Patient care transitions from the emergency department to the medicine ward: evaluation of a standardized electronic signout tool

JED D. GONZALO1*, JULIUS J. YANG2, HEATHER L. STUCKEY3, CHRISTOPHER M. FISCHER4, LEON D. SANCHEZ5 AND SHOSHANA J. HERZIG6

1Assistant Professor of Medicine and Public Health Sciences, Assistant Dean for Health Systems Education, Pennsylvania State University College of Medicine, Hershey, Pennsylvania, 2Director of Inpatient Quality, Silverman Institute for Healthcare Quality and Safety, Beth Israel Deaconess Medical Center, and Assistant Professor, Harvard Medical School, Boston, Massachusetts, 3Assistant Professor of Medicine and Public Health Sciences, Pennsylvania State University College of Medicine, Hershey, Pennsylvania, 4Department of Emergency Medicine, Beth Israel Deaconess Medical Center, Instructor in Medicine, Harvard Medical School, Boston, Massachusetts, 5Vice Chair for Emergency Department Operations, Beth Israel Deaconess Medical Center, and Associate Professor of Medicine, Harvard Medical School, Boston, Massachusetts, and 6Instructor in Medicine, Harvard Medical School and Beth Israel Deaconess Medical Center, Boston, Massachusetts

Address reprint requests to: Jed Gonzalo, Division of General Internal Medicine, Penn State Hershey Medical Center – HO34, 500 University Drive, Hershey, PA, 17033. Tel: +1-717-531-8161; fax: +1-717-531-7726; E-mail: jgonzalo@hmc.psu.edu, jedgonzalo@hotmail.com

Accepted for publication 16 March 2014

Abstract

Objective. To evaluate the impact of a new electronic handoff tool for emergency department to medicine ward patient transfers over a 1-year period.

Design. Prospective mixed-methods analysis of data submitted by medicine residents following admitting shifts before and after eSignout implementation.

Setting. University-based, tertiary-care hospital.

Participants. Internal medicine resident physicians admitting patients from the emergency department.

Intervention. An electronic handoff tool (eSignout) utilizing automated paging communication and responsibility acceptance without mandatory verbal communication between emergency department and medicine ward providers.

Main outcome measures. (i) Incidence of reported near misses/adverse events, (ii) communication of key clinical information and quality of verbal communication, and (iii) characterization of near misses/adverse events.

Results. Seventy-eight of 80 surveys (98%) and 1058 of 1388 surveys (76%) were completed before and after eSignout implementation. Compared with pre-intervention, residents in the post-intervention period reported similar number of shifts with a near miss/adverse event (10.3 vs. 7.8%; \( P = 0.27 \)), similar communication of key clinical information, and improved verbal signout quality, when it occurred. Compared with the former process requiring mandatory verbal communication, 93% believed the eSignout was more efficient and 61% preferred the eSignout. Patient safety issues related to perceived sufficiency/accuracy of diagnosis, treatment or disposition, and information quality.

Conclusions. The eSignout was perceived as more efficient and preferred over the mandatory verbal signout process. Rates of reported adverse events were similar before and after the intervention. Our experience suggests electronic platforms with optional verbal communication can be used to standardize and improve the perceived efficiency of patient handoffs.

Keywords: adverse events, patient safety, hospital care, setting of care, emergency care, general medicine, professions, quality improvement, quality management, health system reform, health care system
**Introduction**

Successful and efficient communication of clinical information and transfer of responsibility between healthcare providers, also known as a ‘handoff,’ is vital for patient safety. Communication breakdowns can result in ineffective handoffs and are associated with adverse events, medical errors and patient safety risks [1–5]. As a result, regulatory agencies, accrediting organizations and educators have increased focus on handoffs, calling for interventions aimed at improving the safety and effectiveness of handoffs to optimize patient care delivery [4, 6–8].

Although handoffs between providers of the same service have been well studied, handoffs of patients transferred from one unit or specialty to another have not been well investigated. Such handoffs may be particularly vulnerable to breakdowns in the communication (or ‘signout’) process [1, 2, 9]. In particular, patient transfers from the emergency department (ED) to medicine ward frequently involve clinical uncertainty and high acuity, which, along with cultural differences between services, can result in communication failures and insufficient information exchange at a critical stage in a patient’s course [2, 10–15]. New handoff approaches using the current technology-enhanced health care environment to incorporate standardized electronic platforms for information exchange have potential to support safe and efficient between-unit transfers [7, 9, 11, 13, 16]. To our knowledge, no work has investigated the perceived safety of an electronic handoff platform that does not require verbal communication between providers [7, 8].

