INNOVATIONS IN CLINICAL PRACTICE

Beyond Paging: Building a Web-based Communication Tool for Nurses and Physicians

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INTRODUCTION: The traditional means of communication between nurses and physicians is through paging. This method is disruptive to the workflow of both professions and is too non-specific to be used for all types of messages.

AIMS: We undertook a quality improvement project to streamline communication between nurses and trainees for urgent and non-urgent matters. We assessed user uptake and satisfaction with the new method.

SETTING: A General Internal Medicine teaching unit in a tertiary care academic centre.

METHODS: Through collaborative techniques, we developed a novel communication method that sends non-urgent messages to a Web-based task list and urgent messages to an alphanumeric pager. We implemented this new technology using a collaborative process between nurses and physicians to address all concerns.

EVALUATION: Post-implementation surveillance indicated a high degree of uptake of the new practice. User surveys and focus groups showed a high level of satisfaction and a perceived decrease in interruptions to the workflow of both nurses and physicians with the new system. Usage data indicated that the new system may increase overall non-urgent communication.

CONCLUSION: A Web-based system to triage urgent and non-urgent messages between nurses and physicians was developed collaboratively and implemented successfully to improve workflow for both groups.

J Gen Intern Med 24(1):105–10

DOI: 10.1007/s11606-008-0827-2

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INTRODUCTION

Health care relies on rapid, efficient communication between providers^{1,2}. Communication failures are leading causes of

sentinel events in hospitals^{1–4}, and interruptions explain lapses in care in many environments^{2,5,6}. Health-care environments are interruption-prone⁷ and create stressful cognitive demands⁸, potentially leading to errors^{9,10}.

For decades, hospital communication has relied upon the radio pager¹¹. The typical teaching hospital pages trainees through a central switchboard. Numeric messages, of varying degrees of urgency, are funneled through the pager from nurses and others. Approximately 50% of pages to physicians interrupt direct patient care, and 42% of pages have been considered non-urgent^{5,11}. In some environments, pages can be received every 6 min¹² during peak periods.

Trainees, including residents and medical students, are taught that all pages are important¹³. In practice, they may not interrupt their workflow to answer immediately^{5,11}. Nurses also frequently interrupt workflow waiting for responses^{1,7,9}. Furthermore, physicians in academic units often cross-cover patient care, and nurses are often uncertain whom to contact¹⁴. Errant pages de-sensitize physicians to urgent messages and interrupt nursing workflow further. The cumulative impacts of interruption are delayed patient care¹ and potential adverse patient outcomes^{1,14,15}. Finally, most nurse-physician communication is undocumented. When sentinel events occur, reconstruction of communication depends on the accuracy of participants' memories.

In our institution, trials of message boards¹⁶ and other systems to collect non-urgent communications were unsustainable. Trainees forgot to check messages, and nurses had no assurance that messages were seen or acted upon.

AIMS

To implement and evaluate a new interdisciplinary communication system developed via collaboration among nurses, physicians, and informatics personnel. We measured uptake and user satisfaction in our setting, with the goal of permanently replacing traditional paging.

SETTING

Mount Sinai Hospital is a 472-bed academic health centre in Toronto, Ontario, Canada. The General Internal Medicine (GIM) Service has four physician teams, drawn every 2 months from over 150 trainees in the entire program. There are

Received January 7, 2008

Revised July 14, 2008

Accepted September 29, 2008

Published online October 29, 2008

approximately 200 nurses who work regularly on the Service. On a typical day shift, 24 RNs communicate clinical issues to 20–28 medical trainees for 80 acute-care GIM inpatients across three physical wards. Trainee interviews and switch-board records confirmed Canadian literature estimates of 15–20 pages per intern per 12-h shift⁶, and half of these were believed to be non-urgent, as in other settings¹⁶.

INTERVENTION - THE WEB-BASED INTERDISCIPLINARY PAGING SYSTEM (WIPS)

Design

An interprofessional design process lasting 6 months was led by physicians, nurses, and an informatics project manager,

Add Urgent Task powered by AG Consulting

you will be automatically logged out in 585 seconds.

