Examining Links Between Sign-Out Reporting During Shift Changeovers and Patient Management Risks

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This article reports on a qualitative study that investigated how various risk factors associated with the process of sign-out reporting across shifts in critical care hospital environments could lead to flawed communication and thus to increased risk of poor patient outcomes. The study was performed in two critical care hospital units: the pediatric intensive care unit (PICU) and the postanesthesia care unit (PACU). We collected data from observations of eight nurses and four resident physicians in the PICU and four nurses and four resident physicians in the PACU giving sign-out reports during their shift changes. In addition, we conducted semi-structured interviews with a separate sample of medical providers consisting of nurse managers, attending physicians, nurses, and residents from each of these two units. The issues that were addressed in these interviews included how various methods of conducting sign-outs and factors such as personality and experience could impact the effectiveness of communication during sign-out reporting. We also collected data from these medical providers on how failures in communication during sign-out reporting could lead to potentially adverse patient outcomes. The article concludes with the presentation of a modeling framework that demonstrates how the combined influences of risk factors can generate a particularly important type of failure mode in communication and how interventions can be targeted to serve as barriers to such events. A number of recommendations intended for reducing risks associated with the communication of sign-out reports are also presented.

KEY WORDS: Communication failures; qualitative study; risk identification; risk mitigation; sign-out reporting

1. INTRODUCTION

During changes of shifts in hospitals, the sign-out report serves as the basis for transitioning patient care between incoming and outgoing medical providers. These reports often communicate essential patient care information that may include diagnoses, current treatment regimens, relevant laboratory and diagnostic tests, and trends in physical parameters and are thus crucial for ensuring patient safety. The exchanges of information that occur during these “handoffs” also provide the opportunity for various types of assessments by outgoing providers, which can direct the nature of patient care during the next shift and impact clinical decisions.

Much of the research in shift change reporting in hospitals has been carried out within the nursing profession. However, despite some emphasis in this research on the content and form of the sign-out report, the possible links between this activity and medical risks to patients has received little attention. Current interest in risks arising from...
“gaps” in patient care followed a landmark report that highlighted the relative absence of systems for tracking and resolving medical errors. Such gaps can be easily introduced through various breaches in the exchanges of patient-related information that occur during sign-out reporting. The possibility for these kinds of failures should not be surprising in light of evidence that the process of transferring patient information at shift changes often occurs in a haphazard manner. Notably, communication was cited by the Joint Commission on Accreditation of Healthcare Organizations (JCAHO) as the most prevalent root cause of sentinel events between 1995 and 2006.

This article reports on the use of a qualitative methodology for identifying and examining medical risks to patients that derive from sign-out reporting across shifts in critical care hospital units. Given the potentially complex array of factors governing the sign-out reporting process, we adopted a broad perspective to the identification of considerations potentially capable of impacting patient management risks. Specifically, sources of variability were considered that included the methods used for sign-out reporting, the communication skills associated with the individuals conveying and receiving reports, psychosocial considerations, and a variety of system factors. The examination of these factors was based on the belief that variability associated with critical sources of risk is often responsible for the propagation of events into adverse consequences.

Data related to these factors were gathered using observations and interviews. The observational data were collected from nurses and residents performing sign-out reports during shift changeovers at two critical care hospital units. The interviews were conducted with a separate sample of nurses and residents, as well as with nurse managers and attending physicians associated with these units.

The article concludes with the presentation of a modeling framework that demonstrates how the combined influences of risk factors related to sign-out reporting during shift changes can generate a particularly important type of failure mode on the part of the provider receiving information, as well as how interventions can be targeted to serve as barriers to such events. A number of recommendations intended for reducing patient management risks stemming from sign-out reporting are also presented along with a discussion of some limitations of the study.

2. METHOD
2.1. Study Sites

Observations of sign-out reports were performed in the pediatric intensive care unit (PICU) and the postanesthesia care unit (PACU) of Jackson Memorial Hospital, a nonprofit tertiary care hospital containing over 1,550 licensed beds and the major teaching facility for the University of Miami Miller School of Medicine. It employs more than 10,000 workers, including more than 1,250 physicians and 3,800 nurses, and is considered one of the nation’s busiest hospitals based on the number of admissions to a single facility. In addition, the staff and patient population at this hospital are ethnically diverse. As a teaching hospital serving a large urban population, this hospital is thus likely to be representative of similar facilities within the United States.