Our hospital implemented a new electronic handoff platform, the ‘eSignout,’ which utilizes a standardized web-based information dashboard visible to all providers, automated paging features between ED and ward-based internal medicine physicians, and the option to electronically ‘accept’ signout, without verbal communication, while preserving the option for verbal discussion if either ED or medicine physicians deem appropriate. We hypothesized the eSignout would be perceived as safe and efficient by medicine residents, and favored over the former process of mandatory unstructured verbal signout for all ED to medicine transfers. In this study of recipient ward-based medicine residents’ perceptions, we evaluated: (i) the change in reported near misses/adverse events and communication of key clinical information before and during the year following eSignout implementation and (ii) the overall perceptions regarding efficiency, safety and satisfaction with the new system. Additionally, to better understand the patient safety issues in ED to medicine ward transfers in the context of the new eSignout, we performed a qualitative analysis of near misses/adverse events reported by the residents during the post-intervention period.

**Methods**

**Study design**

To assess the impact of the new eSignout with optional verbal communication on the change in near misses/adverse events reported, perceptions of efficiency and safety and perceived patient safety issues in ED to medicine ward transfers, we conducted a prospective, embedded, mixed-methods sequential explanatory study design, which involves an analysis of quantitative and qualitative data [17]. We chose this method to acquire an enriched understanding of residents’ perceptions of patient safety issues during transfers, which would have been limited by quantitative data alone. This work was classified as quality improvement by the Beth Israel Deaconess Medical Center (BIDMC) IRB and exempt from further review.

**Setting**

The study was conducted during 2011–12 at BIDMC in Boston, MA, an academic medical center with both emergency medicine and internal medicine residency programs. Since 2000, the ED has utilized a web-based electronic ‘dashboard’ to track patients and associated clinical data throughout the ED stay. This dashboard enables authorized providers to view real-time, ED-based clinical information, including patient demographics, vital signs, orders, imaging/laboratory data, and dispensed medications from any internet-enabled device. This widely accessible and detailed ‘snapshot’ of the patient’s ED course provides real-time clinical data and integrated workflow management elements. It is routinely utilized by numerous providers, including ED-based and recipient ward-based nurses and physicians, and consulting service providers. See Fig. 1 for a representative screenshot of the ED dashboard.

**Intervention**

In June 2011, an electronic handoff tool (eSignout) was added to the pre-existing ED dashboard functionality that included (i) standardized fields for ED-based physician and nursing manual entry of signout information, (ii) an automated page to the recipient ward-based physician sent by the ED-based physician through the dashboard once the signout information is ready for review and (iii) ability for the recipient ward-based physician to either electronically ‘accept’ the patient using the eSignout tool (thereby commencing the patient transfer from ED to medicine ward) or, alternatively, to automatically page the sending ED-based physician for verbal communication if eSignout information was believed insufficient or requiring clarification. Following verbal communication, the ward-based physician would then electronically ‘accept’ the patient via eSignout, initiating the patient transfer. See Fig. 2 for a representative screenshot of the eSignout application. In the ‘pre-eSignout’ period, verbal communication between sending ED-based physician and recipient ward-based physician was mandatory prior to patient transfer. In the ‘post-eSignout’ period, verbal communication was no longer mandatory; patient transfer from ED to medicine ward commenced once the signout was electronically accepted (either after review of the electronic data alone, or after verbal communication, if necessary).

**Outcome measures**

Near misses, adverse events, communication of key clinical information, and patient safety issues before and after eSignout implementation. To compare residents’ report of near misses/adverse events and communication of key clinical information
before and after eSignout implementation, we emailed a ‘shift survey’ to all recipient ward-based admitting medicine residents (n = 4 per day) for 20 days prior (May–June 2011) and for the entire year after (July 2011–June 2012). Survey items included admitting shift characteristics, receipt of key clinical information communicated during the handoff (e.g. diagnosis, clinical course), and, if applicable, characteristics of the verbal handoff (Appendix 1). Respondents were asked whether any patient during their shift experienced a near miss or adverse event related to missing information in the handoff and were asked to describe the event. We sought to collect data immediately after admitting shifts rather than end-of-rotation or end-of-year surveys to acquire an enriched account of events less subject to reporting bias. Within 24-h of initial invitation, a chief medicine resident sent a notification to non-responders requesting completion.

Residents’ perceptions of the eSignout. To assess residents’ overall perceptions of efficiency, patient safety, and quality of information exchange related to the eSignout, we sent a ‘perceptions survey’ to all junior and senior residents one year after implementation (June 2012, Appendix 2). The senior residents, all of whom had experience with the former handoff process as junior residents, were asked specific questions comparing both methods. One week after the initial invitation, a study investigator (J.G.) sent a reminder email requesting completion. Both surveys were pilot tested by the chief medicine residents and managed through www.surveymonkey.com.

