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Evaluation of an Asynchronous Physician Voice Mail Sign-out for Emergency Department Admissions

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Abstract

Background—Communication failures contribute to errors in the transfer of patients from the emergency department (ED) to inpatient medicine units. Oral (synchronous) communication has numerous benefits but is costly and time-consuming. Taped (asynchronous) communication may be more reliable and efficient, but lacks interaction. We evaluated a new asynchronous physician-physician sign-out compared to the traditional synchronous sign-out.

Methods—A voicemail-based, semi-structured sign-out for routine ED admissions to internal medicine was implemented in October, 2007 at an urban, academic medical center. Outcomes were obtained by pre- and post-intervention surveys of ED and IM housestaff, physician assistants and hospitalist attendings; and by examination of access logs and administrative data. Outcome measures included utilization; physician perceptions of ease, accuracy, content, interaction and errors; and rate of transfers to intensive care from the floor within 24 hours of ED admission. Results were analyzed both quantitatively, and qualitatively using standard qualitative analytic techniques.

Results—During September-October, 2008 (one year post-intervention), voicemails were recorded regarding 90.5% of medicine admissions; 69.7% of these were accessed at least once by admitting physicians. The median length of each sign-out was 2.6 minutes (IQR 1.9 to 3.5). We received 117/197 responses (59%) to the pre-intervention survey and 113/206 responses (55%) to the post-intervention survey. A total of 73/101 (72%) respondents reported dictated sign-out was easier than oral sign-out and 43/101 (43%) reported it was more accurate. However, 70/101 (69%) reported

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interaction among participants was worse. There was no change in the rate of ICU transfer within 24 hours of admission from the ED in April-June, 2007 (65/6,147; 1.1%) versus April-June 2008 (70/6,263; 1.1%); difference of 0%, 95% CI, -0.4% to 0.3%. The proportion of internists reporting at least one perceived adverse event relating to transfer from the ED decreased a non-significant 10% after the intervention (95% CI, -27% to 6%), from 44% pre-intervention (32/72) to 34% post-intervention (23/67).

Conclusion—Voicemail sign-out for ED-internal medicine communication was easier than oral sign-out without any change in early ICU transfers or the perception of major adverse events. However, interaction among participants was reduced. Voicemail sign-out may be an efficient means of improving sign-out communication for stable ED admissions.

Introduction

The transfer of a patient from the emergency department (ED) to the inpatient floors is a complex process fraught with potential for error.¹⁻³ Although errors at this transition of care are multifactorial,¹ sign-out communication plays an important role.¹⁻³

Sign-out between emergency medicine (EM) and internal medicine (IM) physicians is typically oral (or “synchronous”), involving a face-to-face or telephone conversation about the patient. Synchronous communication has numerous advantages, including opportunities for confirmation, clarification, error detection, relationship-building, negotiation about management and disposition, and multidirectional information flow.⁴⁻⁷ Studies of healthcare workers show they are overwhelmingly inclined towards synchronous communication.⁸ The emergency department is no exception: 80% of ED communication is typically synchronous.⁹⁻¹¹

However, synchronous communication between EM and IM physicians can be challenging to conduct because of the physical distance between the ED and the inpatient unit, multiple competing demands on physicians’ time, rapidly changing information, professional differences in expectations, the chaotic nature of the ED, and frequent physician turnover.^{1, 2, 6, 12} At times, these challenges inhibit the quality of communication or prevent it from occurring at all. In addition, the interruptions in work required to initiate the conversation, as well as the interruptions that occur during the conversation, may themselves pose a threat to patient safety.^{8, 13, 14}

Written or recorded (“asynchronous”) communication is an alternate format that has several advantages. It is efficient, allowing information to be provided and received at the most convenient time for workflow.^{15, 16} It is durable, eliminating the “game of telephone” that occurs with sequential oral communication and reducing the risk of missing sign-out altogether.¹⁶⁻¹⁸ In some cases, it has been shown to promote more complex and sophisticated interactions, as participants have time to reflect before providing information or asking questions.^{16, 19, 20} Finally, it can be accessed repeatedly, simultaneously and by a variety of people with different needs.^{21, 22} Nurses have long used asynchronous communication methods for handoffs.²³⁻²⁷

Nonetheless, asynchronous communication has important limitations. It can not be adjusted in response to the experience or understanding of the recipient, may reduce opportunities for error detection and feedback, limits relationship-building and restricts the ability of the recipient to influence either the discussion or future action.^{16, 20} If the team is thus prevented from coming to a shared mental model, performance can suffer.²⁸ Perhaps for these reasons, asynchronous handoff among physicians is relatively uncommon.²⁹ One exception in the ED is the “white board” on which key information can be seen at a glance, and which can also serve as a means of two-way communication.^{22, 30}

Qualitative analysis revealed that the existing oral sign-out between EM and IM physicians at our institution suffered from the typical challenges of synchronous communication, leading to dissatisfaction among both EM and IM physicians.¹ As one part of a multifaceted initiative to improve handoffs and workflow, internal medicine and emergency medicine clinical leaders implemented a new, asynchronous sign-out system in which EM physicians dictated a semi-structured sign-out to a voicemail system. IM physicians listened to the voicemail and called with follow-up questions as needed.