The PICU consisted of three geographically distinct but proximal subunits: a primary 10-bed unit, a 4-bed pediatric critical care annex, and a 6-bed pediatric medical special care unit. Nurses provided their sign-out reports during their shift changes, which occurred at 7:00 AM and 7:00 PM daily. Each nurse was responsible for either one or two patients. Residents performed morning bedside rounds with the attending physician and provided their sign-out reports at about 4:00 PM. Four resident physicians rotated on a monthly basis into the unit and allocated the patients among themselves. One of these residents remained on call at night but, due to the recently enacted 80-hour work regulations, could only remain in the unit until noon of the next day. This resident received the sign-out reports from the other three residents during the afternoon shift change. A “cross-covering” resident came on at noon every fourth day for the purpose of maintaining continuity in the rotational system.

The PACU was a 30-bed unit to which patients were generally brought following preoperative tests and procedures, at which time their bed spaces, time of surgery, and one of 40 operating rooms were assigned. Postoperative care was managed in this unit with the exception of patients who had cardiothoracic surgery and liver transplants. Each nurse in the PACU was responsible for two patients, and performed basic postoperative care functions such as administering medicines, placing IVs, and connecting monitors and pain pumps. The anesthesia resident’s tasks within the PACU usually involved pain management, oxygenation, managing blood pressure and breathing problems, and intubation if necessary.
Most of the patients were “routine” cases, and remained in the unit for about 2–3 hours prior to transfer to the hospital floor; however, about 10–15% of the patients required transfer to the ICU. The shift changes for the nurses usually occurred at 7:00 AM, 3:00 PM, and 11:00 PM each day, but could occur at other times as well. Shift changes for residents occurred at 7:00 AM and 7:00 PM, with a single resident responsible for the entire unit during each shift.

2.2. Observations

Eight nurses and four residents from the PICU and four nurses and four residents from the PACU, representing both outgoing and incoming providers at the shift change, participated in the observational component of the study. The participants who gave sign-out reports were observed on at least two different changes of shift. To minimize the effects of observer bias associated with observing the shift change process, the observations encompassed several hours before the sign-out report to about one hour after the shift change. This also enabled the sign-out report to be evaluated within the larger context of activities and issues that these providers faced.

The data were collected by a research team member who was an industrial engineer working in the area of patient safety. This individual was trained by two of the study’s investigators who, on various occasions, were present during observations in order to validate the assessments made by the observer. Training involved the use of an “observation form” whose organization and content determined what constituted relevant data (Table I), which were collected on handwritten notepads. Training also encompassed positioning oneself within the unit so as not to obstruct medical providers, and identifying appropriate times to query medical providers in order to resolve issues related to observed events. Prior to formal collection of these data, “walk-throughs” and extensive interactions with the nurse managers were carried out in each of the units. This enabled the observers to become familiarized with patient care activities and the providers to become accustomed to the presence of observers.

2.3. Interviews

The interview component of the study involved the administration of two semi-structured interview instruments: one targeted nurse managers and attending physicians and consisted of 13 questions; the other was intended for nurses and residents and consisted of 14 questions. From each of the two critical care units two nurse managers, two attending physicians, two nurses, and two residents were interviewed. All 16 interviews were conducted by an experienced human factors professional. The interviews were digitally recorded and later transcribed.

The interview responses that are summarized in this article refer to the questions listed in Tables II and III. The responses by nurse managers and attending physicians to the questions in Table II are followed by the responses by the nurses and residents to the questions in Table III. All the responses are presented in the order in which their corresponding questions are listed in the tables. The results from the PICU are presented first, followed by the results from the PACU. Both the observational and interview study components were approved by the university’s Institutional Review Board (IRB).
Table II. A Subset of Interview Questions for Nurse Managers and Attending Physicians

1. In your view, what constitutes an “ideal” sign-out process? Feel free to discuss any attributes of the handover of patient care that might be associated with patient information as well as attributes associated with the communication process.
2. Do you feel that the experience level, personality, or cultural background (including language issues) of the provider can impact the effectiveness of sign-outs? If so, do you have any anecdotal evidence that you can provide as support for these beliefs?
3. What are your feelings about the use of information technologies in sign-outs? What are your general views concerning the relative importance of face-to-face communication about a patient’s condition as compared to e-mail, voice mail, or other electronic forms of communication?
4. Can you recall a specific instance where problems arose in patient care that resulted in part from the communication across shifts of inadequate, incorrect, or ambiguous information concerning patients? If so, please try to provide the details or scenarios surrounding these situations.
5. If you had the authority to institute or influence the sign-out process, what would you recommend be done? That is, what bothers you the most about the way sign-outs are conducted and what would you want to see changed?