Figure 1 Screenshot of the Electronic Dashboard with eSignout Prompt. The key content domains of the electronic dashboard are highlighted in blue. The blue content areas are imported from the medical record and continuously updated as new information is generated. The blue elements were present prior to implementation of the eSignout. The elements of the eSignout intervention are highlighted in red. The ‘MD signout’ field indicates the current status of the handoff and serves as a hyperlink to the eSignout tool depicted in Fig. 2. In this example, the ED provider has sent the ward-based physician a request to review the dashboard and respond to the eSignout tool (see Fig. 2).
**Data analysis**

**Quantitative.** For the comparison of rates of near misses/adverse events and communication of key clinical information before and one year following eSignout implementation, we used chi-square and Wilcoxon-rank sum tests on median Likert-scale responses. We performed a sensitivity analysis to address the threat of confounding by month, wherein we restricted the post-intervention data to only those surveys returned during the same 20-day calendar time period as pre-intervention data. The end-of-year perceptions survey results are reported descriptively. The data were analyzed using SAS and Stata/IC-8, College Park, TX.

**Qualitative.** To better understand the patient safety issues in ED to medicine ward transfers in the context of the eSignout, we performed a thematic analysis of reported near misses/adverse events in the post-intervention period [18]. We used a general framework from Horwitz et al. to create initial codes pertaining to ‘failures’ in ED to medicine ward handoffs [11]. One investigator (J.G.) independently coded open-ended responses and held regular adjudication sessions with two co-investigators (H.S., S.H.) to allow for additional code creation, elimination, and refinement. Data saturation was achieved after 50 responses were analyzed, but the entire data set of 61 events was coded (Atlas.ti 5.0, Berlin). Finally, co-investigators discussed overarching themes and representative quotations.

**Results**

**Rates of near misses, adverse events, and communication of key clinical information before and after eSignout implementation**

For the pre- and post-implementation periods, 78 of 80 surveys (98% response) and 1058 of 1388 surveys (76% response) were received (Table 1). Compared to the pre-intervention period, the number of shifts without verbal signout for any admitted patients increased from 2.6 to 25.4% \((P < 0.001)\). Comparing the communication of key clinical information during handoffs before and after eSignout implementation, all categories showed similar results, except communication of ‘results of completed studies/consults,’ which showed a decrease in mean Likert-scale response (4.11 vs. 3.95, \(P = 0.03\)). The percentage of shifts with a perceived near miss/adverse event was similar during both periods (10.3% pre-intervention vs. 7.8% post-intervention, \(P = 0.27\)). Comparing the quality of verbal conversations before and after eSignout implementation, two categories showed statistically significant increases in mean Likert-scale responses: (i) ‘verbal

![Figure 2](https://academic.oup.com/intqhc/article-abstract/26/4/337/1789756)
Table 1  Characteristics and Comparisons of the Emergency Department to Medicine Ward Handoff Process Prior to and 1 Year after an Electronic Handoff Process (eSignout) as Reported by Ward-Based Medicine Residents on Day Shifts

<table>
<thead>
<tr>
<th>Characteristics—mean (SD)</th>
<th>Before implementation (n = 80)</th>
<th>Following implementation (n = 1388)</th>
<th>P-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total respondents, n (%)</td>
<td>78 (98)</td>
<td>1058 (76)</td>
<td>–</td>
</tr>
<tr>
<td>Female, n (%)</td>
<td>38 (49)</td>
<td>508 (48)</td>
<td>–</td>
</tr>
<tr>
<td>Team census prior to shift</td>
<td>4.51 (2.01)</td>
<td>5.11 (2.38)</td>
<td>–</td>
</tr>
<tr>
<td>New patients accepted to team during shift</td>
<td>6.73 (3.11)</td>
<td>6.44 (2.69)</td>
<td>–</td>
</tr>
<tr>
<td>Team census at end of shift</td>
<td>9.35 (3.19)</td>
<td>9.65 (3.15)</td>
<td>–</td>
</tr>
<tr>
<td>Of the patients I received signout from the ED, at least 1 patient experienced a near miss or adverse event related to missing information in the signout—n (%) answering ‘yes’</td>
<td>8 (10.3)</td>
<td>82 (7.8)</td>
<td>0.27</td>
</tr>
<tr>
<td>Number of shifts without any verbal signout for admitted patients—a,b—n (%)</td>
<td>2 (2.6)</td>
<td>269 (25.4)</td>
<td>&lt;0.001</td>
</tr>
</tbody>
</table>

At the time of the patient’s arrival to the floor, information known to resident (through ED dashboard or verbal signout):c,d

