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**An Assessment of Patient Sign-Outs Conducted by University at Buffalo Internal Medicine Residents**

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**Abstract**

Internal medicine residents were surveyed regarding patient sign-outs at shift change. Data were used to design and implement interventions aimed at improving sign-out quality. This quasi-experimental project incorporated the Plan, Do, Study, Act methodology. Residents completed an anonymous electronic survey regarding experiences during sign-outs. Survey questions assessed structure, process, and outcome of sign-outs. Analysis of qualitative and quantitative data was performed; interventions were implemented based on survey findings. A total of 120 surveys (89% response) and 115 surveys (83% response) were completed by residents of 4 postgraduate years in response to the first (2008) and second (2009) survey requests, respectively. Approximately 79% of the respondents to the second survey indicated that postintervention sign-out systems were superior to preintervention systems. Results indicated improvement in specific areas of structure, process, and outcome. Survey-based modifications to existing sign-out systems effected measurable quality improvement in structure, process, and outcome.

**Keywords**

sign-outs, quality improvement, handoff communication, internal medicine residents

Less than 4 years ago, the Joint Commission on Accredi­ tation of Healthcare Organization (now known as the Joint Commission) published a landmark document, *2006* *National Patient Safety Goals*, which augmented previoussafety goals1 to include a standardized approach to “hand off” communications, including an opportunity to ask and respond to questions.2 In April 2007, the International Steering Committee of the World Health Organization Collaborating Center for Patient Safety Solutions—of which the Joint Commission is a member—approved 9 patient safety solutions, specifically referencing the impor­ tance of effective patient handovers.3 The third of these solutions states, “These gaps in communication can cause serious breakdowns in the continuity of care, inappropriate treatment, and potential harm to the patient.”3

Well described in health care research literature, discon­ tinuity of inpatient care can lead to a variety of negative outcomes. For example, Lofgren et al4 described both pro­ longed individual hospital stay and increased laboratory testing (independent of length of stay) associated with transfer of patient care between internal medicine residents the day after admission. Furthermore, Laine et al5 found an increased number of complications among medical

inpatients admitted following implementation of work hour rules, when compared with medical inpatients treated prior to implementation of work hour rules. Importantly, many of the complications described are largely prevent­ able.5 Of course, each change of shift contributes signifi­ cantly to this discontinuity of patient care. Research following the American College of Graduate Medical Education (ACGME)–sponsored mandatory decrease in work hours in 2003 estimated that the number of handover events increased as much as 40% when teaching hospitals implemented those duty hour regulations.6 Moreover, the

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Institute of Medicine’s recommendation on residency work hours (2008) has similar implications for current patient handover processes, because implementation of these rec­ ommendations would result in increased numbers of hand over events per 24-hour period of patient care, further con­ tributing to erosion of care continuity.7

Among health care providers, a plethora of studies has demonstrated great variability in methods of patient handover at change of shift. Health care providers accom­ plish patient handover using a variety of methods, depen­ dent on handover techniques acquired during professional training, personal attitudes, beliefs, and habits; handover practices commonly used at the workplace; as well as the prevailing culture at the workplace. However, it appears that formal teaching of handover techniques is not yet common practice among internal medicine residency programs. A national survey of ACGME-accredited inter­ nal medicine residency programs in 2006 indicated that approximately 60% of programs that were successfully surveyed did not provide formal sign-out training.8

At the same time, although many different handover methods have been described and researched, no one par­ ticular method of handover education or process has been established as the gold standard to maximize patient safety and/or reduce preventable adverse outcomes among patients. Establishing a gold standard for patient handover is particularly complicated, because there is an enormous amount of interinstitutional and intrainstitutional variation in handover practice, particularly across disciplines and specialties, and because relevant outcomes are notoriously difficult to measure in today’s complex care environ­ ments.9 Though root cause analysis certainly can shed light on the contribution of poor or faulty communication to pre­ ventable adverse events, determining relationships to actual sign-out practices remains challenging. Nevertheless, the medical community remains acutely aware that a high-quality sign-out at change of shift is extremely important, because transfers of care responsibilities are a frequent occurrence; one study estimates that an internal medicine intern may conduct approximately 300 sign-outs during 4 contiguous weeks of inpatient care.6 Moreover, the odds of preventable adverse events among inpatients increase dra­ matically when the team providing care is not the primary team.10

This quality improvement project served to elucidate the complicated issues surrounding sign-outs among and between teams of internal medicine residents working in our local teaching hospitals. Through this process, a mul­ tifaceted intervention was designed and implemented. This article discusses the measurable structure, process, and outcome improvements in the quality of sign-outs that resulted and explores future possibilities for linkages to patient outcomes.