Table III. A Subset of Interview Questions for Nurses and Medical Residents

1. Do you sometimes find it difficult to communicate with the incoming shift? If so, what do you feel is the basis for this difficulty?
2. In what ways might having a new or nonroutine person in the incoming shift affect your communication of patient care?
3. What would you consider to be the most important factor that hinders you from receiving adequate information from the outgoing shift?
4. Can you recall a specific instance where problems arose in patient care that resulted in part from having received inadequate, incorrect, or ambiguous information from the outgoing shift?
5. What suggestions do you have for improving the communication of patient care information across shifts?

3. RESULTS

3.1. Summary of PICU Observations

Twenty-four observations were taken of PICU nurse sign-outs. All were performed face-to-face, at the patient’s bedside. In 23 of the 24 observations, charts or handwritten materials were used to give sign-out reports, and in 13 of these cases data from equipment monitors were referred to. While pointing to the patient was observed in 21 instances, touching the patient or equipment only occurred on five occasions. In many instances, nurses were observed spending an inordinate amount of time checking orders and performing manual calculations for medications during sign-outs.

Although PICU nurses were allotted 30 minutes for their sign-out reports, in 12 cases sign-outs took between seven and 20 minutes, and in seven cases they took between two and five minutes (mean = 14.6 minutes). Overall, the outgoing nurses were found to be friendly when providing their reports to their incoming counterparts; the incoming nurses, however, generally were not very inquisitive.

Twelve sign-out reports by the PICU residents were observed and, in contrast to the sign-outs by the nurses, all were conducted at the nurses’ station within the unit. Outgoing residents printed out a computer-based sign-out document that contained their updated notes for the incoming resident. They then proceeded to review with this resident the various sections of this form, which included patient problems, medications, transfusions, and things to do. It was not uncommon for outgoing residents to indicate that they were fatigued, and in these cases they were usually abrupt in their sign-outs. Data on the duration of the sign-outs were collected for nine of the 12 observations, and indicated an average time of 7.2 minutes, with none of the sign-outs exceeding 15 minutes and five of the nine sign-outs being of durations of five minutes or less.

3.2. PICU Interviews

3.2.1. Nurse Managers

Responding to Question 1 in Table II, which addressed conceptualizing the ideal sign-out, one nurse manager emphasized the need to stop at each point (the head, the neck, the lines, etc.) “touching and poking” while conversing, “and then go back and talk face-to-face.” The other nurse manager focused on more fundamental issues, such as the need to avoid distractions, reviewing the patient’s parameters (including how the patient did that day or night), and ensuring that IVs, fluids, and drips were correct.

With regard to factors such as personality, experience, or ethnic culture, one nurse manager felt that it was differences in personality that could adversely impact the sign-out report, as “when you have an aggressive outgoing nurse giving a report or an aggressive incoming nurse taking a report from a mild-mannered outgoing nurse.” Specifically, the
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aggressive outgoing nurse could intimidate a milder incoming nurse, who may then not adequately question the outgoing nurse; similarly, an intimidating aggressive incoming nurse could inhibit the communication of a milder outgoing nurse. With regard to experience, the concern that was noted was for the need to ensure that “a less experienced nurse, who may not always know what to ask or look for, is guided by an experienced and not passive outgoing nurse.”

Both nurse managers voiced the need for caution in introducing electronic technology into the sign-out report, primarily because written information is vulnerable to interpretation and creates a tendency to reduce the emphasis on visual reporting—“you can’t just read and interpret... especially on these kids.” However, both nurse managers indicated that technology “would expedite things... pick up mistakes” and keep them at the bedside instead of being occupied writing in charts.

One example that a nurse manager drew from her experiences regarding how sign-out reporting can contribute to risks in patient care exemplified the concern for false assumptions arising from ambiguity in communication. In this case, the outgoing nurse had indicated to the incoming nurse that she had some trouble with a particular intravenous central port line. However, based on the nature of the communication the incoming nurse concluded that the port was “still flushing.” Following the sign-out report, the incoming nurse noted that she needed to “get meds into the patient” but discovered the port didn’t work. In retrospect, she felt that she “should have asked more questions.”

Recommendations for interventions in the sign-out reporting process emphasized “improving the work environment at the time of the report” to ensure that nurses can focus entirely on each other and the patient without distractions such as getting supplies for physicians and talking to parents. Also noted was the need for presenting examples or other forms of training “on providing good information” for sign-out reporting.