<table>
<thead>
<tr>
<th>Characteristics</th>
<th>Before implementation</th>
<th>Following implementation</th>
<th>P-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>The provisional diagnosis</td>
<td>3.96 (0.81)</td>
<td>3.92 (0.75)</td>
<td>0.56</td>
</tr>
<tr>
<td>Relevant details of ED course, including interventions</td>
<td>3.95 (0.76)</td>
<td>3.91 (0.68)</td>
<td>0.52</td>
</tr>
<tr>
<td>Vital signs on arrival and upon transfer</td>
<td>4.08 (0.89)</td>
<td>4.13 (0.81)</td>
<td>0.81</td>
</tr>
<tr>
<td>Results of completed studies/consults</td>
<td>4.11 (0.76)</td>
<td>3.95 (0.71)</td>
<td>0.03</td>
</tr>
<tr>
<td>Pending studies or consults</td>
<td>4.00 (0.79)</td>
<td>3.84 (0.74)</td>
<td>0.46</td>
</tr>
<tr>
<td>Trigger criteria at time of transfer</td>
<td>3.64 (1.13)</td>
<td>3.81 (0.90)</td>
<td>0.41</td>
</tr>
</tbody>
</table>

When a conversation was initiated, verbal signouts received from the ED: c,e,f

<table>
<thead>
<tr>
<th>Characteristics</th>
<th>Before implementation</th>
<th>Following implementation</th>
<th>P-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Were always complete and helpful</td>
<td>3.13 (1.09)</td>
<td>3.44 (1.05)</td>
<td>0.01</td>
</tr>
<tr>
<td>Always conveyed important information that would not have been known otherwise</td>
<td>3.29 (1.08)</td>
<td>3.51 (1.02)</td>
<td>0.09</td>
</tr>
<tr>
<td>Were always given by a physician who knew the patient well</td>
<td>2.90 (1.42)</td>
<td>3.27 (1.09)</td>
<td>0.047</td>
</tr>
<tr>
<td>Included resident reviewing online ED dashboard prior to verbal signout</td>
<td>4.68 (0.58)</td>
<td>4.54 (0.77)</td>
<td>0.22</td>
</tr>
<tr>
<td>By the end of my shift, I discovered elements missing from the signout (EMR and verbal) that would have helped me provide more effective and safe patient care</td>
<td>2.92 (1.08)</td>
<td>2.65 (0.99)</td>
<td>0.04</td>
</tr>
<tr>
<td>The overall signout process (EMR, dashboard, and verbal signout) about patients admitted from the ED to medicine floor was: (0 = poor, 5 = neutral, and 10 = superior)</td>
<td>6.08 (2.20)</td>
<td>6.25 (1.91)</td>
<td>0.32</td>
</tr>
</tbody>
</table>

Chi-square test.

Number of shifts’ calculated by counting respondents who answered ‘n/a’ to all choices in Question 6 (see Appendix 1) but responded to any choice in Question 5 (see Appendix 1).

The Wilcoxon rank sum test was used to compare median Likert-scale responses on pre and post data.

Values are means for Likert-scale responses, which were reported on a scale of 1 (strongly disagree) to 5 (strongly agree).

‘Trigger criteria’ are clinical indicators that designate the acute, new development of any of the following: heart rate <40 or >130, blood pressure decrease to <90 mmHg, respiratory rate <8 or >30, SaO2 <90% with oxygen therapy, any need for a non-rebreather, urinary output <50 cc in 4 h, acute change in consciousness, or marked nursing concern [26, 27].

Values are for Likert-scale responses, which were reported on a scale of 1 (strong disagreement) to 5 (strong agreement).

signouts were always complete and helpful’ (3.13 vs. 3.44, P = 0.01) and (ii) ‘verbal signouts were always given by a physician who knew the patient well’ (2.90 vs. 3.27, P = 0.047).

Our results were qualitatively unchanged when restricting the analysis to only post-intervention surveys returned during the same time of year as pre-intervention data.

Residents’ perceptions of the eSignout Of the 95 residents invited to complete the end-of-year survey, 88 responses were received (93% response rate; Table 2). The majority ‘somewhat’ or ‘strongly agreed’ the eSignout was efficient (88%) and allowed for safe patient transfers (59%). Compared with the former handoff process, the majority of senior residents ‘somewhat’ or ‘strongly agreed’ they were more satisfied with (63%) and preferred (61%) the eSignout and believed the eSignout was more efficient (93%). Twenty-seven percent of the residents ‘somewhat’ or ‘strongly agreed’ the eSignout allowed for safer patient transfers, another 27% ‘somewhat or strongly disagreed,’ and 46% were ‘neutral.’ The most commonly chosen factors contributing to near misses/adverse events from a pre-specified list were insufficient information in the eSignout about the ED course, including interventions (80%) and ‘provisional diagnosis’ (73%).
Table 2  Attitudes and Perceptions of Junior and Senior Medicine Residents (n = 88) Regarding the Emergency Department to Medicine Ward Transfer Electronic Handoff Process ('eSignout')

