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Oiling the gate: a mobile application to improve the admissions process from the emergency department to an academic community hospital inpatient medicine service

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ABSTRACT

The process of admitting patients from the emergency department (ED) to an academic internal medicine (AIM) service in a community teaching hospital is one fraught with variability and disorder. This results in an inconsistent volume of patients admitted to academic versus private hospitalist services and results in frustration of both ED and AIM clinicians. We postulated that implementation of a mobile application (app) would improve provider satisfaction and increase admissions to the academic service. The app was designed and implemented to be easily accessible to ED physicians, regularly updated by academic residents on call, and a real-time source of the number of open AIM admission spots. We found a significant improvement in ED and AIM provider satisfaction with the admission process. There was also a significant increase in admissions to the AIM service after implementation of the app. We submit that the implementation of a mobile app is a viable, cost-efficient, and effective method to streamline the admission process from the ED to AIM services at community-based hospitals.

1. Introduction

Graduate medical education (GME) within an academic community hospital provides many advantages, as well as challenges, in resident education. Smaller program sizes often allow for a more personalized teaching atmosphere and more hands-on experience for residents. However, there are challenges to working in a smaller, and often less strictly structured, environment. One particular concern is transitions in care from the emergency department (ED) to the academic internal medicine (AIM) service. The importance of transitions in care and communication is elucidated in the literature [1] and is underscored by the Milestones Assessment of the American College of Graduate Medical Education (ACGME). In order to graduate from residency, a resident needs to be able to: "Appropriately utilize available resources to coordinate care and ensures safe and effective patient care within and across delivery systems;" as well as "proactively communicates with past and future caregivers to ensure continuity of care" (Milestone 11) [2].

Our goal is to improve the handover process of patients in need of admission from the ED to either resident physicians in the AIM service or to the private hospitalist group. In academic community hospitals, there is currently no single standardized system to guide ED residents and attending physicians about whether to admit to the academic or private group. At our institution, the initial process of triage and acceptance of patients from the ED is the responsibility of the senior resident; always with the ability to seek council from the attending physician. This decision varies greatly and is based on the preferences of the attending and resident physicians working each day. This results in variable size and composition of the inpatient AIM team censuses and frustration of both parties. To resolve these problems, we sought to improve communication and streamline the admissions process through the use of a mobile application (app). We believe this will not only lead to higher satisfaction of participating residents and, but also result in more consistent patient loads on the inpatient services that is more conducive to optimizing resident education.

2. Materials and methods

This was a prospective, non-randomized, non-blinded, single-center trial with evaluation of a cohort before and after an intervention. The intervention was delivered through the implementation of a standardized communication and admission system in the form of an online mobile app. The app was designed to contain pertinent information to ED residents including: the name of the AIM team on call, cell phone and pager number of the senior resident on call, the name of the attending physician responsible for the AIM team, and the number of
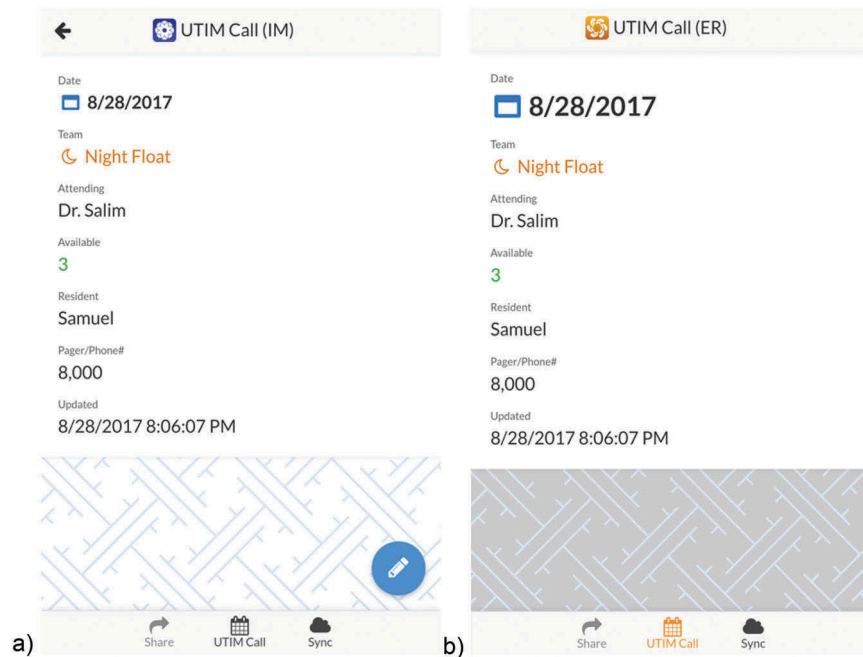
Figure 1. Mobile app user interface for (a) AIM service team and (b) ED residents and faculty.