**Methods**

The University at Buffalo Internal Medicine Residency Program provides internal medicine training to categori­ cal, preliminary, and combined program residents (ie, internal medicine/preventive medicine, internal medi­ cine/pediatrics). A resident rotation is known as a “mod­ ule”; each module is 4 weeks in duration. Residents mainly rotate through 3 hospital sites during their train­ ing: a local Veterans Administration Medical Center, a county trauma/tertiary referral center, and an urban acute care medical center. Each hospital site has a chief resi­ dent from internal medicine who oversees resident activities. Not surprisingly, every hospital site has its own culture, practices, and information systems, which run independently of the other sites. As such, tradition­ ally there has been little uniformity in the way patients are signed out among and between internal medicine resident team members at change of shift. However, internal medicine teams at all sites have consistently made use of both verbal and written sign-out practices.

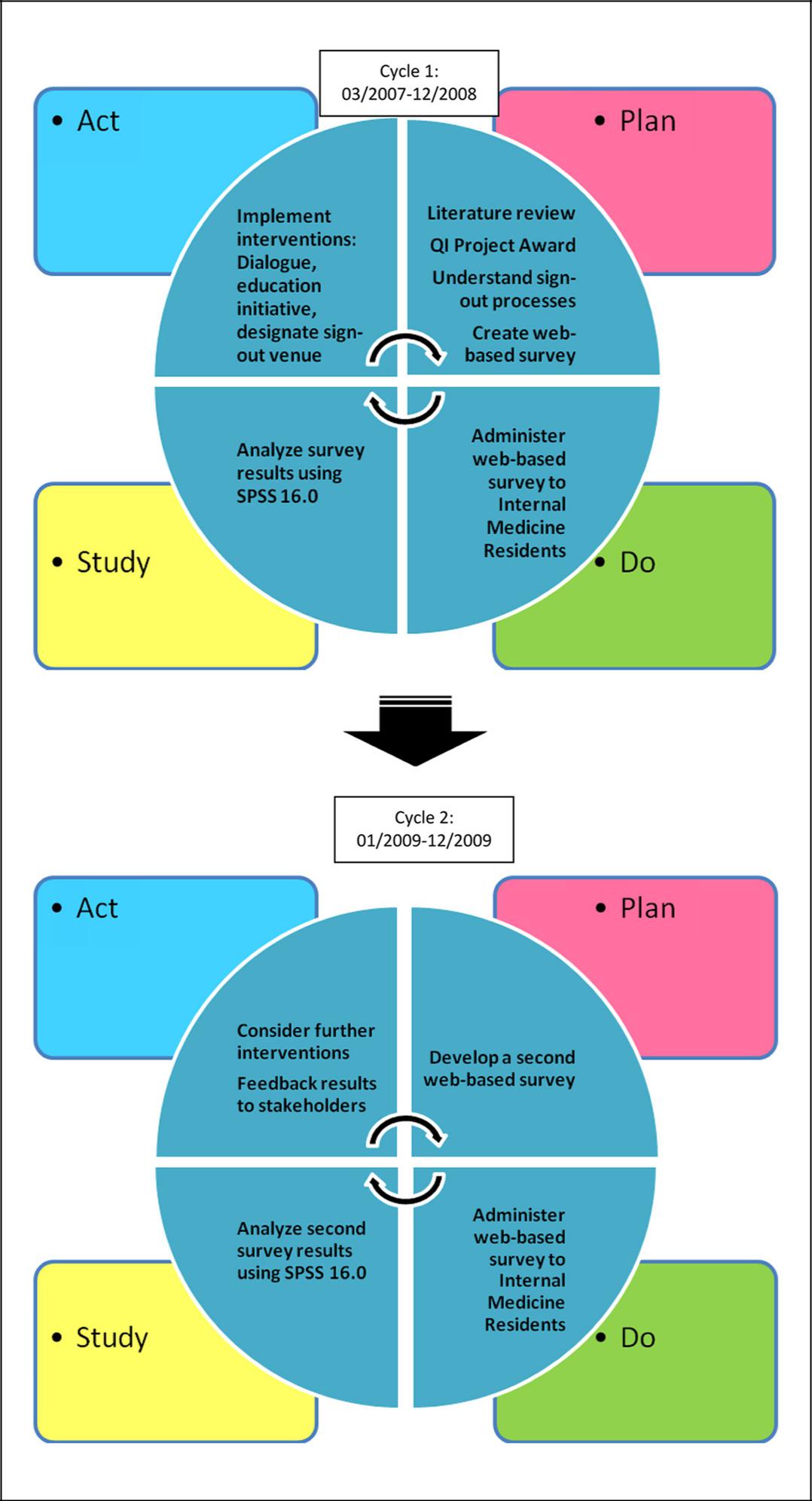
Early in the 2006/2007 academic year, a small group of residents met with faculty to garner support for a qual­ ity improvement project to examine the way in which patient sign-outs were conducted at our hospital sites. This group developed the schema depicted in Figure 1. The involved residents applied for and obtained a quality improvement grant from the Graduate Medical Education office to fund the quality improvement project.

