A great deal of a physician's time is spent communicating. For example, in one study, 24% of hospitalists' time is spent in communication activities, and in another study, ICU staff spent the majority of their time communicating. Yet there are few studies on effective ways to improve communication within hospitals. The growing complexity of hospitalized patients has made communication among members of multidisciplinary teams caring for patients increasingly important. Errors in communication are a major contributor to defects in quality and harm to patients. Beyond patient care issues, it is estimated that ineffective communication causes $12 billion of waste annually in hospitals, equating to an annual loss of $4 million for a typical 500-bed hospital.

Pagers are commonly used to facilitate communication in health care settings. Residents are paged an average of 57 ±3 times on a day when they are on call, and even when they are not, 12 ±3 times. A study at a tertiary care academic teaching hospital revealed that 14% of pages were sent to an incorrect physician who was unavailable at the time of the page. Of those pages, 47% were deemed to be either urgent, requiring a timely response, or emergencies requiring immediate attention. One study demonstrated perceptions of significantly improved patient care by nursing staff after switching from a numeric to alphanumeric paging system. However, many alphanumeric pager messages have insufficient information. Two-way text paging may offer improved communication. Another study at an academic medical center demonstrated that implementation of a standardized team-based paging system reduced incorrect pages by 11%.

Delays in paging response can be attributed to multiple causes. A prior multi-institution study revealed that the majority of pages occur when interns are engaged in direct patient care. Most of the pages were nonurgent, with only a fraction of pages requiring a prompt response in the judgment of the recipient. As a result, many nursing pages may be triaged by house staff and responses delayed by competing priorities. Residency work-hour regulations may also contribute to nursing communication errors. Hospitalized patients at academic medical centers are frequently covered by a variety of shift-based schedules, which increases handoffs. Consequently, an individual patient may be covered by multiple physicians throughout the course of a day. This potentially increases the risk of paging an incorrect physician who is no longer available for patient care, and it significantly complicates nursing communication, as a delayed paging response can initially be indistinguishable from a page to the wrong physician.

This improvement project was initiated at our institution because an average of five paging incident reports per month demonstrated delayed patient care that was attributed to difficulty contacting the correct physician. In some instances, communication difficulty was followed by adverse events and escalation of patient care. These data were supported by a survey of 78 resident physicians who reported a large volume of pages from nurses each day, a significant proportion of which were in error. Our initial problem assessment indicated that a nurse's familiarity with physician teams was the primary driver in knowing whom to contact. The findings showed that if an "off-service" or "unfamiliar" patient was housed on the nursing unit, the confidence in knowing whom to contact with questions decreased dramatically. Prior to this project, 83% of incident reports concerning an inability to contact the correct physician occurred on units where nurses were less familiar with the physician or service. This unfortunately happens when the hospital has high occupancy and patients cannot always be admitted, at least initially, to the unit usually designated for a specialty.

In our local care environment call schedules specific to services, teams, types of activity, day of the week, and time of day were the primary tool for nurses knowing whom to page. Physicians placed high value on these call schedules, as they defined their duty hours. However, the schedules occasionally contained errors, which in turn led to paging errors. There was no standard approach used to maintain these schedules.
To address this problem we implemented a model of team-based pagers similar to that previously used by Wong et al. at another academic medical center. The planned primary outcome of this improvement project was to improve the certainty of nurses knowing which physician to page.

Methods

DEVELOPING THE GHOST-PAGER MODEL

To address the deficiencies of paging system elements in the local care environment, factors likely to influence change were considered. Initial thought was given to improving and standardizing call schedules. However, significant barriers made this unlikely to succeed. Nearly every service had differing needs related to the nature of its specialty; many different tools were in use for constructing schedules; and an array of types of roles, varying from chief residents to clerical personnel, were assigned the responsibility for the schedules. These patterns were deeply entrenched and judged to be very difficult to standardize. An alternative of a single pager number for a team or a specific consult service had been used successfully in a few situations. A multidisciplinary team was formed to confirm the feasibility of this model and implement it for the entire hospital. The team included physicians, nurses, residents, and a physician-informaticist.

