Signing Out Patients for Off-Hours Coverage: Comparison of Manual and Computer-Aided Methods

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ABSTRACT

This paper evaluates the communication of information to physicians who provide off-hours coverage to in-patients in two Family Practice residency programs.
Method: *To describe the importance and accessibility of clinical information used by on-call residents in covering hospital patients, we administered a questionnaire. Then following the use of a new computerized sign-out system in one of the programs, residents filled out the same questionnaire again.*
Results: *Residents felt that a "to do" list and information about the patient's "code status" were the most important data desired from sign-out sheets. However, 69% of residents in both programs felt that provision of this information was normally poor. Nearly all of the residents in Buffalo, using an entirely handwritten sign-out sheet, felt it was in need of improvement. Residents in Pittsburgh, using a summary aided by the hospital's computer print-out, felt this need much less acutely. After implementation of a new computerized sign-out sheet in Buffalo, residents indicated a slightly higher level of satisfaction. The work of data entry and re-entry into the computer was unpopular and inefficient.*
Conclusion: *The present method of transferring information at the end of a work day is not satisfactory for residents. Provision of data summaries from existing hospital information systems is a good first step in improving data transfer. A further study of more comprehensive automated sign-out systems is important, because of the increasing discontinuity of house officer care.*

Key words - Hosp and institutional Health Care, Health Care Research and administration, Biomedical Education.

BACKGROUND

Purpose of sign-out:
Traditionally, the physician caring for patients on weekdays signs-out by providing a written list of patients and verbal instructions to the on-call physician. The medical literature contains no formal analysis of sign-out procedures and problems. Residents apparently learn to choose and communicate critical patient data by a combination of modelling and trial and error. They mimic upper level residents and modify their behavior based on the feedback from on-call colleagues.
Recent limits on the number of hours resident physicians can work have increased the importance of sign-out [1]. The primary resident is available for fewer hours, and more than one on-call resident covers his patients at different times. Multiple on-call, cross-covering and guest-call physicians can cause discontinuity and poor coordination of care. One key to maintaining the quality of care is improving communication between the primary and covering physicians.

Information communicated during sign-out includes hospital location, patient demographics, diagnoses, medications, test results , progress of care and things to do. The nature of this information varies significantly depending on physician style. The severity and stability of a patient's condition are also major determinants of the information passed on to the covering physician. The format of sign-out, however, seems to depend mostly on the standard accepted at a particular hospital. Commonly, residents use addressograph-stamped index cards or written lists to summarize data about each patient. There have been previous computer-aided sign-out programs developed [2].

Residents use sign-out information mostly when the patient chart is not available. They use it to answer phone calls from nurses, to set priorities for the next task to accomplish, and to review data called to them by the lab. However, information provided during sign-out may contain data and opinions not present in the chart. Even when the resident is at the bedside with the chart, sign-out information may be an important adjunct to care.

Much of the information that residents want for sign-out purposes already resides in a computer system somewhere in the hospital. To what degree can Hospital Information Systems (HIS) aid in the process of sign-out?

Computerized systems:
Most hospitals now have an HIS that integrates financial, administrative, laboratory, and pharmacy information on patients. Very few of these systems include progress notes or problem-oriented data displays, but they do contain information relevant to the sign-out process. For this information to be useful, it would have to be easy to access, easy to update, easy to reformat to individual contexts, and easy to read. The sign-out should summarize current problems and treatment and be brief enough to review while on the phone with a nurse. Different physicians at different

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levels and with different responsibilities will expect different information regarding sign-out. Until residents carry portable computers, a printed sign-out sheet using data from the HIS seems the most practical possibility.

The literature contains several models for relevant chart summaries [3]. In the outpatient setting, problem lists, medication sheets, and health maintenance tables are quite common. Attempts to make a current patient profile in the hospital chart have been quite useful [4]. These profiles summarize current orders, medications, and pending tests. Nurses have used a similar summary, the "Kardex", for years, to facilitate reports to the next nursing shift.

To examine the need for an improved sign-out system, and the potential of a computer-aided system in filling this need, we conducted the following study.

METHODS

Sign-out procedures:
Residents in two different Family Practice Residency Programs completed a questionnaire. The group in Buffalo completed the questionnaires during the latter months of the residency year. The group in Pittsburgh completed the questionnaires during the earlier months of the residency year.

The first program, in Buffalo, NY, uses a 150 bed hospital for in-patient training. Physicians at this site do not use the HIS. On-call duties include the emergency coverage of all the patients in the hospital, coverage of the Family Practice Residency Inpatient Service (FPRIS) patients, and all new admissions. After making handwritten sign-out notes on index cards or on yesterday's sign-out list, the primary resident discusses the patients with the on-call resident. Frequently sign-out sheets are "modified" from the previous day and passed along again and again. Some residents hurriedly write down their sign-out information just a few minutes prior to verbal sign-out.