An initial 18-item electronic survey was created in an attempt to more fully understand the current sign-out pro­ cesses at the different hospital sites (Table 1). The survey covered several areas of structure, process, and outcome of the sign-out system, with closed-ended responses indi­ cating level of agreement through use of a Likert-type scale. For the sake of completeness, the survey contained an item where respondents could offer comments through use of free text (Table 2). Both the closed-ended and open-ended questions covered issues related to verbal and paper sign-outs. The survey was reviewed by faculty prior to being distributed to all internal medicine resi­ dents in March 2008 via “E\*value,” a health care educa­ tion system11 regularly used by the internal medicine program to communicate with residents. Resident partici­ pation in the survey was completely voluntary and all responses were anonymous. Because this project does not meet criteria of clinical research as defined by the US Department of Health and Human Services under 45CFR 46.102(d),12 and is geared, instead, toward identifying and implementing best practice for improving patient care, formal institutional review board review was not sought. After completion of surveys, staff from E\*value provided anonymous raw survey data on Microsoft Excel,

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**Figure 1.** Quality improvement project schema



which was entered into SPSS version 16.0 for statistical analysis (IBM, Chicago, IL).

Based on the electronic survey results, a multifaceted intervention was created and launched in July 2008 (at the beginning of the first module of the new academic year), with the aim of improving the quality of the sign-out experi­ ence for internal medicine residents. Specific areas addressed by the intervention included quality of patient information provided at sign-out, atmosphere in which sign-out is conducted, desire for more education and teach­ ing during the sign-out period, and sign-out process train­ ing/modeling.

*Quality of patient information*: This initiativeentailed feedback to residents on their perfor­ mance at sign-out, as well as the content/appear­ ance of sign-out sheets. To accomplish this, chief residents attended sign-out when possible, and frequently reviewed sign-out sheets, to assess for accuracy of information, inclusion of necessary information, and exclusion of extra­ neous information.

*Atmosphere at sign-out*: To optimize the atmosphereconducive to patient sign-out, a venue (time and place) was adopted uniformly across sites for sign-out on nonholiday weekdays. Internal medicine sign-out was to occur at 4 pm Monday through Friday, with mandatory attendance by all residents. The sign-out format was changed from numerous one-to-one sign-outs to a single group sign-out ses­ sion. This change also served to increase the poten­ tial for teaching moments experienced by residents during sign-out and enabled residents who were not on call to finish work in a timely manner after sign-out.

*Education and teaching*: Chief residents and seniorresidents were instructed to ensure that at least 1 teaching moment was identified during the sign-out process. This moment might involve simply discussing an abnormal computerized tomogra­ phy (CT) scan or might involve a deeper, more complex discussion about a patient’s condition, depending on the time available.

*Training/modeling*: A 1-hour experiential training ses­sion on effective patient sign-out was created and implemented for all internal medicine residents across the 3 hospital sites. This session occurred early in the academic year and took place during morning report time, which has mandatory daily attendance. Good sign-out practices also are rein­ forced by chief residents who attend sign-out.

To implement these changes, meetings were scheduled with key senior nursing and emergency department staff to acquire cooperation in decreasing nonurgent interruptions during sign-out. Paper reminders to this effect were posted at nursing stations. In addition, the chief residents worked to optimize the availability of tools required for creation of a good quality sign-out (eg, sufficient computers and print­ ers in good working condition) and worked to remind residents of their sign-out-related responsibilities on a regular basis. The intervention took several months to fully roll out across all 3 sites.