3.2.2. Attending Physicians

The PICU attending physicians approached their characterizations of the ideal sign-out report by voicing concerns about how these reports were being given by their residents. As one physician remarked, “I really dislike it when they (residents) sit down at their station and give each other sign-outs. I think you really need to... go to the bedside, look at the lines, the rates that go into the pumps, eyeball the patient, ask the nurse about the patient... they sit down at a table and go over numbers... it’s not the appropriate way.” This physician went on to note that residents “offload themselves” by focusing on their to-do list, and implied that in the process they miss potentially important visual cues and contexts. The other attending physician indicated that he emphasized to residents that their shift change reports should not be considered concluded until the incoming resident’s inquisitiveness reached a level of annoyance to them, and argued for the need to encourage incoming residents to actively “go out and get information.” At the same time, the outgoing resident must be sufficiently assertive and knowledgeable, and should present a well-crafted “story” or problem description in addition to “relevant numbers.”

Personality, experience level, and cultural background were all acknowledged as factors that could adversely impact communication during sign-outs. Specifically, it was noted that culturally diverse environments (as existed in this hospital) often increase the presence of residents for whom English is a second language, and self-consciousness about one’s command of the English language may lead to reluctance to ask questions.

One concern noted regarding the use of technology in sign-out reporting was that it was often “adopted for technology’s sake, not because it’s improving communication... I have a concern that the technology (could be) taking away from other (e.g., touching) interactions with the patient.” Another concern was that electronic notes tend to focus on “numbers,” but that “for someone coming on a shift, what they need to do is take a stethoscope and see how the patient sounds, and compare that to one hour, three hours later... but it doesn’t happen because everyone is so focused on having the numbers and getting the numbers into a spreadsheet. The numbers without the story do not really allow you to practice medicine.”

One scenario that was recounted concerning communication failure during sign-out reporting involved an outgoing physician who had indicated to his incoming counterpart during the shift change that a consultant would come by “shortly” to perform an echocardiogram on a patient. The outgoing physician’s assumption that “shortly” meant about one-half hour was based on an ambiguous statement made to him by this consultant. This false assumption adversely affected the assessment of the patient’s state, and was blamed by the outgoing
physician on the commotion and workload in the unit at the time the consultant came by. In another example, an outgoing physician omitted to convey during a sign-out report the very critical fact that an X-ray had indicated that a patient’s endotracheal tube was not in the correct position (thus increasing the likelihood of becoming dislodged and producing a respiratory arrest). This omission resulted from the physician becoming distracted while viewing the X-ray.

Recommendations for improving the sign-out process included mandating face-to-face bedside sign-outs, allowing residents the opportunity “to see what they sound like...for them to witness it,” and building the ability to tell a story into their training. It was also recommended that the entire (resident) team perform walk-throughs together, along with the patient’s nurse, in order to minimize loss of information during sign-outs.

3.2.3. Nurses

In response to the first question in Table III, which addressed sources of difficulty in communicating with the incoming during sign-outs, one of the nurses stated: “There are people who come in and who are all over the place and are not focusing on what you’re saying and will ask you to keep repeating things...there are people who interrupt you. People work days on end and sometimes they are exhausted...sometimes they come in from vacations and are focused on everything else (except the patient).”

Giving sign-outs to new nurses was not a concern. As one of the nurses stated, “I don’t mind walking someone through who may be unfamiliar with certain things and who is nervous because they’re new—it’s the nurses who have been around a long time that ask a million questions that I have less patience with...I realize questioning is necessary, you don’t want miscommunication, but it’s when they’re not listening...or they are asking questions about something you already told them...that’s frustrating.”

Factors cited as responsible for undermining getting adequate information during sign-outs included situations in which outgoing nurses attempted to complete procedures as their shift was terminating while also trying to give a sign-out report, and situations in which residents appeared during the nurses’ shift change and physically removed the nurses’ flow-sheets for their rounds and reports. In the first case, the sign-out communication process itself can become flawed; in the latter case, an interruption to the sign-out report is likely because the nurses will need to retrieve these flowsheets.

An example given of a potentially adverse consequence stemming from inadequate sign-out communication concerned a situation in which an incoming nurse had not been informed by her outgoing nurse counterpart that a central spinal fluid drain used to draw off fluid was left open, which for that patient could have led to neurological complications. Another example involved intravenous fluids that were hung at 11:00 PM but were inadvertently switched with another patient: “The nurse who came on the shift before me didn’t physically go to the bag and look at the name that was on it...it was the wrong IV and instead of it being caught at 7:00 (AM), when both (of us) were there, it was caught 5 to 6 hours later.” Suggestions given for improving the sign-out reporting process included a concern voiced by the nurse managers—that nonemergency procedures by physicians should not be allowed to interrupt the nurses’ sign-out reports.