The main building blocks of the new model were assignment of a treatment team to each patient and a dedicated pager number (that is, one that never changes), which we referred to as the “ghost-pager” (as suggested by the lead author [L.S.]) number, to each team. The treatment team was assigned to each patient by the resident (1) admitting the patient, (2) writing postoperative orders, or (3) accepting a patient from another service. A standard team list was made available in the electronic medical record (EMR) to facilitate the assignments. Reports were printed on units twice a day listing any patient without a treatment team assignment. Nurses contacted teams asking that the patient be assigned, or the unit clerk completed the missing assignments when possible. The percentage of patients with a treatment team assignment was tracked weekly. A separate report listed the at-risk patients when possible. The percentage of patients with a treatment team and ghost-pager numbers was also distributed electronically throughout the hospital.

Education of nurses and physicians regarding the new system was carried out through presentations at meetings, posters, pocket cards, and reminders on workstation screens. Physician champions, who were identified for each specialty, provided stakeholder input during the design of the new system and helped disseminate information about it.

ASSESSING THE EFFECTIVENESS OF THE NEW MODEL

The effectiveness of the new model was assessed using a before-and-after prospective assessment of nurses’ knowledge of whom to page, as measured by nurses’ level of certainty regarding whom to page. Before we initiated this model in June 2010, nurses from all shifts on selected units in the hospital were surveyed by e-mail to determine how much difficulty they experienced in knowing which physician to page when they needed medical input in the care of a patient. Each respondent was asked to identify the medical or surgical service most commonly paged, and then to rate the level of certainty of which specific physician to page on the basis of a 4-point scale: “nearly always,” “usually,” “sometimes,” and “rarely.” This process was then repeated for the second- and third-most common service that the nurse typically needed to page. The survey was conducted during a three-week period in February 2009 and again in February 2011. One reminder message was sent halfway through each survey period to increase the response rate. Pearson’s chi-square test was used to assess whether certainty over whom to page increased from the 2009 to the 2011 time period. The threshold level of type I error (alpha) for determining statistical significance was \( p < .05 \).
ADOPTION OF THE GHOST-PAGER MODEL

Adoption of the ghost-pager model was rapid and uniform, and compliance with treatment team assignment was very high. Among patients of faculty physicians, 64% (315/491) had an assigned treatment team within the first week of the rollout. This value grew to greater than 80% within a month and has remained in the 92%–93% range since then.

NURSE SURVEY RESPONSES

There were 561 responses to the nurse survey in 2009 and 916 responses in 2011. Before implementation of this model, 73% of the nurses responding to the survey indicated they “nearly always” or “usually” knew whom to page. This level of certainty varied considerably among services, ranging from 33% for neurology to 91% for neurosurgery. Overall, certainty for all services rose to 87% after the model was implemented (range, 75%–100%). Eight of the services had > 90% certainty, including three with a certainty rate of 100% (Figure 2, page 80).

The improvement for the whole hospital was highly significant ($p < .0001$). The improvements for medicine-cardiology ($p < .0001$), medicine-gastrointestinal ($p < .03$), medicine ($p < .0001$), oncology ($p < .01$), and trauma ($p < .04$), were all statistically significant.

QUALITATIVE RESULTS

Qualitative results were also positive. Incident reports of inability to contact a physician using the ghost-pager number have been uncommon. Nurses in general have expressed wide support for the model, as have physicians. Some services have begun using ghost pagers to help sort calls within teams, such as “admitting resident,” or for additional consulting services. Paging operators liked the new model, as the increased work of more calls to forward a pager were offset by reduction in the burden of trying to find the correct physician, often a frustrating process punctuated by repeated calls from nurses upset that the physician had not called back. Residents now can directly control handoffs or last-minute changes in coverage. The model has remained in-
The use of a dedicated team-based pager number that is always assigned to a team greatly improved the likelihood of a nurse's knowing whom to page. This was particularly true for services with more complicated team structures or whose patients tend to be more dispersed. The results confirm the findings reported by Wong et al., who showed that a team pager reduced the number of after-hours paging errors on a general medicine service in an academic hospital. Our study extends this finding to multiple other medical and surgical specialties and to all three nursing shifts.

Figure 2. Nurses’ responses show their level of certainty about which physician to page in 2009 and again in 2011 after the implementation of the new paging model. CT, cardiothoracic; GI, gastrointestinal. Probability (p) levels for chi-square tests are shown; an asterisk indicates statistical significance. (Available in color in online article.)