In early April 2009, just over 1 year after the initial survey, residents were resurveyed with the aim of detecting change in views of the sign-out system. Very similar in

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|  | | | | |  |  |
| **Table 1.** Resident Agreement by Question and Quality Improvement Area—Both Surveys Included | | | | |  |  |
|  |  |  |  |  |  |  |
|  | Net | Survey 1 | Survey 2 |  | Question | Question |
|  | Change | Agree | Agree |  | Number: | Number: |
| QI Area | (%) | (%) | (%) | Question From Survey | Survey 1 | Survey 2 |
|  |  |  |  |  |  |  |
| Structure | +21.3 | 50.0 | 71.3 | The information communicated to me during | 5 | 5 |
|  |  |  |  | the sign-out session is concise, accurate, and |  |  |
|  |  |  |  | relevant. |  |  |
| Structure | +10.5 | 62.5 | 73.0 | Sign-out sessions provide information on | 6 | 6 |
|  |  |  |  | anticipated problems and status changes, |  |  |
|  |  |  |  | especially with complicated patients. |  |  |
| Structure | +10.3 | 75.8 | 86.1 | The sign-out period allows interactive | 11 | 11 |
|  |  |  |  | communication between all residents involved. |  |  |
| Structure | −4.4 | 58.3 | 53.9 | Current sign-out sheets (written) are well | 4 | 4 |
|  |  |  |  | organized, accurate, and provide up-to-date |  |  |
|  |  |  |  | information regarding patients’ care. |  |  |
| Structure | −5.9 | 83.3 | 77.4 | I am provided with the adequate equipment | 3 | 3 |
|  |  |  |  | needed (computers, printers, supplies) to come |  |  |
|  |  |  |  | up with a good sign-out. |  |  |
| Structure | −10.1 | 67.5 | 57.4 | The current sign-outs take place in an | 8 | 8 |
|  |  |  |  | environment that is free from interruptions and |  |  |
|  |  |  |  | distractions. |  |  |
| Process | +15.0 | 66.7 | 81.7 | Each sign-out period is well supervised by senior | 9 | 9 |
|  |  |  |  | house staff (chief resident or senior resident). |  |  |
| Process | +3.7 | 86.7 | 90.4 | I am able to ask questions and raise issues | 12 | 12 |
|  |  |  |  | regarding the patients the team is signing out |  |  |
|  |  |  |  | to me. |  |  |
| Process | +2.2 | 70.8 | 73.0 | The sign-out period is a good venue for clarifying | 13 | 13 |
|  |  |  |  | conflicting information. |  |  |
| Process | +1.5 | 73.3 | 74.8 | Each patient is discussed with the appropriate | 10 | 10 |
|  |  |  |  | amount of time, depending on the complexity of |  |  |
|  |  |  |  | his/her case. |  |  |
| Process | +0.4 | 41.7 | 42.1 | I receive appropriate feedback about how I sign | 17 | 17 |
|  |  |  |  | out patients under my care. |  |  |
| Process | −2.7 | 30.8 | 28.1 | The quality of the sign-out sheets is assessed by | 18 | 18 |
|  |  |  |  | the attendings at least once during their service |  |  |
|  |  |  |  | period. |  |  |
| Process | −4.2 | 82.5 | 78.3 | I am adequately trained about properly signing out | 2 | 2 |
|  |  |  |  | patients. |  |  |
| Process | −8.4 | 87.5 | 79.1 | I am well educated regarding patient safety issues. | 1 | 1 |
| Outcome | +20.4 | 28.3 | 48.7 | Some teaching points are brought up and | 14 | 14 |
|  |  |  |  | discussed during each and every sign-out. |  |  |
| Outcome | +11.3 | 60.0 | 71.3 | After sign-outs, I feel more confident and more | 15 | 15 |
|  |  |  |  | prepared in providing adequate patient care. |  |  |
| Outcome | +9.3 | 74.2 | 83.5 | Adverse events and miscommunications are | 16 | 16 |
|  |  |  |  | reduced because of the sign-out process. |  |  |
| Structure | N/A | N/A | 58.0 | The sign-out sheets are well organized and I can find | 7 | N/A |
|  |  |  |  | information that I need easily. (First survey only) |  |  |
| Process | N/A | N/A | 74.3 | The 8 pm sign-out session to the night team has | N/A | 7 |
|  |  |  |  | been conducted properly and reflects important |  |  |
|  |  |  |  | patient information that was discussed during |  |  |
|  |  |  |  | the day sign-out session. (Second survey only) |  |  |
| Outcome | N/A | N/A | 79.7 | The current sign-out is better compared to the | N/A | 19 |
|  |  |  |  | previous one. (For postgraduate year 2 and 3 |  |  |
|  |  |  |  | residents only). (Second survey only) |  |  |
|  |  |  |  |  |  |  |

Abbreviation: QI, quality improvement.

