 144 ICU boarders, illness severity was present 84% of the time, code status 21%, ICU indication 90%, summary statement 94%, interventions 74%, pending studies 98%, contingency planning 15%, status changes post hand-off 85%, and rated clarity was present 78% of the time (Table 1). There was a strong inter-user agreement with rubric scoring ($\kappa = 0.70$; 95% CI, 0.66–0.75); however, this varied based on components (eg, certain elements such as illness severity and clarity had no agreement). When the number of elements present was <6, there was reduced agreement (κ of 0.52; 95% CI, 0.42–0.61) in a rubric score <6 compared to kappa of 0.76 (95% CI, 0.71–0.80) for a rubric score ≥ 6 .

Comparing the quality of hand-offs regarding the number of team transitions was not statistically significant, although limited by the number of hand-offs in groups with more than 2 transitions with a total of 126 with 2 team transitions, 14 with 3 team transitions, and 4 with 4 team transitions (median number of hand-offs: 2 [IQR, 2, 2; 95% CI, 2–2]). The median number of elements present was 7 of 9 (95% CI, 6–

7; IQR, 6, 7) for 2 team sign-outs, 6 of 9 (95% CI, 5–7; IQR, 5, 7) for 3 sign-outs, and 6.5 of 9 (95% CI, 4–7; IQR, 5, 7) for 4.

3.3 | Limitations

This brief report has several limitations. This single-center study does not include the full spectrum of hand-off practices encountered in the community or similar academic settings. We cannot evaluate concurrent verbal hand-off or assess for adjunct written notes, which may provide missing and highly relevant information obtained at sign-out. Importantly, our rubric is new and is not standardized throughout our department. We were therefore using a rubric to assess written handoffs when the specifics of this rubric are not currently standardized in our sign-out process. Additionally, we only evaluated a convenience sample during a limited period, approximately 4 months and a more robust review might provide different findings. We also did not control for the experience of the hand-off author(s), which may contribute to overall quality. Last, this study is the first step in a larger validation effort, and the external and construct validity are unknown.

4 DISCUSSION

In this study, we formulated a rubric from an expert consensus that can be used to ensure appropriate, written hand-off for ICU boarders in the ED (Figure 1). Our analysis of hand-off quality yielded several findings. Most notably, illness severity, ICU indication, and pending studies were frequently present, but several were infrequently documented. Those that were infrequently documented included code status (absent from 79% of hand-offs), performed interventions (absent from 26% of handoffs), and contingency planning (absent from 85% of hand-offs).

Further, overall there was substantial inter-rater reliability, and most of the individual elements on the rubric have moderate to strong inter-rater reliability, including at rubric scores \geq 6. However, those with some degree of subjectivity, such as illness severity and clarity, have less agreement. Regarding illness severity, this is likely due to the inability to score such parameters on a reliable basis with what would

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be expected from a clinical standpoint (critically ill, stable, unstable) as this was not explicitly written in the "MD Comments" and had to be inferred based on the written documentation and the judgement of the reviewer. Likewise, clarity is subjective, despite our best efforts to explicitly qualify its scoring. This is reflected in their respective κ values and likely accounts for poor agreement at extreme rubric scores (Table 1).

Interestingly, in addition to illness severity, at extreme values, summary statements, pending studies, and contingency planning had poor or no agreement (Table 1). We suspect this may be due to some degree of subjectivity or buried information. Of note, the "MD Comments," word counts can range from 20 words to over 650 and were variably organized (Appendix 1). The scoring of summary statement was intended to be binary, although it had a degree of subjectivity in that a point was assigned if the statement was cogent (Figure 1). However, one reviewer may not assign a score if there was a sentence fragment instead of a complete sentence or if their interpretation was that it was not cogent. In addition, if there was excessive wording or poor organization, a reviewer may miss a sentence that discusses pending studies or contingency planning, especially if this was not in a bullet format. This likely accounts for these two elements' poor agreement at extreme rubric scores.

In the event of a clinical status change, one could imagine not having the code status documented, knowing what interventions, if any, had previously been performed, or having a thoughtful contingency plan could negatively and directly impact patient care. Relevant to this discussion is that our rubric can be used prospectively as a hand-off tool for single or multiple team sign-outs or retrospectively to assess quality assurance or as part of quality improvement. In a clinical setting, this hand-off tool can be used to ensure that all relevant data are present during team transitions, with the goal of decreasing errors and ensuring the fidelity of the hand-off. Future implementation of our rubric as a hand-off tool in a structured format could ensure that all key elements were present and clarify those with less agreement.

In summary, we have effectively created a hand-off rubric specific to medical ICU patients boarding within the ED. The application of our rubric in the assessment of available written hand-offs during the COVID-19 pandemic demonstrated that all vital information is only sometimes present.

AUTHOR CONTRIBUTIONS

Joshua Kolikof, Daniel Shaw, Bryan Stenson, Leon Sanchez, and David Chiu conceived the study, and supervised the conduct of data collection. Joshua Kolikof undertook data management. Anne Grossestreuer provided statistical advice and analyzed the data. Joshua Kolikof drafted the manuscript, and all authors contributed substantially to its revision. Joshua Kolikof takes responsibility for the paper as a whole.

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CONFLICT OF INTEREST STATEMENT

The authors report no conflicts of interest.

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APPENDIX 1: EXAMPLES OF HIGH AND LOW SCORING "MD COMMENTS."

Example 1

XXX with cabg afib on apixaban pacemaker, solitary kidney, transferred after becoming hypoxic hypotensive and having abd pain this am, at osh got kcentra for rp bleed around kidney, got 1 L NS and 1 L prbcs, had ?seizure in setting of hypotension. Covid in apartment building, he wasnt tested. Got abx at OSH. CT head neck w/o pathology, ct chest w/?pna,

ct abd with: Large acute bleed, predominantly contained within Gerota's fascia arising from the left renal cortex. Full code—patient stated this XXX.

ekg: v paced wide complex rhythm

Physical exam: intermittently sleepy but awakes easily, protecting airway, nl wob, nt abd, pulses in all 4 ext, guaiac+ brown stool

Plan:

XXX w/RP bleed, GI bleed, getting blood (currently on unit #3, 1 at OSH and 2 here) and 1 U platelets and abx and ppi and sicu admit. On norepi. Per IR and urology will observe and not intervene as pt is declining IR intervention. Full code based on discussion with pt in ED, previously noted on MOLST to be DNR/DNI but full code for now.

[] fibrinogen level, if low give cryo

ICU sign out elements	Score
Illness severity (stable/unstable/critical)	1
Code status	1
ICU indication	1
Summary statement	1
Interventions	1
Pending studies (if any)	1
Contingency planning	1
Status changes/interventions post hand-off	1
Clarity	1

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Example 2	ICU Sign out elements	Score
 Patient is a XXX year old XXX with seizure from hyponatremia, Na 120. Still early in workup, needs transfer for emergent renal consult. Discussed with Dr. XXX. 1 versed 9 ativan 	Illness severity (stable/unstable/critical)	0
	Code status	0
	ICU indication	1
	Summary statement	0
No imaging	Interventions	0
Given vanc, Rocephin Side tongue laceration	Pending studies (if any)	0
Hypertonic saline	Contingency planning	0
Wife w covid 1 mo ago Positive abs	Status changes/interventions post hand-off clarity	0
Expansile hypdense mass within he sella extending into the suprasellar space measuring apprxomiately XXX cm. There is apparent involvement of the left sphenoid sinus.		

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