<table>
<thead>
<tr>
<th>Characteristics—n (%) somewhat or strongly agree</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>I am satisfied with the current signout process.</td>
<td>60 (68)</td>
</tr>
<tr>
<td>I believe the current signout process allows for safe patient transfers.</td>
<td>52 (59)</td>
</tr>
<tr>
<td>I believe the current signout process is efficient.</td>
<td>77 (88)</td>
</tr>
</tbody>
</table>

Senior-residents: Based on your experience accepting admissions from the Emergency Department both before and after the electronic signout process was implemented (n = 41):

<table>
<thead>
<tr>
<th>Characteristics, n (%), sometimes, usually or always</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>I am more satisfied with the electronic signout process.</td>
<td>26 (63)</td>
</tr>
<tr>
<td>I believe the electronic signout process allows for safer patient transfers.</td>
<td>11 (27)</td>
</tr>
<tr>
<td>I believe the electronic signout process is more efficient.</td>
<td>38 (93)</td>
</tr>
<tr>
<td>I prefer the electronic signout process over the former process.</td>
<td>25 (61)</td>
</tr>
</tbody>
</table>

If you encountered any near misses or adverse events for patients admitted from the Emergency Department, how frequently did each of the following factors contribute?

<table>
<thead>
<tr>
<th>Workload factors of medicine team</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Difficulty obtaining verbal communication with emergency department staff</td>
<td>47 (53)</td>
</tr>
<tr>
<td>Insufficient information provided in the electronic signout: provisional diagnosis</td>
<td>64 (73)</td>
</tr>
<tr>
<td>Insufficient information provided in the electronic signout: ED course, including interventions</td>
<td>70 (80)</td>
</tr>
<tr>
<td>Insufficient information provided in the electronic signout: vital signs on arrival and upon transfer</td>
<td>54 (61)</td>
</tr>
<tr>
<td>Insufficient information provided in the electronic signout: results of completed studies/consults</td>
<td>46 (52)</td>
</tr>
<tr>
<td>Insufficient information provided in the electronic signout: pending studies or consults</td>
<td>54 (61)</td>
</tr>
<tr>
<td>Insufficient information provided in the electronic signout: trigger criteria at time of transfer</td>
<td>43 (49)</td>
</tr>
</tbody>
</table>

Qualitative analysis of near misses/adverse events in ED-to-medicine ward transfers

Of 1058 post-intervention shifts for which a completed survey was received, a near miss or adverse event associated with the handoff process was reported in 82 (7.8%), with respondents’ providing descriptions of 61 separate events. Although our survey question asked residents to describe near misses/adverse events related to missing information in the eSignout, initial data analysis revealed residents reported a number of global patient safety issues related to ED to medicine ward transfers, many of which were not specific to the eSignout. Key themes were grouped into four categories: (i) perceived sufficiency/accuracy of diagnosis, treatment or disposition, (ii) information quality, (iii) patient flow between units and (iv) relationship tensions between providers (Table 3).

Ward-based medicine residents questioned the accuracy and completeness of patient work-ups, expecting more definitive treatments or diagnoses to be made prior to transfer. For example, one resident commented:

A 72-year old male with diverticulosis sent to the floor with a signout that said ‘Type/Screen and crossmatch for 4 units.’ He had one 20 g IV. I accepted the patient based on vitals but suggested immediately another IV would be appropriate. He arrived on the floor bleeding. There was no type and screen, no crossmatch of blood, and no 2nd IV.

Additionally, medicine residents perceived patients were transferred prior to adequate stabilization or inappropriately transferred to the medicine ward when a higher level of care was required, necessitating immediate intervention upon patient arrival.

Information quality was another commonly identified patient safety issue during transfers. Residents described situations where eSignout information provided by ED providers was felt to be insufficient, omitted or inaccurate. Content areas perceived as inadequate included: ED course (13), vital signs (12), testing/treatment (8), physical exam (6), history (2) and complete omission of signout (2).

In several instances, residents described a violation of the sequential steps required for patient transfers to the medicine ward, or ‘patient flow.’ For example, the physical transfer of a patient prior to eSignout acknowledgment and acceptance was perceived as a patient safety concern. Lastly, ward-based medicine residents also reported situations in which they perceived tensions from ED providers about the need for clarifying information and differing expectations about patient workups.