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**Table 2.** Free-Text Survey Responses From Survey 1

Chiefs are not present all the time, leaving the on-call team to conduct the sign-out, answer pages, and do admissions at the same time.

Allows opportunity to discuss different plans of care with different members of the team.

Not feasible to allot time for learning.

Little to no teaching or learning takes place because of time constraints and the “let’s get the sign-out over with” attitude of most residents.

Interruption frequently occurs during sign-out—mostly from the ER and nurses calling about admissions.

Residents, interns, and students are in a hurry to leave or finish unfinished work/admissions.

Sign-outs are not always updated or organized, thus decreasing comfort or preparedness for the call.

Some of the information in the sign-outs is not relevant.

Up-to-date information on the sign-out is the MOST important issue! I often find that the paper sign-out is useful only for clinical information (eg, admission diagnosis, ongoing medical problems requiring treatment)—medications are often outdated.

Quality of sign-outs either never or hardly assessed on a regular basis.

No formal orientation on how to sign-out patients, skills were learned from practice.

Residents need more instruction on how to give a good sign-out.

Sections on the sign-out that are not regularly updated should be taken out rather than give the wrong information.

Administer training sessions for residents during morning report or noon conference.

How does one give a good sign-out? Expectations of a good sign-out seem to have been thought out pretty well, as evidenced by this survey. However, the residents need more instruction on \*how\* to achieve these expectations.

The sign-out patterns vary from hospital to hospital.

No or inconsistent feedback on quality of sign-out.

Not much teaching going on, just signing out tasks that need to be done. Oftentimes the sign-out only has the patient’s name on it, which is unacceptable.

Main limitation is lack of time and coordination. Residents and interns sign out separately—by which some important issues could be missed and there would be no room for supervision or interactive communication.

Not enough paper, chaotic, high patient load.

If there was a system where the patient list of the sign-outs could be updated from the EMR with info (eg, name, admitting diagnosis) then people could probably spend more time putting in information about patient problems.

Abbreviation: EMR, electronic medical record; ER, emergency room.

content and administration to the initial survey, the second survey again explored various issues related to both verbal and written sign-outs, but also queried whether there was an overall improvement in the sign-out system postinter­ vention (question 19, Table 1). Respondents were provided with the option to provide comments through use of free text (Table 3). The anonymous data from the second sur­ vey were analyzed in the same manner as the data from the first survey. On this occasion, statistical analysis included comparison with previous results. Once again, feedback was provided to stakeholders, and further interventions were considered and planned.

**Results**

The survey response rates were excellent (survey 1 = 89%, survey 2 = 83%). In terms of postgraduate year level, there is no statistically significant difference between number of respondents to the 2 surveys follow­ ing χ2 analysis (*P* = .13; Figure 2).

Survey questions regarding structure, process, and outcome of the sign-out system are presented in Table 1. Except for questions 7 and 19, all questions were included

in both surveys. On review of the first survey, question 7 was quite similar to question 4. As a result, a new question was substituted for the original question 7 on the second survey. Also on the second survey, question 19 was directed to only those residents who had previously com­ pleted a survey. Therefore, first-year residents were ineli­ gible to answer this question. Of those eligible to answer this question (n = 59), a total of 47 respondents (79.7%) agreed that the current (postintervention) sign-out system was better than the preintervention sign-out system.

Comparative analysis between surveys was made using the data categories displayed in Table 1, using the 2-sample *t* test. There was a statistically significant gain in resident satisfaction with the structure components (*P*

* .002). The top 3 areas of improvement among all struc­ ture items were accuracy of verbal and written informa­ tion relayed at sign-out (increase of 21.3%), awareness of anticipated problems during shift (increase of 10.5%), and the extent of communication between residents (increase of 10.3%). In fact, the overall greatest gain in resident satisfaction with sign-out was in the area of structure, specifically the aforementioned increase in res­ ident satisfaction with accuracy of information provided.

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**Table 3.** Free-Text Responses From Survey 2

I believe group sign-out is a very good move. It is a good opportunity for bringing up and sometimes summing up the day’s happenings.

The sign-out is better overall but I still think it needs a bit more work. Sometimes we get in our own way—the team not signing out will be talking among themselves or on their cell phones (this can be a distraction).

Give incentives to teams with consistently good sign-out sheets.