**Discussion**

Effective, timely communication is essential to provide outstanding patient care. Over the years, there have been repeated concerns about improving nurse-to-physician communication.8–25 In academic medical centers with complex teams of physicians, the most fundamental step in communicating is finding the correct physician responsible for the patient. Our results suggest that the use of a dedicated team-based pager number that is always assigned to a team greatly improved the likelihood of a nurse’s knowing whom to page. This was particularly true for services with more complicated team structures or whose patients tend to be more dispersed. The results confirm the findings reported by Wong et al., who showed that a team pager reduced the number of after-hours paging errors on a general medicine service in an academic hospital. Our study extends this finding to multiple other medical and surgical specialties and to all three nursing shifts.

The application of new communication technologies is often the focus of communication improvement initiatives.14,26–32 However, simply imposing these technologies on existing work flows may not improve communication.27,31,32 A technology may be seen as an improvement for physicians, but not nurses, or...
vice versa. Furthermore, one technology may be useful for some types of communication but less so for others. In one study, the use of e-mail via smartphones was favored for conveying nonurgent information, but other modes were preferred for urgent matters. In addition, team members disagreed about appropriate use of communication modes. There is the possibility of making matters worse, as Quan et al. found when a Web-based communication system increased interruptions of residents by 233%. The authors cautioned that “the interplay of technology with existing clinical workflow, culture, and social interactions may create other unintended consequences.” The model evaluated in this study did not employ new technologies, depending only on those that were already being used. The focus was on reducing variation and errors in the work flow of paging. The results suggest significant potential for improving paging even without additional technological tools. Furthermore, the work-flow improvements would have been needed even if new communication technologies had been added.

The new model implemented in this study did take advantage of functionality in the EMR system not previously employed. The hospital’s informatics team was essential to move the process forward. Embedding the ghost-pager number into the treatment team name eliminated any additional order entry steps for physicians assigning themselves to a patient. The treatment team and ghost-pager number information were also automatically pulled into the nursing notes for additional quick reference. A line was added in the RN sign-out note to enable nurses to communicate nonurgent issues to physicians for follow-up to reduce some of the unnecessary night-shift paging.

The new model represented a significant change in traditional practice. Stories drawn from paging incidents, information gathered to characterize the problem, and the data gathered in the initial survey of nurses established the need for improving paging effectiveness. From the onset of this project, physicians responded with genuine concern when reports of delays in patient care were brought to their attention. The congruency of data from all these sources was sufficiently compelling to establish a multidisciplinary team to critically evaluate paging effectiveness strategies and implement the new model. The potential to improve trainee experience with pages may have helped drive their compliance with the new model as well.

LIMITATIONS

This study has several limitations. The results are based on nurses’ perceptions rather than objective measures of reduced paging errors or of improved patient outcomes. This was not a randomized, control trial of the model. The evaluators were not blinded as to the intervention. It is possible that the changes in nurses’ perceptions were biased by the attention focused on the model by the campaign conducted to increase adoption. Nevertheless, the results suggest that this model can be helpful in reducing errors in communication due to paging the incorrect physician. Although improvements in communication in general are expected to enhance quality and patient safety, the impact of this model on improved patient outcomes is important to assess in further studies. In addition, more study is needed on whether the changes implemented have improved resident experience with the number and self-perceived appropriateness of paging, particularly at night.

Summary

As complexity of care of hospitalized patients has increased, the need for communication and collaboration among members of the team caring for the patient has become increasingly important. This often takes the form of a nurse’s need to contact a patient’s physician to discuss some aspect of care and modify treatment plans. Errors in communication delay care and can pose risk to patients. This report describes the successful implementation of a standardized team-based paging system at an academic center. Results showed a substantial improvement in nurses’ perceptions of knowing how to contact the correct physician when discussion of the patient’s care is needed. This improvement was found across multiple medical and surgical specialties and was particularly effective for services with the greatest communication problems.

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References


Figure 1. The paging model requires residents to assign the treatment team to each patient and to forward the ghost pager (GP) to their personal pager whenever they are responsible for the patient or on call. Nurses page physicians using the ghost-pager number, which never changes for a team. Ghost-pager numbers are embedded in the electronic medical record (EMR) nursing work flow.
Figure 2. Nurses’ responses show their level of certainty about which physician to page in 2009 and again in 2011 after the implementation of the new paging model. CT, cardiothoracic; GI, gastrointestinal. Probability (p) levels for chi-square tests are shown; an asterisk indicates statistical significance.