Importance

Asynchronous and synchronous communication has not been directly compared to our knowledge in interspecialty handoffs. This initiative was expected to improve efficiency, reduce the frequency of missed sign-out and increase the participation of ED physicians with direct knowledge of the patient. However, because of the drawbacks of asynchronous communication, its potential overall effect on patient care was uncertain. We thus describe and evaluate this quality improvement initiative with particular attention to the quality and safety of handoff communication.

Methods

Study design

The intervention was structured as a quality improvement initiative, featuring rapid evaluation, feedback and modification as needed. An important feature of such “action research” is that the intervention often changes mid-cycle in response to continuous evaluation and feedback.³¹ This approach is akin to the Plan-Do-Study-Act method pioneered by Shewart, in which the intervention is studied and modified in real time.³² We describe both the initial intervention and modifications made in response to feedback.³³ The study was designed as a prospective, pre-post analysis involving both quantitative and qualitative assessment.

Setting

The study was conducted at a 944-bed urban, academic medical center with both EM and IM residency training programs. The hospital uses a computerized physician order entry system, but at the time of the study ED orders, notes and vital signs were not always available in the electronic medical record. Medicine patients are divided approximately equally between a teaching service and a non-teaching service. Sign-out is conducted by ED residents or physician assistants. Sign-out is received by house staff for patients admitted to the teaching service and by attending hospitalists for patients admitted to the non-teaching service.

Pre-intervention, when emergency physicians determined that a patient required admission to internal medicine they alerted the admission office to find a bed. When a bed and team was identified, the admitting office notified the ED. The EM physician then paged the admitting resident. EM physicians sometimes had to repeat the page or contact several physicians before reaching the correct provider. Likewise, admitting residents sometimes had to call the ED repeatedly to reach the ED physician. When communication with the admitting physician was established, the ED physician provided sign-out, answered any questions, and sometimes altered patient management or disposition based on comments from the admitting team. Transport was then called to bring the patient to the floor. Patients admitted to the hospitalist service were signed out to one hospitalist who held the admitting pager. At times, this hospitalist then repeated the sign-out to a different attending hospitalist who would be the attending of record.

Interventions

In October, 2007 we implemented a commercial dictation program, CBaySystems (Annapolis, MD). In the new system, when ED physicians determined that a patient required admission to internal medicine they alerted the admission office to find a bed and then dictated a sign-out if the patient was stable. ED physicians were also asked to follow a new, semi-structured format for sign-out that included provisional diagnosis, ED course, pending data and the name and phone number of the ED physician to call in case of additional questions. The dictation was retained as a voicemail but was not transcribed.

When the patient was assigned a team, the ED business associate sent a text page to the admitting team with the patient's name and medical record number. Simultaneously, the transfer process was set in motion to bring the patient up to the floor. It was the responsibility of the admitting team to listen to the voicemail upon receiving the page. ED staff continued to page receiving physicians directly for real-time discussions about patients admitted to the medical intensive care units or step-down units. Most ED physicians had portable telephones, allowing the admitting team to reach the physician directly without paging or calling the main ED desk. Only internal medicine patients were included in the intervention since patients admitted to other specialties had to be seen in the ED by the accepting physician before they could be admitted.

Measurement and outcome measures

We measured uptake of the intervention 5–6 months after implementation by obtaining records of all voicemails left on the system and all accesses to the system between February 1, 2008 and March 31, 2008. We measured maintenance of the intervention at one year by reviewing all accesses between September 1, 2008 and October 31, 2008.

Intensive care unit transfer has been identified as a potential adverse event following admission from the ED to the floor.¹ Consequently, we identified all instances of patients admitted from the ED to an inpatient unit and then transferred to the intensive care unit within 24 hours from April 1-June 30, 2007 (prior to the intervention) and April 1-June 30, 2008 (after the intervention).