The current 4 pm sign-out system is definitely better compared to the previous system. The senior residents have to take more responsibility in pushing the interns to keep the sign-out updated, and help them by updating sign-outs themselves whenever they have time. It’s not only an intern’s job. Overall, the system is much better compared to previous years. Having the option of updating the sign-out from any computer would make life easier and sign-out more efficient too.

This sign-out is definitely better than the previous one; there is less room for error because all the team members are present and it is surely a good learning opportunity.

One factor that could improve sign-out is adequate space during the sign-out process. At times, people are standing because of lack of seats available. This can be distracting.

It would help immensely if the house staff were not paged constantly during sign-out.

I would recommend a formal process by which the night team signs out important events to the day team.

I think that interruptions and having the sign-out session becoming a social gathering is a big problem . . . we need more focused, prompt, and concise sign-out.

The common sign-out is a very good mechanism to get a comprehensive and timely sign-out as it is supervised and done in a timely fashion.

The number of interruptions and pages during sign-outs has yet to go down to zero. There is often a lot of cross-talk during sign-out and I personally have had to ask residents/interns to stay quiet.

The current sign-out far exceeds one-to-one sign-out.

There still needs to be enforcement of updating of sign-outs. Having senior residents oversee this process has improved this. Also, I believe interns should be taught in the beginning of the year during orientation on what should be included in a proper sign-out.

Please repeat the presentation regarding proper sign-out.

I think the current sign-out is OK if not very good. There are days when the interns are very busy with patient care and admissions during the day. It would be very nice and responsible for the team resident to update the sign-out.

I think excellent results are already being achieved with sign-outs. We have been made aware of its importance with regard to transfer of care and treat it with due seriousness. Having senior residents around is certainly a major factor in making it effective as they can anticipate problems better and ask for relevant details.

There also was a gain in resident satisfaction with process components, although this was not statistically significant (*P* = .091). The top 3 areas of improvement among all process items were presence of senior resident supervision (increase of 15%), ability to ask questions/ raise issues during sign-out (increase of 3.7%), and clari­ fication of care-related issues (increase of 2.2%). The third highest gain in overall resident satisfaction was in the area of process, specifically the aforementioned increase in resident satisfaction with supervision by senior house staff at sign-out.

There was a statistically significant gain in resident satisfaction with the outcome components postinterven­ tion (*P* = .001). The top 3 areas of improvement among all outcome items were teaching during sign-out (increase of 20.4%), confidence in providing patient care during shift (increase of 11.3%), and perceived reduction in adverse events (increase of 9.3%). The second highest gain in overall resident satisfaction was in the area of out­ come, specifically, the aforementioned increase in resi­ dent satisfaction with the inclusion of teaching points during sign-out.