Clinician Details

Full Name Phone [Ext]

Patient
Reelnaim, Notta (MRN 1234)

Task Details

Cardiovascular

- ☐ Chest pain > 10 minutes
- ☐ Tachycardia (new) HR > 120
- ☐ Bradycardia (new) HR < 40
- ☐ Hypotension SBP < 90 mmHg
- ☐ Hypertension SBP > 220

Respiratory

- ☐ Desaturation SaO2 < 85%
- ☐ Newly requiring > 50% O2
- ☐ New shortness of breath
- ☐ Hemoptysis
- ☐ Major aspiration
- ☐ Trach out
- ☐ Low respiratory rate < 10

Laboratory

- ☐ Accucheck < 4
- ☐ Accucheck > 20
- ☐ Critical lab value
- ☐ Positive blood culture

GU

- ☐ Difficulty voiding
- ☐ No urine output > 6 hours
- ☐ New hematuria

Incidents

- ☐ Medication reaction
- ☐ Transfusion reaction
- ☐ Fall - possible injury
- ☐ Violent patient
- ☐ Leaving AMA

CNS

- ☐ Decreased LOC
- ☐ New agitation/confusion
- ☐ New focal deficit
- ☐ Uncontrolled severe pain
- ☐ Seizure

GI

- ☐ Hematemesis/rectal bleeding
- ☐ Acute abdominal pain/distension
- ☐ Uncontrolled nausea/vomiting

Infection

- ☐ New fever/rigors/sweats

Other (250 characters max) currently used=0

Further Notes (applicable to any task, not just "other")

Figure 1. Nurses' interface for adding urgent tasks to be sent to a dedicated "WIPS" pager. (Fictitious patient data).

using consensus for decision making. The basic concept of separating non-urgent from urgent messages was developed with broad input from users. For example, nurses wanted the ease of the telephone when contacting a trainee, and trainees wanted to look up patient information quickly when an urgent message was received. Multiple focus groups of users were shown prototypes, and changes were made based on feedback. The hospital administration mandated standards for documentation and information security. The Chief Information Officer, Physician-in-Chief, and Chief Nursing Officer provided highly visible support.

An existing electronic patient list formed the basis for the new tool because it was familiar and time-tested with trainees. A separate interface was developed for nurses to enter "tasks" for patients, viewable on the trainees' patient list (Figs. 1 and 2). Nurses used clinical judgement to request a non-urgent or urgent response. The process of contacting trainees in STAT, urgent, and non-urgent situations is shown in Fig. 3. Urgent messages were all sent to a single alphanumeric pager per team. The switchboard was only used under STAT conditions. WIPS is not part of the health record, and orders cannot be transmitted through it. System administrators can generate usage reports for routine monitoring and audit reports after critical incidents.

Implementation

The following principles guided the implementation of WIPS. First, parallel use of traditional paging would undermine the new system, so our switchboard redirected nurses to WIPS, except under STAT conditions. Second, in-depth user training was essential, and we developed online training modules for

nurses and trainees, which hospital administration mandated for all users. Third, support and responsiveness were crucial to successful implementation. Trained nursing peer leaders were scheduled to provide 24-h support.

EVALUATION

We used WIPS data and switchboard records to measure uptake of the new process and reduction in paging. We measured users' perception of improvement in workflow and overall satisfaction with WIPS through focus groups and an e-mail survey of residents, students, and nurses from the initial 6-month period.

System Uptake

The system was implemented in December 2006. During implementation, our switchboard recorded one nurse per shift attempting to page a trainee in the former fashion. After the first few months, the switchboard was only used when clinical deterioration required STAT communication. This pattern persisted through multiple rotations of trainees throughout the evaluation period.

There was a steady increase in both urgent and non-urgent messages sent through WIPS (Fig. 4). From June through October 2007, when the number of messages was relatively stable, each patient had, on average, 3.0 urgent messages and 8.8 non-urgent messages sent per admission on their behalf. Both day- and night-time use of WIPS increased over 7 months for non-urgent messages, whereas the number of urgent messages stayed relatively stable.