We assessed perceptions of sign-out quality, accuracy, efficacy, ease of use, interaction, content and adverse events through a survey, which included 22 5-point scale questions and 3 open-ended questions about adverse events, use of the voicemail system and general comments. The questionnaire was distributed to all EM house staff and physician assistants, IM house staff, and IM hospitalist attendings in March-April, 2007 and then again in April-May, 2008 (six months after the intervention). The post-intervention survey included additional questions about experiences with the voicemail system. For technical reasons the survey was distributed to all IM house staff, but we excluded all intern responses because they did not routinely receive sign-out before or after the intervention. These surveys were pilot tested for clarity and content by chief residents in EM and IM. The questionnaires were self-administered and anonymous and were sent via e-mail three times and distributed at conferences. A lottery for one of three \$50 Amazon.com gift certificates was a financial incentive for participation in each round.

The Yale Human Investigation Committee approved the study, granted a waiver of signed informed consent to preserve anonymity of respondents, and granted a Health Insurance Portability Act and Accountability waiver. Return of the survey was considered consent to participate.

Selection of participants

We sent the survey to all medical staff who were routinely involved in providing or receiving sign-out about medicine admissions from the ED. This included house staff, physician assistants and attending hospitalists.

Primary data analysis

We used qualitative data analysis methods³⁴ to analyze open-ended comments about the voicemail system. The study team included EM physicians (R.K., T.M., V.P., J.S.), and IM physicians (L.I.H., G.J., N.S.). Several participants were experienced in qualitative analysis (L.I.H., T.M., J.S.). We began with a start list of codes based on a separate analysis we had conducted of flaws in the ED to inpatient transfer.¹ Three study investigators (L.I.H., R.K., V.P.) independently reviewed each comment to assign codes. At subsequent coding meetings, we added, subtracted and revised codes as needed using the constant comparative method.³⁵ Disagreements were resolved by negotiated consensus. We continued this process until thematic saturation was achieved, i.e., no new concepts were being generated. The full study group periodically reviewed the code structure. We used Atlas.ti 5.0 (GmbH, Berlin, Germany) to facilitate qualitative analysis.

We used descriptive statistics to characterize the data. We compared categorical results among groups using the chi square test. We used SAS 9.2 (SAS Institute, Cary, NC) to facilitate quantitative analysis.

Results

Survey responses

We received a total of 117/197 responses (59%) to the pre-intervention survey, excluding IM interns. These included responses from 39/60 ED house staff and physician assistants (65%), 21/37 hospitalists (57%), and 57/99 internal medicine house staff (58%). We received a total of 113/206 responses (55%) to the post-intervention survey. These included responses from 39/63 ED house staff and physician assistants (62%), 34/44 hospitalists (77%), and 40/99 internal medicine house staff (40%). There was no difference between respondents and non-respondents by specialty. Internal medicine respondents to the post-intervention survey were more likely to be hospitalists and less likely to be senior residents than non-responders (Table 1).

Respondents wrote free-text comments about the voicemail system in 13/39 (31%) EM pre-intervention surveys, 50/100 (50%) IM pre-intervention surveys, 14/39 (36%) EM post-intervention surveys and 34/79 (43%) IM post-intervention surveys.

Uptake and maintenance of the intervention

From February 1, 2008 to March 31, 2008, sign-outs were recorded regarding 1,643 of the 1,836 patients admitted from the ED to medicine units (89.5%). A total of 1,074 were accessed at least once (65.4% of voicemails; 58.5% of admissions). The median length of each sign-out was 2.9 minutes (IQR 2.2 to 3.8 minutes). Those that were accessed were listened to a mean of 1.2 times each (SD 0.5).

Utilization was sustained one year after the intervention. Between September 1, 2008 and October 31, 2008, sign-outs were recorded regarding 1,724 of the 1,910 patients admitted from the ED to medicine units (90.3%). A total of 1,201 were accessed at least once (69.7% of voicemails; 62.9% of admissions). The median length of each sign-out was 2.6 minutes (IQR 1.9 to 3.5 minutes). Those that were accessed were listened to a mean of 1.2 times each (SD 0.5).

Adverse events

There was no change in the rate of ICU transfer within 24 hours of admission from the ED in April-June, 2007 (65/6,147; 1.1%) versus April-June 2008 (70/6,263; 1.1%); difference of 0%, 95% CI, -0.4% to 0.3%.

The proportion of internists reporting at least one perceived adverse event relating to transfer from the ED decreased a non-significant 10% after the intervention (95% CI, -27% to 6%), from 44% pre-intervention (32/72) to 34% post-intervention (23/67). The change in EM perceptions was similar: a non-significant decrease of 11% (95% CI, -23% to 2%), from 5/37 (14%) to 1/37 (3%).