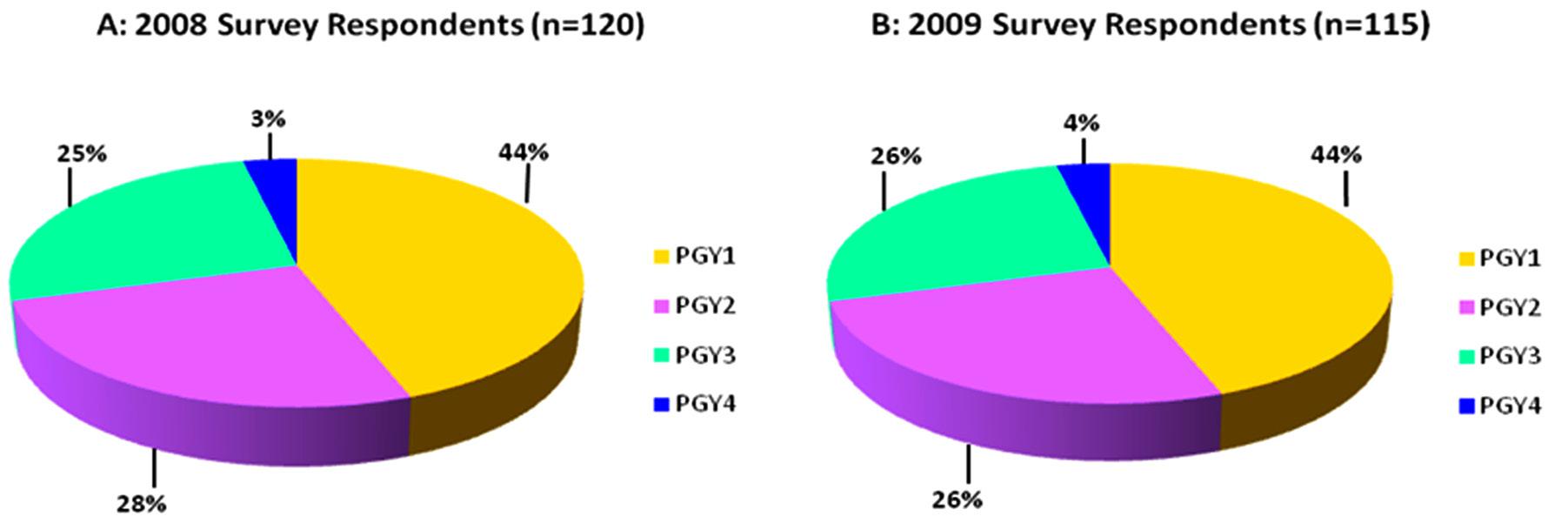
**Discussion**

Based on information gleaned from a primary survey, this project used a customized multicomponent interven­ tion to increase resident satisfaction with the structure, process, and outcome components of the patient sign-out process in an effort to improve the overall quality of the patient sign-out at change of shift. Although the 3 hospi­ tal sites involved in this project vary widely in terms of culture and practices, the intervention was implemented very similarly at each site. Informal feedback from chief residents, senior residents, and interns confirmed that patient sign-outs occurred in a uniform manner across the 3 sites postintervention.

Postintervention, the greatest increases in resident sat­ isfaction related to accuracy of information provided (+21.3%, structure), inclusion of teaching points (+20.4%, outcome), supervision by senior house staff (+15%, pro­ cess), and confidence in and preparedness for patient care responsibilities during shift (+11.3%, outcome). Notably, overall increases in satisfaction in the general areas of outcome and structure were statistically significant.

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**Figure 2.** Survey responses by year and postgraduate level

Residents from all 4 postgraduate years participated in 2 Web-based surveys. A total of 120 respondents completed the first survey (2A: 89% re-sponse rate); 115 respondents completed the second survey (2B: 83% response rate). There was no significant difference in response rate between the 2 groups (*P* = .13).

In terms of patient safety, the improvement in satisfac­ tion with the accuracy of patient information and confi­ dence in ability and preparedness for patient care responsibilities are very positive changes, because exten­ sive root cause analyses have shown that errors in com­ munication are the most common cause of sentinel events in patient care.13 Although at this point we lack data to connect these survey findings to measurable change in patient outcomes, residents appear more satisfied with the information they are being provided, which is likely reflected in their increased confidence in care provision.

Inclusion of teaching points, largely facilitated by the attendance of chief residents at sign-out, as well as the single venue for sign-out, has provided residents with an extra incentive to attend sign-out on time. Previously, sign-outs were generally one-to-one (intern-to-intern, resident-to-resident), held any time, any place, and cer­ tainly could be hampered and/or delayed by nonurgent patient care responsibilities. There really was very little if any opportunity for teaching, particularly because those signing out to each other were generally at the same level of training. Now, residents sign out their patients to the covering team first, hand over pagers, and then finish nonurgent work. Inclusion of teaching points also encour­ ages residents to remain attentive during the entire sign-out, even when the patient under discussion is not on a particular resident’s team. At the same time, this sort of experiential learning reinforces and consolidates many of the features and concepts about which residents may read but not otherwise have the chance to see very often (eg, head CT of an adult patient with newly diagnosed glioblastoma multiforme). Finally, informal feedback from residents indi­ cates that incorporation of teaching moments in the group setting has had the unexpected beneficial effect of increasing camaraderie within and among team members at each hospital site.

Not only did this project serve to elicit areas of improve­ ment postintervention, but areas requiring further attention also were identified. In particular, the quality of information on paper sign-outs remains an issue for residents, as mani­ fested by the decreased satisfaction (−4.4%) in this area evi­ denced in the second survey (Table 1). Because of differences in electronic resources and the way they are administered among the 3 hospital sites, the appearance and verity of information on paper sign-outs vary a great deal between the sites. According to feedback from chief residents, the issue identified most often is that the information on the sign-out is incomplete and/or out of date, resulting in a lack of valid­ ity. One site has an electronic interface engine that allows population of a few fields on the sign-out sheet with some up-to-date information from the electronic medical record. However, the functionality of this feature, though helpful, has not yet been optimized. The remaining fields on the sign-out sheet from that site, as well as all fields of the sign-out sheets in the 2 remaining sites, are completed via manual input of data by team members. Depending on the computer skills of the resident or intern and the resources available to complete the necessary tasks (eg, paper, toner, time), the data input and update process can be tedious and time con­ suming, resulting in suboptimal data quality. This point is reflected in the decreased satisfaction (−5.9%) with the equipment available to produce a good sign-out (Table 1).