The screenshot displays the 'General Internal Medicine WIPS' interface, powered by AG Consulting. The top navigation bar includes a search function, links to 'add patient', 'tasklist', 'print', and 'refresh data', and a team selection dropdown (A, B, C, D). A message indicates the user will be automatically logged out in 506 seconds. Below this, a header bar explains that clicking the header bar or an icon expands content detail, and flashing icons indicate urgent tasks (bullet), overdue tasks (triangle), and pending tasks (square).

The main section is titled 'Physician Task Inbox' and contains a table with the following data:

Status	Description	Time Sent	Time Left	Action
1215 - Identité, Fausse				
URGENT	Respiratory - Desaturation SaO2 < 85%	11/27/2007 - 8:18 PM	OVERDUE	complete task
12S08A - Nim, P. Sudo				
PENDING	Order - Cosign Needed	11/27/2007 - 7:06 PM	OVERDUE	complete task
17N37A - Nevermettim, Iva				
PENDING	Other - click for details	11/27/2007 - 6:42 PM	OVERDUE	complete task
PENDING	Other - click for details	11/27/2007 - 6:30 PM	OVERDUE	complete task
17S 1701 - Oldelf, Joly				
PENDING	Order - Order required	11/27/2007 - 5:45 PM	OVERDUE	complete task

Below the task inbox is a patient list table:

BED	NAME	MRN	CODE	OPEN TASKS	
1205A	Oop, Allie		DNR	0	edit
1206B	Boddy, Ennie		Full Code	0	edit
1215	Identité, Fausse		Full Code	1	edit
1217	Vu, Image A.		Full Code	0	edit
12S04A	Gezoo, Yul Niver			0	edit
12S04B	Cognito, N.		Full Code	1	edit
12S05B	Cogito, R. Gosum		DNR	0	edit
12S08A	Nim, P. Sudo		DNR	1	edit

Figure 2. Physicians' initial view, showing urgent or overdue items as well as the entire patient list. (Fictitious patient data).

Figure 3. Process for nurse communication with trainees under WIPS. Nurses decide whether situations are STAT, urgent, or non-urgent, as defined by required response time. STAT messages are the only ones using traditional paging. Urgent messages are sent to a single alphanumeric WIPS pager per physician team, formatted to include callback information, patient data, and the nature of the problem. Non-urgent messages are listed on a patient task list and can have a time limit attached; if time expires, a reminder message is sent to the WIPS pager.

Figure 4. Growth of non-urgent messages relative to urgent ones over a 7-month period.

User Survey and Focus Groups

The survey included two e-mail reminders over a 2-week period. Some survey questions pertained to the perspective of only one discipline. Respondents rated answers on a 5-point Likert scale. We categorised favourable responses as those indicating moderate or strong agreement, and unfavourable responses as those indicating moderate or strong disagreement. Thirty-eight (46%) of 83 trainees and 68 (47.2%) of 144 nurses participated in the survey (Fig. 5). Responder trainees were slightly more likely than non-responders to be students rather than residents. There were no observed differences between responder and non-responder nurses regarding full- or part-time status and experience with WIPS. In general, trainees and nurses viewed communication through WIPS as an improvement over previous paging practice.

Separate focus groups were conducted 6 months after implementation from convenience samples of trainees (1 session) and nurses (2 days and 1 evening) over a 3-week period. Sixteen trainees and 38 nurses were available for

Figure 5. Summary of survey results of trainees and nurses. Methods used in developing percentages shown are described in the text.

separate focus groups conducted by the chief medical resident and a senior nurse administrator, respectively. Informal content analysis elicited the following themes:

Nurses Valued the Ability to Sort Messages into Urgent and Non-urgent Categories. They noted that trainees responded reliably to urgent WIPS messages within 10 min. They recognised that paging trainees for non-urgent messages had been disruptive to overall workflow. Trainees echoed this, although at times did not agree with nurses' decisions as to a situation's urgency.

Trainees Said WIPS Improved Their Ability to Manage Time and Workflow. The reduced interruption by non-urgent messages outweighed the new duty to check the task list frequently. There was an onus on each team to clear its non-urgent tasks before the end of the day, as any remaining would become overdue overnight and trigger the WIPS pager when another team was covering the wards. Corrective peer feedback was noted to be swift and effective in improving a team's performance in monitoring their list.