Discussion

In this prospective survey-based study, we demonstrated similar rates of reported near misses/adverse events following implementation of a new electronic handoff tool (eSignout) without mandatory verbal communication for ED to medicine ward patient transfers compared with the former process requiring verbal communication for all transfers. The majority of
Table 3  Patient Safety Issues in the Emergency Department to Medicine Ward Patient Transfer Using an Electronic Handoff Process (eSignout) as Reported by Receiving Ward-Based Medicine Residents.6

<table>
<thead>
<tr>
<th>Category and themes</th>
<th>Code frequency – n (%)</th>
<th>Example quotation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Perceived sufficiency/accuracy of diagnosis, treatment, or disposition</td>
<td>48 (47)</td>
<td>‘A patient was transferred on 50% Venti-mask, saturating at 89–91%, tachypneic and using accessory muscles. The patient, immediately upon arrival to the floor, required a non-rebreather mask, [furosemide], and a CCU consult’.</td>
</tr>
<tr>
<td>Information quality</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Insufficient/omitted information</td>
<td>43 (42)</td>
<td>‘A hyperkalemia patient had an EKG performed in the ED (per the verbal signout) but it wasn’t included in the documents sent up to the floor’.</td>
</tr>
<tr>
<td>Inaccurate information</td>
<td>20</td>
<td>‘Electronic signout reported patient as DNR/DNI and stated that it was confirmed with family. Patient arrived to floor with moderate respiratory distress, which was treated conservatively with antibiotics and diuretics. While patient did ultimately improve, it was later found that patient was full code’.</td>
</tr>
<tr>
<td>Patient flow</td>
<td>8 (8)</td>
<td>‘A patient arrived on floor without having first gotten eSignout or verbal signout, admission orders were placed by ED staff alone, though they called upon patient arrival to provide signout after they recognized’.</td>
</tr>
<tr>
<td>Relationship tensions between ED and medicine providers</td>
<td>3 (3)</td>
<td>‘A patient was admitted for sugars in 600 s and high a1c. No one gave insulin in ED despite my asking. I explained my worry that the patient could go into DKA by time they hit floor, but they still refused to give insulin’.</td>
</tr>
</tbody>
</table>

*A total of 61 events were described, with investigators applying the five codes (Column 1) a total 102 times.

medicine residents believed the eSignout was more efficient and preferred it over the former process of mandatory verbal signout. During the year following eSignout implementation, the major themes of the 61 near misses/adverse events described by residents involved perceived insufficiency/inaccuracy of diagnosis, treatment, disposition or communicated information. This analysis suggests our standardized, electronic handoff process for between-unit transfers with optional verbal communication is perceived to be similarly safe and more efficient compared with mandatory verbal handoffs and can be used as a model for hospitals seeking to streamline and standardize their ED to medicine ward patient handoffs.

There are several benefits to the eSignout in the vulnerable ED to medicine ward transfer. First, the electronic interface allows for standardization of information contained in a handoff, helps to limit information omission, and prevents the need for an inefficient chart ‘biopsy’ to obtain necessary clinical information [1, 19, 20]. Secondly, recommended information variables are embedded into the electronic interface, eliminating many problems with information integrity occurring during verbal handoffs, thereby ensuring communication of key information required for a mutual understanding among providers [21, 22]. Thirdly, ambiguity in accepting responsibility for patient care in between-unit transfers is remarkably reduced, as ED-based and ward-based physicians are required to electronically submit their readiness for transfer of responsibility [23]. Finally, as ED and medicine providers are constantly multi-tasking and performing unscheduled care activities, eSignout allowance for asynchronous communication is a distinct advantage over required synchronous verbal communication in all circumstances [6, 24].

Prior work has demonstrated that within-unit handoffs that included electronic data decreased the incidence of adverse events and improved the quality of information transfer compared with paper-based handoff methods [4, 25]. For example, Bhabra et al demonstrated the retention of information was improved if an electronic plus verbal handoff was used over a verbal handoff without recipient note-taking [4]. These studies, however, all included verbal communication as a mandatory handoff component. Concerns regarding the independent use of electronically based handoffs (without verbal discussion) include misunderstanding the patient’s clinical status, lack of timely review by recipient provider, and failure to convey subtle patient issues [10, 21, 22]. Our eSignout provides a combination of asynchronous standardized electronic information, and, at the discretion of the accepting physician, easily initiated synchronous verbal communication.