The second program, in Pittsburgh, PA., uses a 400 bed hospital for its in-patient training. The hospital has an HIS that provides limited patient data. Residents also use a computerized patient record system in their family health center. On-call duties are similar to those in the first site. The sign-out system includes use of a printed geographic patient list showing location, name, age, and attending physician. The primary residents have these lists printed daily for all the patients on the service, and use the list to note information collected during the day. The primary resident uses the notes on this list while giving verbal sign-out, but does not usually pass the list along. Instead, the on-call resident takes notes on a fresh list while listening to the verbal sign-out.

Computer System Implementation:
To study the impact that a computer-aided system would have on sign-out , we first designed a system. The computer-aided sign-out system is a stand-alone software program running on an IBM-PC compatible system. Programming was done using a dBASE-compatible language. The data format included demographic data, medications, diagnoses, problem lists and comment lines. The system was menu-driven, but required typing skills to enter the data. The system did not interface with any other computer system, so all data had to be put into the system separately. After the initial entry of data, only updates to the problem list and medications were necessary.

We printed different formats of the sign-out lists, with varying detail, depending on the level of the resident. Supervising residents received summary-style sheets for the whole service which did not include the details on medications and all problems. Junior level residents, who required more detail, received summaries of only the patients they were following with more details on problems and medications. We printed sign-out sheets that included the above data items, and gave them to the primary residents to use for notes during the day. These annotated forms were then passed along to the on-call resident at sign-out.

The system was implemented at the first site, in Buffalo. Seven residents used the system: four junior level residents, two supervising residents, and one senior level resident acting as night float. We then readministered the original questionnaire to assess change in beliefs and attitudes one month after use of the system.

RESULTS

Resident beliefs about sign-out information importance and accessibility:
Table 1 summarizes initial questionnaire data from all the residents and compares responses from each site. Both groups agreed on the importance of sign-out data and were dissatisfied with the current sign-out system. The group at site 1 was more dissatisfied with sign-out, and felt it to be more important than the group at site 2. "Code status" and a "to do list" were the most important components of sign-out for residents. Sixty-nine percent of residents felt that important components were not provided at sign-out. In group 1, 81% felt that important components were not communicated, compared to 56% in group 2.

All residents managed minor problems by phone. The sign-out sheets were the most frequently used information source when faced with a patient problem. Group 2 used the sign-out sheet more frequently, 88%, compared to group 1, 69%, when faced with a patient problem. On the other hand, the sign-out sheet was

rarely used to prioritize a problem. The nature of the problem was the key priority factor 89% of the time and nurse's remarks 11% of the time. Most all residents felt that improvement in areas of legibility, comprehensivness, and consistency would help in sign-out documents. The residents were neutral overall in changing the time spent on sign-out, but 84% felt that the system should be improved.

Impact of the Computer system:
Table 2 presents the differences in the residents' perception of sign-out sheets before and after implementing the computer-aided system. This group of seven residents ranked their satisfaction with the sign-out system prior to implementation as "poor", compared to "very good" afterward. After the implementation, 100% of the group felt they were getting the components of the sign-out that were important, compared to only 14% of the group prior to implementation. Only 29% of the group felt improvement of the sign-out system was needed after implementation, compared to 100% prior to implementation. These dramatic improvements in attitude were achieved with difficulty, however.

According to comments collected on the follow-up questionnaire, problems in implementing the system began because residents were already very busy managing patients on the inpatient service. Residents liked the concise, consistent, and legible sign-outs when on-call, but they did not like the intrusion of learning a computer program. They also did not want to do the typing to update the data daily on patients. They especially did not want to go through the mundane part of entering the initial data, when a patient is first admitted. They commented that the system would be much more practical if someone else did the data entry.

DISCUSSION

Pre-existing Sign-out Method:
Residents using a strictly manual sign-out system at site1 were slightly more dissatisfied with sign-out and used the sign-out sheets less than residents ,at site 2, with a partially computerized system. At site 2, where a computer printed list of patients is given to the on-call resident, availability of demographic information was less of a problem. Legibility was better because of the printed lists, and because residents wrote their own notes, rather than trying to read the primary resident's handwriting. Sign-out using partially-computerized lists was more complete.

After Use of Computer-aided Sign-out:
The computer-aided sign-out sheet definitely enhanced information transfer for residents. Residents updated the new sign-out sheet by hand, using the printed sheet as an outline. The data were then entered into the system for them. This saved them time, and allowed them to work the same way as in the past. It also avoided direct use of the computer system. Unfortunately, depending solely on the resident for updated data caused a deterioration in the accuracy of the data. They updated only information that they felt to be important, and often ignored or forgot other important data. For this reason, some of the information on the computer system was not up-to-date. A weekly review of the in-patient chart showed that medication lists in particular had many errors and omissions. The noted improvements in legibility and completeness of the sign-out sheet did not appear to increase its use. Part of this was inertia; residents had less than a month to learn how to integrate the new sign-out sheets into their daily work routine. The data inaccuracies may have been another reason the residents did not increase their use of the sign-out sheet.