new admissions desired from the ED for that particular day (Figure 1). This number was determined daily based on the ACGME-allowed number of patients per team and anticipated transfers that were automatically accepted into the AIM team which include, but were not limited to academic closed intensive care unit (ICU) and outside hospital transfers. With each new admission to the AIM service, the number of admissions available is updated by the respective senior resident. The ED and AIM residents and faculty are responsible for referencing this list to call for admissions.

Prior to the implementation of the app, a pre-intervention data set was collected to evaluate two primary variables: (1) the satisfaction of ED and AIM residents with the overall ease, safety, and efficiency of the admissions process and (2) the average inpatient census from the AIM team. Satisfaction was assessed through a four-question pre- and post-intervention survey administered to all ED and AIM residents and faculty members. In addition, ED faculty and residents were asked three questions relevant only to ED personnel. Scoring of the survey was on a Likert-style scale ranging from Strongly Disagree (1) to Strongly Agree (9). The four-question survey assessed satisfaction with sign-out structure, patient safety on transfer, and efficiency of patient transfer. The three questions asked only of ED residents and faculty measured satisfaction with ease of contacting the AIM on-call resident, knowing how many patients the AIM team can admit, and understanding which cases were most appropriate for the AIM team. To allow for comparison and internal validity, the same survey was utilized pre- and post-intervention (Figure 2).

Pre and Post Satisfaction Survey for AIM and ED Residents

ED and AIM Faculty and Resident Responses

Q1: I feel there is a clear and uniform process for determining which group (hospitalists vs. Academic IM team) should be called to when a new patient is needing admission.

Q2: I am satisfied with the current admission/signout structure

Q3: I believe the current admission/signout process allows for safe patient transfers.

Q4: I believe the current admission/signout process allows for efficient admission of new patients. transfers.

ED ONLY Faculty and Resident Responses

Q5: I am always able to get in touch with a resident when I am wanting to discuss a patient for admission.

Q6: I always know how many patients the Internal Medicine team can admit during my shift.

Q7: I have a clear understanding of the types of cases that are appropriate for admission to an academic medical team.

Figure 2. Pre- and post-satisfaction survey for AIM and ED residents.

We also investigated admission numbers from the ED to the AIM team pre- and post-intervention. This was done by comparing admissions from 90-day period pre- and post-intervention. Admissions to AIM teams were compared with those to the private hospitalist group. Pre-intervention data were pulled from a 90-day period 6 months prior to the intervention, and post-intervention data were obtained 90 days immediately after implementation of the app. Expected admissions counts were developed using hospital billing data for the two time periods. These expected values were used to evaluate admission performance specific to each time period and to help control for seasonal variations in hospital admission rates.

3. Results

Of the participating responses from the AIM and ED residents and faculty (N = 30), there was a significant increase in mean satisfaction scores pre- and post-intervention with sign-out structure, patient safety on transfer, and efficiency of patient transfer (p < 0.001) (Graph 1).

Similarly, we found an increase in mean satisfaction post-intervention score from the ED perspective (N = 15) in reaching the AIM on-call resident, knowing the AIM team cap, and understanding appropriate admissions to the AIM team (Table 1) (p < 0.01).