Perceptions of sign-out

Prior to the intervention, the majority of respondents of both specialties had been skeptical that a voicemail system would result in improvements in the ease of providing or receiving sign-out, the accuracy of content, or the likelihood of errors (Table 2). Open-ended comments from both specialties about the anticipated effects of a voicemail system were overwhelmingly negative (Table 3). Respondents were most concerned that voicemail would lead to a reduction in real-time interaction, commenting that interaction improved retention of information; increased mutual understanding; altered diagnostic, therapeutic and disposition plans; reduced errors; and provided opportunities for real-time feedback. IM physicians were also concerned about the possibility of waning influence on ED management and disposition. Most respondents were skeptical about potential improvements in workflow, feeling that both parties valued interaction so highly that it would continue in addition to the voicemail. Respondents were similarly pessimistic about the effect on the quality, comprehensiveness and accuracy of sign-out content, and felt the system would have a negative impact on patient care.

Six months after the intervention, a total of 52/107 (49%) respondents felt communication with the other specialty was good or excellent compared with 58/113 (51%) in the baseline period (difference -3%; 95% CI, -16% to 11%). A majority of internists (56%) and all EM physicians felt sign-out was easier. The ease of contacting counterparts in the other specialty, the helpfulness of sign-out for patient care, sign-out accuracy, the likelihood of errors, and nearly all the content of sign-out were felt to be unchanged (Tables 4 and 5). Internal medicine respondents felt the clinical condition of the patient was less likely to be conveyed in the voicemail system ("always or usually stated": 45% vs. 26%; difference -20%; 95% CI, -35% to -4%). Both EM and IM respondents agreed that the frequency of questions asked about patients decreased after the intervention (Table 5), and that the amount of interaction declined (Table 4).

Qualitatively, emergency physicians were generally strongly in favor of the voicemail system, reporting substantially improved efficiency. Internists also reported improved efficiency in open-ended comments. However, many were concerned by reduced interaction with EM physicians. Internists also commented that although sign-outs were longer and more thorough, they were not correspondingly more useful. In fact, internists felt recorded sign-outs contained too much factual information about labs and studies that were readily obtained elsewhere and too little information about difficult-to-obtain details, such as what had been done for the patient and how the patient responded. (Table 6)

EM physicians reported several situations in which they did not dictate sign-out: when there were technical barriers such as a busy phone line or a receiving physician who did not have access, when the IM physician was already in the ED and could receive sign-out in person, when the patient was particularly complex, or when the ED provider was shortly leaving the hospital and wanted to have an in-person discussion. IM physicians reported several additional

reasons, chiefly involving workflow mismatch; perceived low utility of sign-out; and reduced influence on management and disposition. (Table 6)

Respondents from both specialties commented that some of the problems of the previous system had been remedied by the voicemail. They were particularly pleased that sign-out was generally recorded by the EM physician who knew the patient best, and that it remained accessible to new internal medicine teams or providers. However, they reported several new problems. The access number for the voicemail system was frequently busy. If the text page notification about the new admission went awry, new patients could arrive to the floor without an admitting physician being aware of them. Finally, the new parallel rather than sequential admission process meant that patients could arrive on the unit before or while the receiving physician was listening to the voicemail, leaving little opportunity to affect ED disposition or treatment plans. Indeed, 54/69 (78%) internists said they always or usually accessed the voicemails, but only 10/66 (15%) reported they always or usually had time to do so before the patient arrived on the floor. Of note, while 100% of EM physicians reported they always or usually recorded a sign-out, only 11/37 (30%) reported always or usually doing so prior to booking the patient for admission.

Modifications

Based on this feedback, leadership made several immediate modifications to the system. They obtained a new voicemail access number that was rarely busy. They required the receiving team to call the ED to confirm receipt of the text page notification before transfer procedures were initiated. They altered the instruction card so that it emphasized information requested by IM physicians and eliminated information that was unnecessary or readily available elsewhere. They asked IM physicians to identify high and low quality sign-outs, and planned to implement sign-out training for ED residents that included playbacks of those sign-outs.