Furthermore, residents’ satisfaction with the level of interruptions during sign-out did not improve as had been hoped but instead declined (−10.1%; Table 1). Nonurgent pages from nursing and emergency room staff continue to be a problem despite the intervention. Of course, the reminder system is a continuous process that must serve to educate relevant staff on a rolling basis, particularly with regard to staff turnover. At the same time, informal feedback indicates that there has been recent discontent with the level of interruption/distraction arising from

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within the group signing out rather than from external sources. This is borne out by the data collected from the free-text responses in the second survey (Table 3). Overall, responses to this question likely reflect residents’ discontent that the problem has not been completely solved by the intervention, in that the sign-out is not com­ pletely free of unnecessary interruption. This likely will require further investigation and intervention to ensure that the level of unnecessary interruption is as low as possible.

Last, residents expressed a decrease in satisfaction with training in patient safety (−8.4%), and, relatedly, in the exercise of signing out patients (−4.2%; Table 1). It is possible that the sign-out training currently received by residents, which is part of the project intervention, was not attended by all residents (eg, those with days off). Moreover, residents may have believed that the training received was not extensive enough and may have benefited from rein­ forcement training at some later point. Clearly, this area deserves further investigation. Future sign-out training may be followed by evaluations to determine where areas of deficiency in training actually lie.

*Limitations*

Several limitations inherent in this project have been identified. First, because surveys were anonymous, we could not assess change in responses using matching, which would likely have been even more informative. Furthermore, this project implemented a multifaceted intervention, so the ability to assess the effect of any one intervention was limited. Also, the surveys assessed house staff, including chief resident, opinion only, and did not examine quantitative outcomes such as changes in preventable adverse events or near misses. At the time these data were gathered, the processes were not fully in place to enable such data collection. Finally, because survey participants were limited to 1 depart­ ment in 1 residency program in 1 geographic area, gen­ eralizability of results to other programs may be challenging.

**Conclusion**

This quality improvement demonstrated measurable improvement in internal medicine resident satisfaction with the patient sign-out system at change of shift follow­ ing a targeted multifaceted intervention. Notably, the improvements in structure and outcome were found to be statistically significant, although impressive changes were shown within all core areas of structure, process, and outcome. As an added and unexpected bonus, informal feedback from residents has indicated that teamwork and camaraderie among and within patient care teams has

been promoted as a result of the changes to the sign-out system. In addition, although the 3 hospital sites through which internal medicine residents rotate are quite differ­ ent, a coherent and consistent intervention plan resulted in uniformity of implementation across sites.

Based on identified areas for further improvement, as well as noted limitations, future areas of development for this project include use of electronic sign-out templates, which are interfaced with and prepopulated by patient electronic medical records. Use of such a system would undoubtedly increase information fidelity, free up house staff time, and, it is hoped, contribute to improved effi­ ciency of the sign-out system. Our internal medicine pro­ gram has piloted such a template on a limited basis, in both a ward and an intensive care setting. Overall, positive informal feedback was received from residents, in terms of decreasing the amount of paper produced and carried for sign-out, clarity of information available, and ease of use. At the same time, issues requiring further exploration include data security, with particular reference to linkages to existing databases, as well as system support and main­ tenance. In addition, several residents have expressed interest in developing a brief, straightforward, and uniform method of signing out from night teams to day teams. Interestingly, sign-outs from short-call to night-call teams seem to run smoothly and uniformly across the 3 hospital sites, although this has not been a particular goal of resi­ dents; rather, the situation has evolved. Opportunities for improved sign-out training and possible patient safety training in general have been explored, with particular ref­ erence to the use of simulation in such training and with the inclusion of formal feedback mechanisms. Of course, such training could apply equally to day-to-short-call team sign-outs as well as night-to-day team sign-outs. Finally, oppor­ tunities to forge links with patient safety data, including near miss and reportable adverse events, have been identi­ fied locally and would add an important new dimension to the foundation created by the existing project. Such a dimension could allow concrete measurement of the effect of changes in the sign-out system on patient safety and well-being.

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**Declaration of Conflicting Interests**

The authors declared no potential conflicts of interest with respect to the research, authorship, and/or publication of this article.

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