With respect to admission counts, we found that the AIM team had under-performed compared to the expected number of admissions in a 90-day period obtained 6 months prior to intervention at 1918 admissions compared to an expected number of 2037. However, in the 90-day period immediately after the implementation of the app, the AIM team exceeded the expected number of admissions at 2285 (expected: 2186) (Table 2).

4. Discussion

The process of admitting new patients from the ED is one of the most educationally rich learning experiences for interns and residents training in Internal Medicine. Since the 2011 implementation of duty hour restrictions and various other scheduling limitations, these opportunities are becoming increasingly
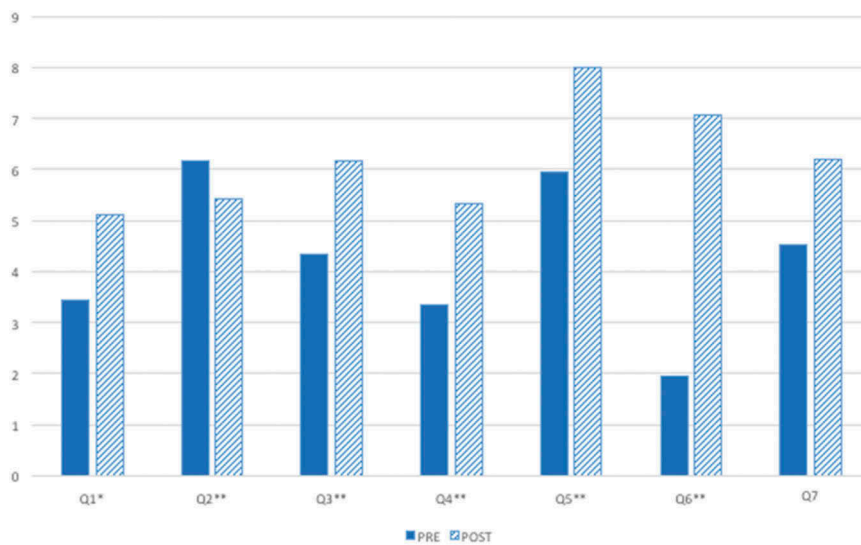
Graph 1. Mean pre- and post-ratings for resident/faculty satisfaction.

Table 1. Mean pre- and post-satisfaction scores for AIM and ED resident/faculty.

Mean pre- and post-satisfaction scores for AIM and ED residents				
	Pre		Post	
	Mean	SD	Mean	SD	t-test
ED and AIM faculty and resident responses (n = 30)					
Q1: I feel there is a clear and uniform process for determining which group (hospitalists vs. Academic IM team) should be called to when a new patient is needed admission.	3.45	2.96	5.10	2.50	2.37*
Q2: I am satisfied with the current admission/sign-out structure.	3.24	2.21	5.43	2.47	3.72***
Q3: I believe the current admission/sign-out process allows for safe patient transfers.	4.33	1.85	6.17	1.68	4.10***
Q4: I believe the current admission/sign-out process allows for efficient admission of new patients, transfers.	3.33	2.27	5.33	2.45	3.36**
ED only faculty and resident responses					
Q5: I am always able to get in touch with a resident when I am wanting to discuss a patient for admission.	5.95	2.38	8.00	1.87	2.90**
Q6: I always know how many patients the Internal Medicine team can admit during my shift.	1.95	2.44	7.07	2.69	5.82***
Q7: I have a clear understanding of the types of cases that are appropriate for admission to an academic medical team.	4.53	3.06	6.20	2.78	n.s.

*<.05; **<.01; ***<.001.
Note: Question response scale ranges from 0 (not at all) to 10 (completely agree).

Table 2. Hospitalist vs. AIM inpatient admit census pre- and post-interventions (90-day period).

90-day admission counts pre- and post-app intervention: AIM team vs. hospitalists group		
	Pre (6 months prior)	Post (90 days after intervention)
Hospitalist group	11,356 (85.5%)	11,825 (83.8%)
Academic IM team	1918 (14.15%)	2285 (16.2%)

Note: $x^2(1) = 16.007$, $p < 0.001$; $\phi = 0.024$, $p < 0.001$.

rare for physicians-in-training [3, 4]. Additionally, transitioning the patient's care to the medicine wards in a safe and efficient manner is a crucial part of training for ED residents.