3.2.4. Residents

Difficulties that PICU residents noted in communicating with incoming residents were attributed to tendencies for that person to “go off on questions that are not relevant,” so that one “winds up forgetting about things you wanted to say about that patient,” and to incomings who are adamant about wanting the sign-out report to be provided immediately and rapidly, which is not always possible if “the unit is very hectic and you get pressed to take care of a number of other things.” The residents indicated that they were more sympathetic, and thus more deliberate in their sign-outs, to incoming residents who either were inexperienced with being on call or who were unfamiliar with the patients (e.g., in the case of the cross-covering resident who appeared every fourth night).

On the issue of factors that hinder adequate sign-out reporting, one of the residents noted: “There are just too many interruptions. We need a better, quieter workspace for sign-outs...before going to the patient bedside.” The other resident presented a wider array of issues, including the tendency for outgoings to “want to get out and leave, rushing through, rather than taking the time to give the sign-out...the people giving the sign-outs are tired and want to get out.” One resident placed the blame for the lack of
preparation by some residents in giving sign-outs on attending physicians who provide poor presentations of patient cases during morning rounds: “The attending doing the rounds is the key to determining how good the sign-out will be.”

The examples offered of communication failures during sign-outs typically involved situations where the information that they received as incoming providers was not updated, or the information that they provided as outgoing providers was taken too literally (e.g., indicating that a patient should be cultured if the patient’s temperature exceeds 101.5, and the incoming decides not to culture despite a reading of 101.4). Suggestions for improving communication during sign-out reporting included the need for a “workspace removed from the nurses’ station . . . a set time for sign-outs . . . (and that) everyone finishes their prior (mostly clinic) duties so that they can get there for the sign-out so no one feels rushed when giving the sign-out.”

3.3. Summary of PACU Observations

Ten PACU nurse sign-out reports were observed. All were performed face-to-face, with the outgoing and incoming nurses usually reading the patient’s chart jointly and referring to the monitors at the patient’s bedside. Pointing and “poking” were common during the reports, whether it was to demonstrate the incision, indicate particular values on the monitor, or to note a drainage line. Also, there was an effort to try to communicate with the patient. The incoming nurses usually took notes during the sign-outs.

The awareness of an impending arrival from the operating room into the unit, which was a relatively common occurrence, generally had the effect of making the outgoing nurse communicate information at a very rapid pace and rushing the incoming nurse in taking information. Interruptions during sign-out reporting by attending anesthesiologists and residents were also frequently observed. For the one complex patient observed, the sign-out took 18 minutes; however, the remaining (routine patient) sign-outs took five minutes or less. All the outgoing nurses were perceived to be friendly and willing to provide information to their incoming counterparts, and all provided a short “story” concerning the patient’s case prior to reviewing details.

Six sign-out reports by PACU residents were observed, which in this unit occurred between the single outgoing resident and the single incoming resident. Reports were typically given at the PACU residents’ station and ranged between two and 10 minutes. In some cases, the outgoing resident would walk through the unit pointing to various patients who either did or did not require attention. The incoming resident typically did not take notes during sign-outs, relying on memory for information. A great deal of variability was observed in pointing, touching, and speaking to patients, and in the degree of inquisitiveness of the incoming resident. Interruptions of sign-out reports by residents were common, usually by a nurse or attending anesthesiologist.

3.4. PACU Interviews

3.4.1. Nurse Managers

Responding to Question 1 in Table II, both PACU nurse managers described the ideal sign-out report as involving “going over everything,” which comprised checking the patient, ensuring all orders have been taken care of, reviewing the patient’s medical history including what the patient was there for, and determining what was left for the incoming nurse to do. These nurse managers also noted that one-way exchanges of information from the outgoing to the incoming nurse were discouraged in favor of highly interactive discourses.

Of the various individual factors considered, personality was noted as the one that could have the most impact on the effectiveness of the sign-out report. As one of the nurse managers indicated: “Some nurses you don’t want to give a report to because of the nature of the way they ask questions.” Both nurse managers emphasized the criticality of face-to-face communication for obtaining needed information as opposed to accessing information from computer-based records—rapid verbal inquiries appeared to them to be more efficient. One of the nurse managers stated that sign-outs (in the PACU) were generally fast, and the use of technology would not likely improve the reporting process. In referring to the computer-generated anesthesia history record that is compiled during the patient’s surgery, the other nurse manager indicated that “it’s hard to find information you need,” thus requiring you to “get a good (verbal) report from the person bringing the patient out from the OR.”