Both Groups Thought Other Professions Should Use WIPS. This system was implemented only between nurses and physicians. Separation of urgent and non-urgent messages from pharmacists, therapists, social workers, and other pro-

fessionals was requested by both nurses and trainees to address ongoing communication difficulties for these groups.

Other Issues Arose, Not Well Handled by WIPS. For example, after implementation, nurses occasionally encountered patients' family members requesting an immediate physician visit. STAT pages were not justified under the circumstances, but WIPS did not allow nurses to contact specific trainees urgently — only the trainee carrying the team's WIPS pager. Nurses and trainees recommended that a method of scheduling family meetings that did not rely on interruptive communication be developed.

DISCUSSION

Our usage and satisfaction results indicate that the WIPS method of communication between nurses and trainees has replaced paging as a sustained practice, well beyond its implementation and early support period. Furthermore, our data show that use of WIPS is continuing to grow for non-urgent messages. We suspect that the reliability of the system has encouraged nurses to communicate more issues more frequently to trainees. The perception that workflow is improved, despite a steady increase in overall messages, supports the effectiveness of separating urgent and non-urgent messages as a design concept.

Attempts have been made in other settings to replace traditional radio paging as a dominant means of communica-

tion. Elsewhere, using alphanumeric pagers as a method to communicate critical laboratory results¹⁷ has gained wide acceptance. Nguyen¹⁸ found high user acceptance of alphanumeric paging for all types of messages in a surgical ward setting as a method of increasing the content sent in the message. Our system extends this work by diverting all non-urgent messages entirely away from paging into a database that trainees can review at an opportune time. This accomplishes the goal of removing unnecessary interruptive phenomena completely from the work environment^{13,19}.

We believe that this project succeeded because of effective partnership between clinical and informatics leaders. Clinical staff were engaged in solving system and design problems²¹. Collaboration effected improvements for both nurses and physicians. Pre-testing with focus groups, rigorous user certification, support from expert peers, and the technical team's responsiveness were all key factors in the initial success and sustainability of this intervention²².

WIPS is a first step in improving the communication infrastructure at our institution and has spurred movement in other areas. For example, problems with family meetings demonstrated that ad hoc requests from families for information are common, whereas scheduled meetings are infrequent. Using the collaborative techniques of the WIPS project, we are developing a system for scheduling routine family meetings.

Both nurses and trainees described reduced time in contact with each other following WIPS implementation. We were concerned that the system isolated practitioners from each other. Further investigation revealed that reduced interruptive information transfers were the main change in nurse-physician interactions. We now encourage more productive nurse-physician face-to-face interactions, focussed on collaborative decision making, rather than simple transfer of information²⁰.

Our evaluation of this change in practice has limitations. First, this was a pilot study of a new communication concept within a single hospital's GIM service. Local unique factors that contributed to our success may not be generalisable. Implementations elsewhere should identify local conditions affecting design and deployment. Second, we surveyed a convenience sample of users within 6 months after implementation. The views of later users, from when WIPS was a more mature component of hospital processes, may differ. In addition, our low survey response rate (47%) may suggest bias toward more satisfied users. However, surveillance since the evaluation period has shown continued general satisfaction and elicited many development suggestions. Third, we used a before-after design rather than a controlled study, with perception of change as a primary measurement. Control groups within the GIM service were not feasible and could become easily contaminated, and other sites and services could be sufficiently different to invalidate comparisons. Finally, user satisfaction and perception of workflow improvement are surrogate outcomes, and our positive results may not reflect patient outcomes or global caregiver satisfaction directly. In future work, our goal is to evaluate the tool's impact on overall caregiver satisfaction, communication failures, and adverse patient events.

CONCLUSION

WIPS manages information flow between nurses and trainees, and reduces interruption in non-urgent situations. Broad,

early input from nurses and physicians resulted in a tool with sustained uptake and acceptability to users. This development model, aimed at improving established practice within a large institution, should be considered for any similar intervention.

Acknowledgements: We thank Ms. Marlene Robinson, Chief Information Officer, and Dr. Allan Detsky, Physician-in-Chief, Mount Sinai Hospital, for their support of this project, which was funded exclusively by Mount Sinai Hospital.

Conflict of Interest: None disclosed.

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