For a small community hospital with AIM teams, there are many factors that affect and limit the admission cap per team. Increasing hospital volume in the context of scheduling limitations (a stable number AIM residents, the discontinuation of the Transitional Year program, and reduced manpower) has resulted in the downsizing of AIM services from double- to single-intern teams, resulting in lower patient censuses to maintain compliance with ACGME regulations. Per ACGME guidelines, interns may admit no more than five patients in a 24-hour period [5]. This excludes transfers from the ICU and bounce backs within the same month. Additionally, the senior resident may supervise up to 10 new patients in a 24-hour period with up to 4 transfer patients. This results in a census cap of approximately 14–15 new patients per single-intern team.

Furthermore, these smaller community healthcare centers may experience ICU closure, which can lead to additional sources of new patients for AIM teams. While this may increase the overall census, these patients have usually been worked up by the ICU teams and are typically of limited educational value. To provide the optimal educational experience for the AIM residents, the on-call team would aim to ensure the maximum number of new admissions from the ED. Ideally, this would require up to five new patients (per intern) in a call day, with the preference of accepting educationally rich patients from the ED rather than capping teams with patients transferred from the ICU and outside facilities (OSF) that have been mostly stabilized.

However, despite these limitations on AIM team cap, on-call teams frequently receive fewer patients than requested from the ED on a given call day. While many factors contribute to inability of the AIM team to reach the admission cap, the lack of a standardized communication system for ED providers can greatly affect the consistency of AIM admissions. With advances in communication, we have aimed to utilize efficient and cost-effective technologies to optimize communication between two

departments with the aim of a more consistent admission flow to the AIM team with the goal of reaching the daily cap.

With the introduction of the mobile app, our primary focus was to enhance communication between the AIM and ED team by providing daily cap on for the AIM on-call team on a real-time basis throughout the day. By establishing a standardized channel to allow for effective communication between the two departments during the patient's transition in care, we observed an overall significant increase in admissions to the AIM team. Consequently, optimizing the admissions process through the mobile app allowed us to maximize opportunities for new patient admissions from the ED towards the daily cap, despite the limitations we face in generating this daily cap as a small community hospital. Overall, the intervention resulted in greater satisfaction between the two departments regarding sign-out structure, transfer-of-care efficiency, and patient safety.

By addressing the vital aspect of new patient admissions through our mobile app, our intervention has the potential to improve medical education for both ED and AIM teams. Not only does this maximize the opportunity for AIM residents to initiate work-up for new patients, it also allows ED residents to admit patients to the medicine wards in a safe and efficient manner, both a crucial part of GME training for each respective department. Given its ease of customization and use, we believe this app could be readily tailored for use by private hospitalist groups and larger academic institutions alike. As a result, our mobile app has valuable implications in resident education, especially in the setting of a small community hospital with predefined restrictions on the admissions process.

Our intervention has several potential limitations. We did not directly observe the usage of the mobile app for each patient admitted to the AIM team. To this end, we could not examine the exact usage of the app as it relates to the satisfaction score pre- and post-intervention from both ED and AIM faculty and residents. Our data were collected in one small community hospital, potentially limiting generalizability to other hospitals of similar size.

In summary, we have found that within a small community hospital, there is a general gap that significantly hinders admissions rates from the ED to the AIM service teams. Despite limitations set by the ACGME guidelines and logistical operations in a small community hospital, the use of an app resulted in the daily AIM team cap being fulfilled by educationally rich inpatient admissions. Establishing an effective standardized communication platform with

a mobile app can increase satisfaction and admission capacity of the AIM team. Going forward, we aim to identify and address factors that are essential for maximizing ED admission and streamlining admission flow from other departments such as the ICU and OSF.

Disclosure statement

Funding

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