Limitations

This study has several limitations. First, the majority of our results are subjective, although we included one objective measure of adverse events, ICU transfers. We attempted to mitigate recall bias by prospectively collecting pre-intervention data. Nonetheless, we did not evaluate the sign-outs themselves, nor did we examine efficiency measures such as ED length of visit, which was confounded by simultaneous initiatives at our institution. Second, the study was conducted at a single, academic institution. Results might differ at other institutions, particularly those without teaching programs, for which recorded sign-out quality might be higher. Third, overall response rates in both periods were less than 60% and the post-intervention survey included few third year IM residents. However, house staff and hospitalist results did not differ significantly, and the post-intervention hospitalist response rate was 77%, reducing the likelihood of bias. Fourth, some respondents participated in both the pre- and post-intervention surveys. As we could not identify which these were, we were unable to adjust our statistical testing to account for some paired results. Fifth, we could not identify how many sign-outs were not accessed because they occurred in person instead, although we know from survey comments that this occurred with some regularity. Thus, we overstate the number of missed sign-outs. In addition, since we were not able to identify how many sign-outs were missed in the baseline period, we were unable to compare this outcome. Finally, we did not resurvey physicians after modifying the intervention.

Discussion

This report describes the effects of a switch from synchronous to asynchronous communication between internal medicine and ED physicians about newly-admitted patients. Overall, physicians reported improvements to workflow, ease and efficiency without adverse effects

on patient safety, despite having been deeply skeptical about the intervention beforehand. ED utilization was high and was sustained at one year. As predicted by participants, however, the new system substantially reduced interaction among physicians, causing some dissatisfaction among internists. In addition, 30% of voicemails were not accessed by internists.

All interventions require tradeoffs. In this case, we traded increased efficiency for decreased interaction. We were unable to detect any effect of this tradeoff on perceptions of patient safety or on early ICU transfers, perhaps because both forms of communication have positive and negative effects on safety. Studies of nurses and physicians have found that asynchronous communication can lead to more time spent on patient care and less on failed communication attempts, potentially improving care.^{15–17, 30} However, reduced two-way conversation may worsen care by diminishing opportunities to correct misunderstandings, identify errors, discuss care, change management or alter disposition.^{7, 28, 36} It may also impede team-building and feedback.⁴ We did not directly examine effects on education, interpersonal relationships and teamwork in this study.

On the other hand, while synchronous communication when it does occur may have numerous benefits both for safety and team-building,^{4–7} it is highly interruptive.^{13, 37} Interruptions are a particular burden for emergency department personnel.³⁰ Emergency physicians are interrupted 5–20 times an hour^{10, 30, 38–40} – more than twice as often as primary care physicians.³⁹ Not only do interruptions make work less efficient, they can lead to errors.^{13, 30, 37, 41, 42} For example, one half of aviation accidents attributed to crew error are precipitated by interruptions, distractions or preoccupations.¹⁴ In addition, synchronous communication is vulnerable to conflict, competition, hierarchy, peer pressure, deference, role expectations and other factors^{6, 43–45} that might be mitigated by less confrontational asynchronous communication methods.²¹

Although information was received in sufficient time to assist the admitting team's care, it was often only accessed after the patient had reached the floor. This reduced opportunities for internists to affect care in the ED. Such diminished influence may have prompted some internists to refuse to participate in the process at all. In fact, a striking finding of this study was that – despite the importance both specialties placed on sign-out in surveys – 30% of the voicemails were not accessed.

Respondents gave several reasons for not accessing the voicemails, including receiving sign-out in person instead, not having time to listen before the patient arrived on the floor, or being hindered by technical barriers which were later solved. A few internists, however, reported the sign-out did not add enough value to justify the access time. Three factors may have contributed to this perception. First, internists perceived some sign-outs to be a litany of sometimes irrelevant facts instead of a synthesis that allowed participants to come to a shared mental model of the patient.^{28, 46} Such communication was not useful and therefore felt not to be worth accessing. Second, the ED-to-floor handoff is unique in that the receiving physician must conduct a thorough history and examination of every new patient no matter how effective the sign-out. It may therefore be rational for a busy receiving physician not to listen to information s/he will feel obligated to re-obtain. Again, encouraging EM physicians to provide interpretation during sign-out (“she responded best to 20mg of furosemide”) rather than only facts (“her creatinine was 0.9”) might improve its perceived value. Third, some internists declined to participate because they had less opportunity to influence ED management and disposition – “The patient is sent to the floor regardless, so I don't waste my time listening.” This suggests that successful asynchronous models must either deliberately encourage bidirectional influence (perhaps by altering timing or including a mandatory follow up call), or provide sufficient value for recipients by other means.

Another notable finding was that EM physicians gave the quality, content and accuracy of their sign-out communication much higher ratings than IM physicians did. On the one hand, self-assessment correlates poorly with external assessment.^{47, 48} On the other hand, IM perceptions might have been distorted by negative stereotypes of EM physicians^{1, 2, 30} or by conflicting expectations about the purpose and content of sign-out.^{1, 2} Objective external assessment of sign-outs in future studies would be helpful to resolve these discrepancies and might point to areas in which sign-outs could be improved.