Situations recalled in which patients were put at risk as a result of flawed communication during sign-outs mostly involved omissions by the outgoing nurse, and the nurse managers indicated that
these could have been minimized by engaging in a systematic hands-on appraisal of the patient. This was exemplified in the case of an incoming nurse who observed bleeding during her shift but did not know when the bleeding was initiated. Had it been present and noted during the sign-out report, it would have been easier to associate the bleeding with a previous order. In another example, omitting to communicate problems in morphine management created uncertainty for the incoming provider as to how much morphine was actually put into the patient. Finally, and in stark contrast to the nurse managers in the PICU, these nurse managers did not have any concerns with the sign-outs in the PACU nor did they feel there were any interventions (e.g., in training) that were needed, apparently because of the rigorous and unique orientation program that preceded practice in the PACU.

3.4.2. Attending Physicians

One of the attending PACU physicians conceptualized the ideal sign-out as entailing going from bed to bed, determining if the patient is routine, and if not, obtaining the “entire story as to why (the patients) are not routine.” The other attending felt that the resident should “write down everything that happens to everyone who stays the night . . . which wasn’t necessarily happening when (he) wasn’t here last month . . . you could get by in 85%–90% of the cases, but in 10%–15% of the cases it could come back to affect you.”

These two physicians differed in their views regarding the relative importance of experience, personality, and cultural factors. One physician cited personality as the most important issue: “I think the need (for the incoming provider) to be more inquisitive is very important . . . if something is ambiguous, not clear, find more details about it.” The other attending physician believed that experience was the critical factor: “A senior resident explaining to a junior resident that a patient has X problems . . . the latter may not appreciate the severity of the problems or their implications, so level-to-level there may be some concerns, but I don’t think there are concerns for the other (personality or culture) issues.”

Recommendations for improving communication during sign-outs included the need for afternoon rounds with the nurse manager and with the attending in charge: “Pieces of the puzzle sometimes fall between the cracks. One person may know something that another person does not know . . . by bringing together the people who know all the pieces you have an opportunity to get the complete picture . . . there must be at least one opportunity for the people who are covering to come together . . . if some people know some of the pieces and others don’t, then everyone is at a loss.” The use of teaching lectures was also suggested to “demonstrate, in a video, how information about a patient keeps getting transferred and how the story changes, and as a result how the patient could die.” Other recommendations included the use of a computer-based system that contains all the information in the face-to-face sign-out reports and making the sign-out more standardized so that it’s not done “ten different ways.”

3.4.3. Nurses

One account given of how a patient was put at risk as a result of flawed communication during sign-out reporting involved an outgoing resident who had failed to inform the incoming resident during the sign-out that a patient who arrived from the operating room intubated had in fact been difficult to intubate. This omission significantly increased the likelihood that the patient would get extubated without the precautions necessary for a patient that was difficult to intubate, which could be catastrophic. In another scenario, also involving the airway realm, a patient who was shivering was administered Demerol following consultation with the resident, which resulted in the patient “coding.” What had happened was that upon this patient’s arrival to the PACU the outgoing resident extubated him, but had forgotten to note in the sign-out that this patient required more oxygen during the later part of his surgery because of damage that had occurred to his trachea during surgery (which is rare). The Demerol reduced oxygen to the patient, and thus resulted in the need to reintubate the patient.

Responding to the first question in Table III regarding possible difficulties associated with providing sign-out reports to incoming nurses, one of the PACU nurses noted that “she felt good if someone asks too many questions” but that incoming nurses with passive aggressive personalities “are bad . . . because they don’t want to hear anything. It’s
difficult to give these people reports.” The presence of new or less-experienced incoming nurses, however, did not appear to be an issue.

Reasons given by the nurses for not receiving adequate information during sign-out reports were mostly attributed to interruptions such as an admission from the operating room, which was commonplace in this unit. Because these interruptions can be extensive, as when there is a need to obtain pain medication for the new arrival, they increase the likelihood of omissions upon continuation of the sign-out report.

Examples of communication failures during sign-out reports recounted by these nurses included issues that were discovered following the shift change that could have been resolved through proper checking during the sign-out report, such as problems in the flow of morphine (which may have been due to improper calibration) or drugs whose settings were confused with one another. Finally, to improve the sign-out process, these nurses emphasized the need for enforcement of punctuality for the nurse arriving to the shift change, as well as for the outgoing nurse who may take a break prior to the shift change and thus leave little time to “give a report on two complicated patients.”