Using David Eddy's evaluation methodology [5], we may conclude the following:
1st level : Do the mechanics of the system work? The hardware and software do work.
2nd level : Does the system produce accurate data? Interfacing the system to an HIS would update information automatically, and avoid the costly and idiosyncratic data updates by the physician.
3rd level: Is there a need for the system? The data is important and useful to the on-call physicians.
4th level: Does information in this format change the actions taken by an on-call physician?
5th level: If it is shown to change the actions taken by the on call physician, does it change outcome, or improve patient care?
These last two questions are much more difficult to answer, and will require futher study.

Future: Resident physicians want and need a better system to sign-out patients during off-hours. Formal evaluation in the manner outlined above will help determine if a computer-aided system should be widely implemented. In our next study, we will interface with the HIS at our institution, and automatically update the database in the computerized sign-out system. Other institutions [6] that have HIS's that are clinically oriented, currently do produce such documents for their in-patient services. Centralized HIS's have many advantages, but may not be able to meet the needs of clinicians analyzing patients in a problem-oriented manner. This is especially true because system design has focussed on the hospital's financial and administrative tasks. A clinical information system that interfaces with the HIS to allow data to be presented to a clinician in a format that is focused on the physicians needs, may be better suited and accepted by physicians. The sign-out system should be one component of such a clinical information system.

TABLE 1- Questionnaire Results

	SITE 1 BUFFALO 16 RESIDENTS	SITE 2 PITTSBURGH 16 RESIDENTS
SATISFACTION WITH CURRENT SIGN-OUT SHEETS RANK 1 (VERY GOOD) - 5 (BAD)	AVG =3.4 RANGE 3 TO 5	AVG =3.1 RANGE 2 TO 5
IMPORTANCE OF SIGN-OUT SHEETS RANK 1 (VERY IMPORTANT) - 5 (NOT IMPORTANT)	AVG =1.4 RANGE 1 TO 4	AVG=2 RANGE 1 TO 4

CONTENT	VERY IMPORTANT	IMPORTANT	NOT NECESSARY	DON'T INCLUDE	
demographics	18%	39%	29%	14%	BOTH
allergies	43%	29%	25%	4%	GROUPS
medications	29%	39%	25%	7%	INCLUDED
to do list	82%	14%	4%	0%	IN
diagnosis	36%	43%	18%	4%	TABLE
resuscitation status	89%	11%	0%	0%	

DO YOU CURRENTLY GET THOSE THAT YOU CONSIDER important	44%	82%
DO YOU CURRENTLY		
handle problems entirely by phone	100%	100%
order medications by phone	100%	100%
order lab studies by phone	100%	88%
FACED WITH A PATIENT PROBLEM, DO YOU ALWAYS		
look at a sign-out sheet	69%	88%
see the patient	38%	19%
look at the chart	38%	19%
know all medications the patient is on	19%	25%

WHAT INFORMATION SOURCE DO YOU USE TO PRIORITIZE YOUR TIME?
PERCENTAGE OF RESIDENTS WHO :

	RANKED 1ST	RANKED 2ND	RANKED 3RD	
sign-out	0%	7%	93%	BOTH GROUPS
nurse	11%	82%	7%	INCLUDED
nature of the problem	89%	11%	0%	IN TABLE AT LEFT

WHAT IMPROVEMENTS IN THE SIGN-OUT WOULD HELP YOU		
legibility	94%	56%
comprehensiveness	94%	63%
consistency	94%	75%
SHOULD THE AMOUNT OF TIME SPENT ON SIGN-OUT BE INCREASED?	27%	13%
SHOULD THE CURRENT SIGN-OUT SYSTEM BE IMPROVED?	94%	75%

Table 2- Attitudes toward sign-out documents before and after Computer-aided System Implementation

Study Group: Seven Family Practice residents in Buffalo assigned to the in-patient service during implementation of computer-aided system.

	BEFORE Implementation	AFTER One Month Implementation
SATISFACTION WITH CURRENT SYSTEM RANK 1 (VERY GOOD) - 5 (BAD)	AVG =3.7 RANGE 3 TO 5	AVG = 1.1 RANGE 1 TO 2
DO YOU CURRENTLY GET THOSE COMPONENTS OF SIGN-OUT YOU CONSIDER IMPORTANT?	14%	100%
DO YOU CURRENTLY		
handle problems entirely by phone	100%	100%
order medications by phone	100%	100%
order lab tests by phone	100%	100%
FACED WITH A PATIENT PROBLEM, DO YOU ALWAYS		
look at the sign-out sheet	71%	43%
see the patients	57%	14%
see the chart	57%	29%
know all the medications a patient is on	43%	14%
WHAT IMPROVEMENTS IN THE SIGN-OUT WOULD HELP YOU		
legibility	100%	0%
comprehensiveness	100%	0%
consistency	100%	0%
SHOULD THE CURRENT SIGN-OUT SYSTEM BE IMPROVED?	100%	29%

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