The regulatory and legal implications of communication models are always important to consider. The Joint Commission mandates that handoff communication include “an opportunity to ask and respond to questions,”⁴⁹ and allows taped reports if there is a mechanism to facilitate such questions in a timely fashion.⁵⁰ To fulfill this mandate, we required every sign-out to conclude with a direct phone number to the ED physician, and to be completed prior to the patient leaving the ED. The durability of asynchronous communication may raise concern about future legal liability. We encourage our staff to assume that this communication – like the written sign-out sheets used for shift-to-shift handoffs – is potentially discoverable, although it is not officially part of the medical record and is only retained for 30 days.

Our intervention initially included two asynchronous communications (the sign-out itself as well as the text page notification about the new admission). Respondents identified this as a major safety concern, since if the text page notification was not received, the patient could arrive on the floor without anyone’s knowledge. We rapidly solved this problem, while still retaining the asynchronous sign-out, by asking internists to call the ED to verify receipt of the page. This was one of several problems we were able address as they were identified, following the PDSA model.³² Improving the quality and utility of the sign-out itself, however, will require curricular and feedback efforts. We plan to use the recorded sign-outs to anchor a curriculum to improve sign-out skills. Other future modifications might include making the sign-outs accessible to nurses and administrators.

In summary, we devised, implemented and evaluated a new system of sign-out communication among physicians to facilitate the ED-internal medicine transfer. The new system was perceived to be easier for participants while not appearing to increase major adverse events. However, it did reduce interaction among physicians, and we therefore continued to mandate in-person discussion of unstable or critically ill patients. Busy emergency departments might consider this method as an efficient means of conducting some types of physician-physician communication.

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Table 1
 Characteristics of respondents and non-respondents, pre- and post-intervention

	Pre-intervention		Post-intervention	
	Responders (N=117)	Non-responders (N=80)	Responders (N=113)	Non-responders(N=93)
Specialty				
Internal medicine	78 (67%)	58 (73%)	74 (66%)	69 (74%)
Emergency medicine	39 (33%)	22 (28%)	39 (35%)	24 (26%)
Level of training*				
Internal medicine PGY2	29 (25%)	21 (26%)	25 (22%)	25 (27%)
Internal medicine PGY3-4	28 (24%)	21 (26%)	15 (13%)	34 (37%)
Attending hospitalist	21 (18%)	16 (20%)	34 (30%)	10 (11%)
EM physician assistant	11 (9%)	7 (9%)	12 (11%)	9 (10%)
EM house staff	27 (23%)	15 (19%)	27 (24%)	15 (16%)
Unknown EM	1 (1%)	N/A	N/A	N/A

PGY=post graduate year; EM=emergency medicine

* P=.0002 for responders vs. non-responders level of training, post-intervention period

Table 2
Pre-intervention anticipated effect of dictated sign-out versus oral sign-out

	Internal medicine (N=78)			Emergency medicine (N=38)		
	Worse	Same	Better	Worse	Same	Better
Accuracy of sign-out (%)	43 (61)	18 (25)	10 (14)	15 (39)	18 (47)	5 (13)
Ease of sign-out (%)	37 (52)	17 (24)	17 (24)	2 (5)	7 (18)	29 (76)*
Interaction among participants (%)	63 (88)	7 (10)	2 (3)	28 (74)	7 (18)	3 (3)
Errors related to sign-out (%)	53 (75)	12 (17)	6 (8)	17 (45)	14 (37)	7 (18) [†]

* p<.0001 for comparison with internal medicine

[†] p<.01 for comparison with internal medicine

Table 3Pre-intervention comments from respondents about *anticipated* consequences of a dictated sign-out

Domain of sign-out assessment	Emergency medicine	Internal medicine
Quality and accuracy of sign-out content	"I think it is a bad idea. On a spectrum where ideal is a face to face sign out, to worst where the new MD just reads the ED chart, I think a phone message is near bottom in terms of quality of exchange of information. Like all things, real time verbally communicated and exchanged ideas are imprinted strongly in one's memory. That is why doctors remember what their patients and other MDs say better than they remember what is written or heard third hand. I believe the BEST care would be to have the admitting MD visit the ED and get sign out at the bedside. This new idea is a step away from what SHOULD be the standard of care."	"The ER will prematurely record their sign-out... and [it will] have a high likelihood of old or incorrect information. I would prefer never hearing from them about a patient to this." "Assuming that all voice messages are kept recorded, I suspect that this will enforce people to do more complete sign-outs and more thorough work up of a patient before transferring the patient's care to admitting floor team."
Efficiency and workflow	"This will unfortunately provide more work for emergency physicians/residents since they will not only give a report to a voicemail system, but almost always the admitting team will call the resident to ask for additional information. Therefore, this will probably double the sign-out time and work involved."	"The end result will be us having to call the ER for clarification on every case anyway, defeating the purpose."
Interaction	"It seems like it would be very efficient but at the same time it would be very unreliable and will not overall benefit the patient. Talking to someone is a lot different then leaving a message. Ideas will no longer be bounced back and forth for more difficult patients, and that may sacrifice care."	"It is useful to actually speak to an ED physician because any other test results that might be easier to obtain in the ED, affect where the patient should be triaged or affect the service to where the patient goes will be unable to be asked for." "I'm worried that they'll leave a message and then won't be available for any questions, especially if they're nearing the end of their shift." "How does this allow for real time feedback on ER resident presentation to Admitting Attending?"
Safety	"The current process needs improvement. In the last month I signed out multiple patients to the hospitalist service because the patients have a hospitalist attending, but the patient is going to a resident team (and thus the team does not get sign-out). The ED secretary does not see that it is a resident team, and thus pages the hospitalist service. As an ER resident, I have no way of knowing that there is an error (until the upset medicine resident calls about not receiving sign-out)." "Sure the receiving doc will be able to contact us with questions, but without adequate sign-out, the patient may be sitting up in the hallway on the floor for 3 hours before this very important question is asked."	"I suppose the rate of near misses will be higher since the ED person will leave a message and then move on in his/her thinking about new patients. When the IM house officer receives the message, this will likely generate many more questions which the ED person may not have the focus to answer at that point." "This system will decrease communication and will ultimately worsen patient care in the critical hours early in admission." "I expect the rate of mis-triage to substantially increase under the new system."

Table 4
Post-intervention perceptions of dictated sign-out versus oral sign-out

	Internal medicine (N=74)		Emergency medicine (N=37)		
	Worse	Same	Better	Same	Better
Accuracy of sign-out (%)	15 (23)	27 (42)	22 (34)	3 (8)	13 (35) [*]
Ease of sign-out (%)	13 (20)	15 (23)	36 (56)	0 (0)	0 (0) 37 (100) [†]
Interaction among participants (%)	51 (80)	8 (13)	5 (8)	19 (51)	6 (16) 12 (32) [‡]
Errors related to sign-out (%)	28 (44)	22 (34)	14 (22)	2 (6)	21 (58) 13 (36) [§]

^{*} p<.05 for comparison with internal medicine
[†] p<.0001 for comparison with internal medicine
[‡] p<.01 for comparison with internal medicine
[§] p<.001 for comparison with internal medicine

Table 5
Participant perceptions of sign-out quality, ease, utility, interaction and content, pre-versus post-intervention

	Internal medicine			Emergency medicine		
	Pre (N=75)	Post (N=70)	Difference, % (95% CI)	Pre (N=38)	Post (N=37)	Difference, % (95% CI)
Quality: Overall quality of communication, good or excellent(%)	27 (36)	21 (30)	-6 (-22 to 10)	31 (82)	31 (84)	2 (-15 to 20).
Utility: Sign-out helpful for patient care, agree or strongly agree(%)	58 (77)	54 (77)	-0.2 (-14 to 14)	36 (94) [†]	34 (92)	-3 (-15 to 9)
Ease: Easy to contact other specialty, agree or strongly agree (%)	25 (33)	29 (41)	8 (-8 to 24)	20 (53)	13 (35)	-18 (-40 to 5)
Interaction: Ask or receive questions, usually or always(%)	57 (77)	18 (26)	-52 (-66 to -37)	20 (53) [†]	5 (14) [†]	-39 (-59 to -19)
Content: Specific information provided, usually or always (%)						
Working diagnosis						
Clinical condition	33 (44)	29 (41)	-3 (-19 to 14)	36 (95) [*]	34 (92)	-3 (-15 to 9)
Tests/procedures performed	34 (45)	18 (26)	-20 (-35 to -4)	38 (100) [*]	36 (97)	-3 (-8 to 3)
Pending data	37 (49)	38 (54)	5 (-12 to 21)	37 (97) [*]	37 (100) [*]	3 (-3 to 8)
Admitting attending [§]	26 (35)	19 (27)	-8 (-23 to 8)	34 (89) [*]	32 (86) [*]	-3 (-18 to 12)
	8 (15)	4 (11)	-4 (-19 to 10)	17 (46) [†]	19 (51)	5 (-18 to 29)

^{*} p<.0001 for comparison with internal medicine, same period
[†] p<.05 for comparison with internal medicine, same period
[‡] p<.01 for comparison with internal medicine, same period
[§] Hospitalist physicians are the admitting attending physicians and were excluded from this question for internal medicine

Table 6
Representative quotes from respondents about experiences with dictated sign-out: post-intervention

	Emergency medicine	Internal medicine
Quality and accuracy of sign-out content	"I feel that when I use the voicemail sign-out system, I provide a much more detailed sign-out and it is decidedly more thorough. In my opinion, this system has vastly improved sign-out and communication between the ED and internal medicine."	"I would say only half of [the sign-outs] have been appropriate and on point. I have had sign-outs describing a litany of normal exam findings but fail to mention why the patient was being admitted." "I can read the labs and studies myself. In fact, I've almost always read them before a sign-out is even dictated. In general, the new system is a success." "Since the introduction of the voicemail, the assessment and plans are better outlined. The staff are willing to discuss the care, though there is a voicemail available. So it appears the system is working well."
Efficiency and workflow	"Improves ED provider workflow because sign-outs are done as the provider makes time for them." "I think it's a great system. It was very time consuming in the past to have to track down the team and repeat my sign out again and again." "It drastically increases ED productivity. I no longer have to worry about the teams changing on the patient and having to sign out to another team, especially if I acquire a patient from a previous ED resident and am not very familiar with the patient."	"The voicemail is good in that we can listen to it whenever we want." "As a daytime hospitalist, I find the new system to be extremely helpful when I am admitting, as many times we are signing out several admissions to the nighttime team... With the new dictation system, the doctor admitting the patient can listen to the full sign-out rather than taking second hand sign-out from someone else. Overall, I think the new dictation system is great." "Sometimes there is no time to discuss care with the ED. By the time the admission page comes, the patients are usually in transit."
Interaction	"When signing out, I always give a number at which I can be reached at if they have further questions. Although I have given this option, I have never once been called back for questions." "Although there is little interaction, calls for additional questioning occur and are helpful in management."	"I cannot say that I am particularly fond of the voicemail sign-out for the simple reason that I believe it generally leads to fewer discussions regarding a patient's proposed plan of care between ED and floor staff." "One advantage of the old system was the ability to give... feedback and direction right away and for the residents this was a valuable learning tool."
Patient safety and patient care	"I personally like to speak with the internists about the patient to better coordinate care, but the new system helps with flaws related to sign out." "Much better system. It allows the primary physician taking care of the patient to provide direct sign out before leaving and transferring care. It avoids the second physician who may not be as familiar with the patient from providing incomplete information. It also prevents the primary team from blocking the admission or deflecting responsibility."	"The main benefit from my perspective is that patients now have a more complete workup before they are booked and sent upstairs than they used to." "The idea of electronic sign-out has many positives, foremost of which is reducing the amount of time patients are forced to remain in the ER. I've heard many patients complaining to me about having to sit there for many hours after being told they would be admitted." "The rate of errors related to sign out is about the same because dictations are sometimes done with labs pending and a few times there's no addendum when either the patient's status changes or other steps have been taken due to abnormal labs." "Without the ability to ask questions - to demand more info as appropriate - numerous patients have been mistriaged to the floor instead of the ICU/stepdown, and we transfer them soon after admission." "If the patient is dictated, and then a shift changes and then you get the page that the patient is assigned to you, if you call the ED to ask any questions, the person who is now taking care of them has no idea what is going on... So in some ways it leads to less responsibility for the patients than before."
Reasons for not using system	Technical barriers: "If the system is down or the hospitalist doesn't have a code." Check-back desired: "If there are social situations that I want to be sure the resident understands, and to emphasize what I've done and/or what the patient will need to get home." Shift constraints: "Other times I [will] conduct an oral sign-out if explaining a difficult situation and I'm off soon." Proximity: "Sometimes the resident is in the ED and I give direct verbal sign-out..." High-risk patient: "...same in the case of being downgraded from ICU or stepdown."	Technical barriers: "Line is usually busy." "Forget how to do it." Workflow mismatch: "If the patient arrives on the floor before the text, I go see the patient immediately." "Most times the patient is already on the floor before I get a chance to access the voicemail, so I just go through the ED notes and talk to the patient." Proximity: "Spoke with ER staff first." Little perceived utility "1. Often not very good quality sign out does not 2. Often reflect current clinical situation 3. ED often does not think about a diagnosis 4. Can often tell enough from lab results and imaging studies 5. Can read the chart notes." Lack of influence: "The patient is sent to the floor regardless, so I don't waste my time listening." "Will not affect disposition most of the time."