Nearly all published recommendations for handoffs suggest synchronous verbal communication between sending and recipient providers to foster bidirectional conversations, allowing
for opportunities to identify and correct errors in real-time. However, in studies characterizing phone-based verbal handoffs between ED and medicine physicians, conversations primarily include ‘information-giving’ regarding the patient’s course rather than ‘information-seeking’ exchanges [23]. These discussions are primarily driven by sending physicians with recipient physicians being passive listeners, limiting two-way communication. One study by Horwitz et al. compared traditional synchronous oral communication with audio-recorded, asynchronous communication [24]. This study found no change in intensive care unit transfer rates upon arrival to the medicine ward and improved ease of use but with decreased accuracy of signouts, as reported by ED and medicine providers. Interestingly, in our study, 75% of shifts still included verbal communication on at least 1 patient, and residents reported improvement in the ‘completeness’ and ‘helpfulness’ of verbal communication, when it occurred. These findings suggest that residents still found value in verbal conversations while using the eSignout, and that verbal communication in this setting was more useful. We hypothesize the review of standardized information in the eSignout improves the usefulness of adjunctive verbal communication by allowing increased focus on specific clarifications [23].

Our qualitative analysis was planned with the anticipation that even within such a system, patient safety issues would still arise. In a prior study investigating patient safety issues arising during ED to medicine ward transfers, Horwitz et al. similarly identified communication difficulties as the key theme involved in unsafe transfers, particularly key content and verbal communication ‘omissions’ during handoffs [11]. In the context of the eSignout, residents in our study also identified deficiencies in information quality as a primary issue; however, the issues were related more to perceived inaccuracies of information in the electronic dashboard, and less to omission. Additionally, other themes identified by Horwitz et al. included environment (e.g. crowding, workload), information technology (e.g. vital signs/notes not easily accessible, responsible provider ambiguous) and assignment of responsibility (e.g. follow-up of pending data, responsibility of boarded patients), none of which were identified in our analysis (zero comments/quotations pertaining to these themes). Aside from the difference in study groups (Horwitz et al. also investigated views of ED providers), we hypothesize a main reason for this disparity is because of the more standardized information repository in the electronic dashboard, which prevents information loss and worrisome ambiguity of responsibility awareness in ED to medicine ward handoffs.

The conflicting expectations and sometimes divergent approaches to medical care between ED and medicine providers identified by our residents as a patient safety issue have also been identified in prior work [10, 11]. Characterized by uncertainty and difficult decisions, clinical care in the ED often occurs before critical information is known. ED providers often view their main role as stabilization and disposition while recipient providers may expect more definitive diagnoses. These differing expectations can lead to relational tensions, particularly in a system encouraging increased throughput. The persistence of such perceived patient safety issues from receiving physicians in our study is not unexpected, as our eSignout system does not address the cultural underpinnings and differing expectations of the role the different services play in patient care [9].

There are several limitations to our study. The primary limitation is the use of resident self-report of near misses/adverse events, which may not be an accurate surrogate for actual events. Validation of reported patient safety events via chart review likely would have improved accuracy of our results. Although residents were not given specific training in adverse event reporting for the purposes of this study, the trainees in our program are exposed to several educational curricula related to quality improvement/patient safety, providing each with a working knowledge of patient safety events and terminology beyond that expected of first-year residents or other healthcare professionals not exposed to such curricula. Second, although all surveys were pilot tested for content validity, the construct validity was not rigorously assessed. Additionally, since we only assessed the views of ward-based receiving physicians, reported perceptions of near misses/ adverse events and patient safety issues lack the input of other key stakeholders, specifically ED providers and medicine nurses. Furthermore, many patient safety issues reported by residents were not necessarily specific to the eSignout, but rather, addressed vulnerabilities in ED to medicine transfers as a whole. This limited our ability to comment on vulnerabilities specifically introduced by the eSignout. Lastly, because the eSignout is fully dependent upon the pre-existing and well-integrated electronic dashboard, a feature not likely used by many institutions, our results may not be fully generalizable to many hospitals.

In conclusion, our results suggest an electronic handoff with optional verbal communication, such as the eSignout, can be efficiently and safely embedded into providers’ workflow. This electronic tool allows for information standardization and efficient transactional communication between providers, both of which may help to promote safe patient transfers.

Acknowledgements

The authors thank the internal medicine residents at the Beth Israel Deaconess Medical Center for their participation and Alicia Clark, MD, for her assistance with data collection.

References


Appendix 1—Admitting Shift Survey

(1) What is the date of your call day?