3.4.4. Residents

The PACU residents noted several sources of difficulty in communicating with the incoming resident. As one resident stated: “Some incomings want past patient history first and then current issues, others prefer the opposite . . . a style conflict can cause interruptions in the process of giving the sign-out.” Also noted were the frequent interruptions of resident sign-outs by nurses and shortcomings in the way sign-out reporting was carried out. In recalling how he had forgotten to communicate that a patient’s “blood culture from two days ago came back positive,” one resident indicated that “the (incoming) resident would probably find out about it . . . it happens because we often rely on memory.”

The PACU residents also identified a number of factors that hindered them from obtaining adequate information from the outgoing resident. These included situations in which the outgoing leaves out information “that got you burned,” and the nature of the way the sign-out report is given: “Not everyone is a good communicator . . . an intern right out of medical school is way more likely to give you a sign-out that is totally disorganized, full of unimportant information that’s not relevant to patient management and leave out the most important information.” Other factors that were noted included interruptions from being paged and from nurses wanting orders.

Multiple instances were recalled where inadequate communication in sign-out reporting gave rise to problems in patient care. Typically, these situations involved omissions of information such as when the outgoing resident failed to inform the incoming about the need to follow-up on a lab or consult, or that the patient is allergic to a medication. As stated by one of the residents: “Even though it’s written down it may not get read and if it’s not communicated it gets missed . . . in reality the majority of written records in the hospital are totally illegible . . . (so) it’s valuable to hear the details that are being communicated . . . we typically don’t spend a lot of time digging through all the reports to seek information—we rely on nurses.”

Suggestions for improving the sign-out process offered by the residents included the need for “having things written down that the anesthesiologist who was in the operating room would want to know if he or she were now in the PACU caring for that patient . . . even though information is in reports, you need to know where to look,” and having a formal typed sign-out that includes name, diagnosis, and issues “like we had when I was an intern in the ICU” even though “it’s more work for the person leaving.”

4. DISCUSSION

Using data collected from observations and interviews, this study examined how various factors associated with sign-out reporting during shift changeovers can translate into increased risks of adverse outcomes for patients in two contrasting critical care hospital units. A key finding from the study was the clear association between the methods used by medical providers to perform sign-outs and problems in patient management that arose from the nature of the exchanges of patient-related information during sign-out reporting. This was exemplified in the case of the PICU nurse who noted that she was not told that a central spinal fluid drain used to draw off fluid was left open. A more hands-on approach to conducting sign-outs in the form of extensive head-to-toe “touching and poking” of the patient would likely serve to avert many of these types of incidents. Nurses in the PACU were more likely to resort to this
approach, probably because most of their patients were new and thus unfamiliar. Also, by working 8-hour shifts, these nurses are less likely to be fatigued during the shift change report.

The tendency for nurses in the PICU not to incorporate more hands-on sign-out reporting may have been influenced by the inordinate amount of time that they spent checking orders and performing manual calculations for medications during their sign-outs. The underlying problem—poor consideration of human factors issues in interface design—could be largely resolved through the use of computerized charting and medication calculation aids that could diminish the cognitive load associated with these tasks and thus increase the opportunity for focusing on the patient.

Another emergent theme concerned the nature of the patient information conveyed during sign-out reporting. Both PICU attending physicians strongly believed that the outgoing resident needed to present a well-crafted “story” in addition to relevant “numbers” during the transition of patients. Several factors were identified that could contribute to undermining this possibility. For example, by conducting sign-outs at their workstations as opposed to the bedside, PICU residents risked neglecting contextual details necessary for forming useful patient problem descriptions, and instead relied on developing an understanding of the issues from the raw data alone. Another factor is rushed sign-out reporting, which was observed on several occasions among PICU residents and could be attributed in part to insetting fatigue.

An important psychosocial consideration that was found to be capable of exacting considerable influence on the sign-out report was the personality of the provider. Various forms of tension can arise between the outgoing and incoming providers depending on each of their personalities. For example, passive personalities on the part of incoming providers are not likely to be conducive to effective exchanges of information, especially if outgoing providers have aggressive personalities and are relatively inflexible concerning sign-out reporting. Another source of tension derives from questioning by incoming providers. If perceived by the outgoing provider as irrelevant or asynchronous with one’s reporting, it can generate frustration and ultimately prove distracting, which increases the tendency for omissions. The implication is that providers need to rise above the behavioral tendencies that could compromise the quality of information during sign-outs, and that interventions may be required for optimizing the sign-out discourse.

This study also indicated that experience and even cultural background can play a role in generating ambiguity and compromising the exchange of patient information. Having providers who may be self-conscious about their command of the English language (which could be a growing concern in large multicultural hospital environments) and are thus more reluctant to ask questions, or who are less experienced and thus not as knowledgeable concerning what to ask for, exemplify how language and experience can undermine sign-out reporting.

Finally, the suggestions offered by residents for improving the sign-out process in the PACU pointed to the need for better tools for making information readily available. Establishing and maintaining these kinds of resources, however, requires an investment of effort, and there may be a tendency to bypass such information documentation activities if other less-effortful avenues for securing information can be identified. Good interface design in proposed solutions and consistent policies regarding the use of these resources increase the chances for successful adoption of such tools.\(^\text{(17)}\)

Fig. 1 demonstrates how the interplay of some of the issues associated with human characteristics and work context in sign-out reporting, as derived from both the observational and interview data as well as from literature regarding behavioral tendencies during shift changes,\(^\text{(6,18)}\) can result in a false assumption by the incoming provider. Because the arrows in this figure represent influences, these diagrams are often referred to as influence diagrams, which represent a type of modeling framework.\(^\text{(16)}\) This particular influence diagram was motivated by the case noted earlier, where the way in which the outgoing nurse had indicated to the incoming nurse that she had some trouble with a particular intravenous central port line led to the incoming nurse falsely assuming that the port was “still flushing.” Similarly, influence diagrams could also be constructed to model omissions in the communication of patient information during sign-out reporting (for example, stemming from interruptions during work activities).

The usefulness of these models is that they provide a basis for identifying interventions for minimizing potential negative outcomes. This is illustrated in
Fig. 1. Use of an influence diagram for exploring factors that can contribute to the tendency for a false assumption by an incoming provider.

Fig. 2. Exploring interventions by “breaking the paths” associated with the false assumption in Fig. 1 (refer to the text for the specific example).

Fig. 2, which refers to the scenario represented in Fig. 1. System safety specialists often talk about “breaking the paths” (represented by the double lines in Fig. 2) as ways for preventing hazardous events or mitigating adverse outcomes.(19,20) In Fig. 2, note that “touching and poking” could have in and of itself broken the major link in the false assumption regarding whether a central port line was flushing. However, as discussed earlier and as Fig. 2 demonstrates, to have the time for touching and poking, a number of human factors and ergonomic issues need to be resolved.
Table IV. Some Recommendations for Minimizing Risks to Patient Care in Sign-Out Reporting

<table>
<thead>
<tr>
<th>Recommendation</th>
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<tr>
<td>1. Emphasize systematic “touching and poking,” especially for nurses.</td>
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<tr>
<td>2. Teach providers to tell a “better story,” including more effective integration of “global” and “numbers” information.</td>
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<td>3. Emphasize the importance of developing a “balanced” inquisitive technique.</td>
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<td>4. Mandate bedside discussions by residents either during or at least following sign-out reports.</td>
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<tr>
<td>5. Couple inexperienced providers with experienced incoming and outgoing nurses; the experienced incoming can demonstrate proper inquiries about patient status and issues and the experienced outgoing can demonstrate proper “story-telling” and method.</td>
</tr>
<tr>
<td>6. Consider the use of videotaped simulated sign-outs for demonstrating the nature of false assumptions and omissions, including the effects of interruptions, good versus poor patient problem descriptions, and the consequences of the absence of visual cues and relying only on written information.</td>
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<tr>
<td>7. Minimize interruptions during sign-outs of both nurses and residents.</td>
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<tr>
<td>8. Promote an effective use of computerization during sign-outs, both as aids (e.g., for medication calculations) and as support documentation.</td>
</tr>
<tr>
<td>9. Address workspace and other human factors and ergonomics issues that can adversely impact upon the sign-out process.</td>
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</table>

5. CONCLUSIONS

Based on this study, a number of recommendations are suggested for minimizing the risks associated with sign-out reporting of patient information. (Table IV). However, these recommendations need to be viewed with caution in recognition of some key limitations of this study. Most importantly, hospitals differ in their organizational structures, administrative policies, training protocols, equipment, and patient populations, and differences in these and other considerations could call into question the generalizability of the proposed recommendations to other hospitals. In the same vein, the study only sampled two critical care units and fundamental differences among the various critical care units would likely impact upon the degree of applicability of any of the study’s results or recommendations, as evidenced by the differences in sign-out reporting that were found in this study between the PICU and PACU for both nurses and residents.

These limitations notwithstanding, interventions need to be carefully thought out, especially in regard to altering existing contexts in ways that could produce new opportunities for failures or other unwanted consequences. It is also important that the effects of interventions be measurable. Finally, identifying interventions and detailing strategies for their implementation is just a start. Ultimately, the real challenge will be to seamlessly integrate these interventions into the already protocol-saturated high-risk environments of existing critical care systems.

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REFERENCES