(2) What is your name?_________

(3) What service are you on?
   Blumgart/Tullis (ward service)  Robinson/Kurland (ward service)
   Zoll (cardiology service)      SIRs (fourth-year medical student/senior resident service)
   Night float

(4) Which day of the week are you on call?
   Monday  Tuesday
   Wednesday Thursday
   Friday   Saturday
   Sunday

(5) At the time of the patient's arrival to the floor from the ED, what information did you know, either through OMR, the dashboard, or verbal hand-off:
   The provisional diagnosis
   Never  Rarely  Sometimes  Usually  Always  n/a
   Relevant details of ED course, including interventions
   Never  Rarely  Sometimes  Usually  Always  n/a
   Vital signs on arrival and upon transfer
   Never  Rarely  Sometimes  Usually  Always  n/a
   Results of completed studies/consults
   Never  Rarely  Sometimes  Usually  Always  n/a
   Pending studies or consults
   Never  Rarely  Sometimes  Usually  Always  n/a
   Trigger criteria at time of transfer
   Never  Rarely  Sometimes  Usually  Always  n/a

(6) For cases where a conversation was initiated, the verbal signouts that you received from the ED during this call shift:
   Were always complete and helpful
   Strongly disagree  Somewhat disagree  Neither agree nor disagree  Somewhat agree  Strongly agree  n/a
   Always conveyed important clinical information that would not have been known otherwise
   Strongly disagree  Somewhat disagree  Neither agree nor disagree  Somewhat agree  Strongly agree  n/a
   Were always given by an MD who knew the patient well
   Strongly disagree  Somewhat disagree  Neither agree nor disagree  Somewhat agree  Strongly agree  n/a
   Prior to verbal signout, I reviewed OMR and the ED dashboard
   Strongly disagree  Somewhat disagree  Neither agree nor disagree  Somewhat agree  Strongly agree  n/a

(7) By the end of my shift, I discovered elements missing from the ED signout (both EMR and verbal) that would have helped me provide more effective and safe patient care.
   Never  Rarely  Sometimes  Usually  Always  n/a

(8) Of the patients I received signout from the ED, at least 1 patient experienced a near miss or adverse event related to missing information in the signout.
   No  Yes
   If yes, please describe: ______________  ______________

(9) Please rate the following statement (0 = poor, 5 = neutral, and 10 = superior): The overall signout process (EMR, dashboard, and verbal signout) about patients admitted from the ED to the medicine floor was:
   0  1  2  3  4  5  6  7  8  9  10  n/a
Appendix 2—End-of-Year Perceptions Survey

(1) What is your gender?
   Male   Female

(2) What is your current level of training (2011–12)?
   Junior Resident   Senior Resident

(3) Please provide your response to the following statements in reference to the signout process for patients admitted from the Emergency Department to your Medicine teams:
   I am satisfied with the current signout process.
   Strongly disagree   Somewhat disagree   Neither agree nor disagree   Somewhat agree   Strongly agree
   I believe the current signout process allows for safe patient transfers.
   Strongly disagree   Somewhat disagree   Neither agree nor disagree   Somewhat agree   Strongly agree
   I believe the current signout process is efficient.
   Strongly disagree   Somewhat disagree   Neither agree nor disagree   Somewhat agree   Strongly agree

(4) For senior residents only: Based on your experience accepting admissions from the Emergency Department both before and after the electronic signout process was implemented:
   I am more satisfied with the electronic signout process.
   Strongly disagree   Somewhat disagree   Neither agree nor disagree   Somewhat agree   Strongly agree
   I believe the electronic signout process allows for safer patient transfers.
   Strongly disagree   Somewhat disagree   Neither agree nor disagree   Somewhat agree   Strongly agree
   I believe the electronic signout process is more efficient.
   Strongly disagree   Somewhat disagree   Neither agree nor disagree   Somewhat agree   Strongly agree
   I prefer the electronic signout process over the former process.
   Strongly disagree   Somewhat disagree   Neither agree nor disagree   Somewhat agree   Strongly agree

(5) If you encountered any near misses or adverse events for patients admitted from the Emergency Department, how frequently did each of the following factors contribute?
   Workload factors of medicine team
   Never   Rarely   Sometimes   Usually   Always
   Difficulty obtaining verbal communication with emergency department staff
   Never   Rarely   Sometimes   Usually   Always
   Insufficient information provided in the electronic signout: provisional diagnosis
   Never   Rarely   Sometimes   Usually   Always
   Insufficient information provided in the electronic signout: ED course, including interventions
   Never   Rarely   Sometimes   Usually   Always
   Insufficient information provided in the electronic signout: vital signs on arrival and upon transfer
   Never   Rarely   Sometimes   Usually   Always
   Insufficient information provided in the electronic signout: results of completed studies/consults
   Never   Rarely   Sometimes   Usually   Always
   Insufficient information provided in the electronic signout: pending studies or consults
   Never   Rarely   Sometimes   Usually   Always
   Insufficient information provided in the electronic signout: trigger criteria at time of transfer
   Never   Rarely   Sometimes   Usually   Always

(6) Please provide any additional comments you have related to signout on admissions from the emergency department: