

Comparison of Time Spent Writing Orders on Paper with Computerized Physician Order Entry

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Abstract

Computerized physician order entry (CPOE) has been shown to improve quality, and to reduce resource utilization, but most available data suggest that it takes longer to enter orders using CPOE. We had previously implemented a CPOE system, and elected to evaluate its impact on physician time in the new setting. To do this, we performed a prospective study using random reminder methodology. Key findings were that interns spent 9.0% of their time ordering with CPOE, compared to 2.1% before, although CPOE saved them an additional 2% of time, so that the net difference was 5% of their total time. However, this is counterbalanced by decreased time for other personnel such as nursing and pharmacy, and by the quality and efficiency changes. We conclude that while CPOE has many benefits, it represents a major process change, and organizations must factor this in when they implement it.

Introduction

Computerized physician order entry enables physicians to write all orders directly on a hospital information system. Since nearly everything that occurs in hospitals occurs as a result of an order, automation of this process has enormous potential for improving the quality of care. Specifically, it allows structuring of the orders and makes it possible to provide physicians with feedback at the time that they are making decisions.

Order entry can help to reduce costs and improve quality of care. One randomized control trial showed that implementation of an order entry system resulted in a 12.7% decrease in costs per admission (1). In addition, efficiency improved through a reduction of handling time per order and the allowance of order placement from remote sites (2). Order entry systems can also improve the quality of care. In one study, computerized physician order entry resulted in a 55% decrease in the serious medication error rate (3).

Despite these successes, experiences with order entry have been mixed (4;5). The primary problem has been that such systems take providers longer to execute ordering than pen and paper (1;5). At one site, where order entry had been implemented (5), housestaff claimed that ordering time had increased and that the system had resulted in the assignment of more clerical duties. This resulted in widespread resistance in a work action in which housestaff entered most orders using a free text option. Thus, the major determinant for order entry acceptability is the speed of use (1;5). This factor is particularly important to physicians who are already working long hours and are then asked to accept an added time-consuming responsibility.

Our information systems group previously implemented a physician order entry system at Brigham and Women's Hospital (2;6). Recently we have implemented a similar system at the Massachusetts General Hospital. To determine how implementation affected physician time use, we performed a before and after study using a random reminder methodology. Specific goals of this study were to: 1) measure time spent ordering before and after CPOE; 2) compare the impact on medical housestaff time; 3) evaluate the impact of order entry on other housestaff responsibilities; 4) measure impact on time spent with various people, such as other physicians and patients.

Methods

Study Setting

Massachusetts General Hospital is an 820-bed tertiary care hospital. A physician order entry system was implemented on the medical service in the middle of November 1998. The system allows providers to enter all patient orders, with most being entered in coded form. In addition, it allows patient-specific and order-specific information to be delivered to providers in real time.

We refer to the period before implementation of order entry as Phase 1 and to the period after as Phase 2. For medical housestaff, interns are the primary order writers at the institution. Thus, we elected to study this group of house officers. In Phase 1, 43 medical interns participated in the data collection that occurred from September 1998 through November 1998. In Phase 2, 29 of the medical interns participated; all but one had participated in Phase 1. Phase 2 data collection took place from May 1999 to June 1999.

Data Collection

In the random reminder methodology, physicians carry pagers programmed to go off at random intervals. On the average, these pagers were set to go off 1.8 times each hour. At the time of each random page, the physicians record their activities in a logbook using structured codes. Random reminder pagers allow 24-hour data collection and are less disruptive to the subject's regular work patterns than a human observer (7).

A full call cycle consisted of the following consecutive days: on-call, post-call, swing (no overnight responsibilities) and pre-call. Each physician was given a logbook and a pager (Divilbiss Electronics, Champaign, IL) on one of their pre-call days. The physician was instructed to carry the reminder beeper for the next full cycle, which included from the morning of the on-call day until they went home on their pre-call night. These cycles varied in duration from three to four days. During this time interval, the beeper was to be turned off only when the physician went to sleep or left the hospital.

Classification of Time Use

Types of activities were classified using an activity checklist developed by Overhage (8); categories were mutually exclusive. For each page received, the physician was to record the date, time, primary, and secondary activity codes as well as the appropriate contact code in the format provided by the log booklet. If the physician was engaged in more than one secondary activity at the time of the page, only the highest priority activity was recorded. If each of the activities carried the same ranking, the physician then was to make an assessment of the relative priority and the amount of time consumed by each activity to determine which to record. If the physician was in contact with more than one person at the time of the page, only the person that the intern was interacting with the most was recorded.

Primary activity codes represented general categories of activity including: Rounds, Conferences, All Other Hours Beeper On, and Beeper Off. Secondary activity codes were more specific. Major categories included: talking, speaking on the telephone, writing notes, writing orders, reading the computer, completing forms, examining a patient, doing procedures, transporting, walking, and miscellaneous or personal. Each category included subheadings; for example, the category "writing notes" included options of daily,

admission, transfer, discharge, x-cover, and other. The checklist included a total of sixty-nine possible activities.

The "contact codes" indicated the particular person with whom the physician was interacting. The list of contact people was developed using a checklist developed by Oddone et al (9). Categories within "contact person" included: self, patient, patient's family, other physician (attending, resident, consult, medical student), nurse, ward clerk, lab technician, and other personnel.

Results

In Phase 1, before the implementation of order entry, 43 medical house officers participated in the study. These medical interns recorded a total of 1729 observations in over 1554 hours; their average time of participation was 36.1 hours. In addition, medical interns spent a mean of 15.6 hours a day in the hospital and awake on-call days, 15.1 hours on post-call days, 10.8 hours on swing days, and 10.6 hours on pre-call days (Figure 1).

In Phase 2, 29 interns participated in the study and all but one of these interns had participated in Phase 1. At this time, medical interns recorded a total of 953 observations in over 962 hours; their average time of participation was 33.1 hours. Medical house officers spent a mean of 14.0 hours a day in the hospital on on-call days, 13.8 hours on post-call days, 7.6 hours on swing days, and 8.6 hours on pre-call days (Figure 1).

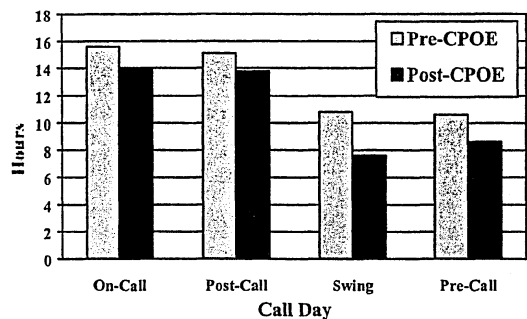


Fig. 1: Hours Per Day Spent in Hospital

In Phase 1, medical interns spent most of their time in rounds (Figure 2). More specifically, while rounding, secondary activity code data indicates that interns were mostly talking (50%) and writing notes (14%). Phase 2 data shows that interns spent less time talking (39%) and about the same time writing notes (14%). In general, comparing Phase 1 and Phase 2, the largest shifts in the primary codes show that interns spent more time rounding and less time in conferences. More specifically, secondary code data shows that interns spent more time ordering with computer entry and subsequently, less time talking and reading.

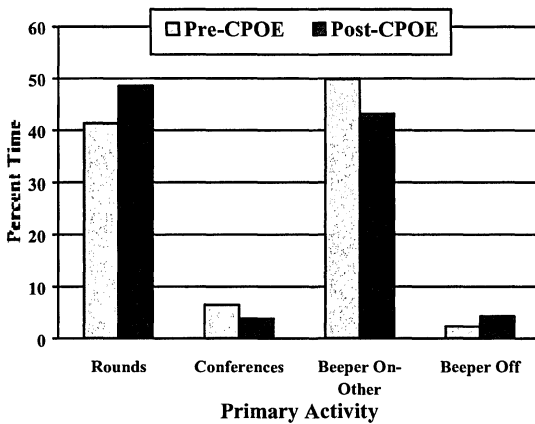


Fig. 2: Primary Activity Codes

In addition, we categorized activities into specific kinds of tasks: patient-related, clerical, educational and other (Figure 3). In Phase 1, interns spent 68% of their time on patient-related activities. Similarly, in Phase 2, interns spent 68% of their time on patient-related activities ($p < .825$). The largest shift was participation time in educational activities. Phase 1 interns spent 10% of their time engaged in educational activities, while Phase 2 interns reported devoting only 4.1% of their time to educational activities ($p < .001$). Clerical duties actually decreased: 5.2% vs. 4.7%.

Time Spent Ordering

When time spent ordering was compared between Phase 1 and Phase 2 (Figure 4), the percent of total time spent writing orders for medical interns increased from 2.1% to 9.0% ($p < .001$). In addition, interns spent less time talking and reading. Amount of time talking decreased from 50% to 39% ($p < .001$) and amount of reading decreased from 1.7% to .73% ($p < .042$).

The proportion of time spent using the computer changed substantially because of the increased time associated with ordering, going from 6.8% to 13.5%, while time reading things on the computer remained constant (Figure 5). However, interns recovered time because of decreased time performing activities expected to take less time after order entry (Figure 6): 8.0% compared to 6.1% after order entry, for a net gain of 1.9%. These activities included scheduling tests, completing forms, walking, travelling in the elevator, and looking for patients. For unclear reasons, scheduling tests actually took longer after order entry was in place. Overall, the net difference in percent time associated with ordering was approximately 5% (9% after, vs. 2% before, with savings of 2%).

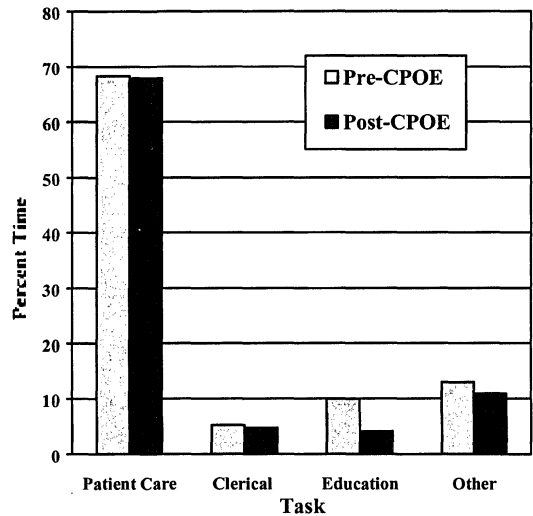


Fig. 3: Time Spent on Different Types of Tasks

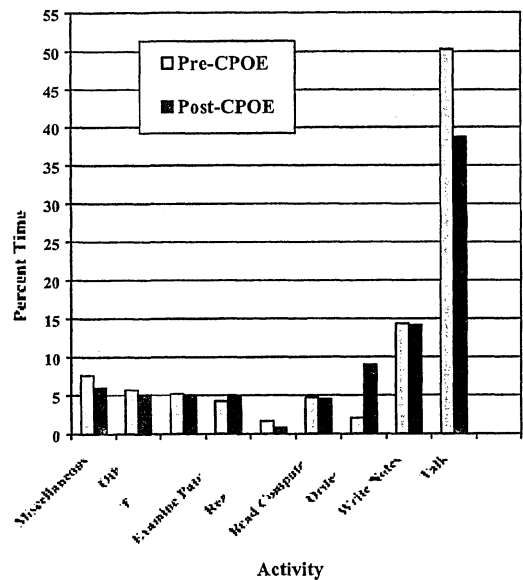


Fig. 4:
Intern Activity Distribution – Secondary Activity Codes

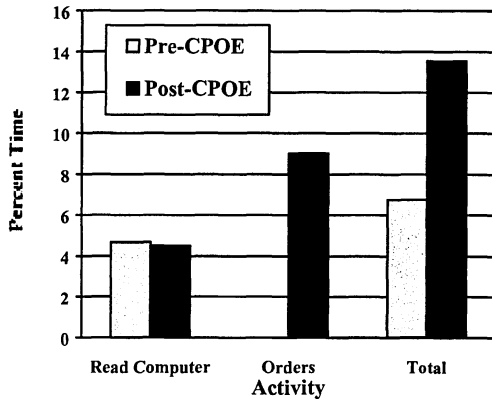


Fig. 5: Time Spent with Computers

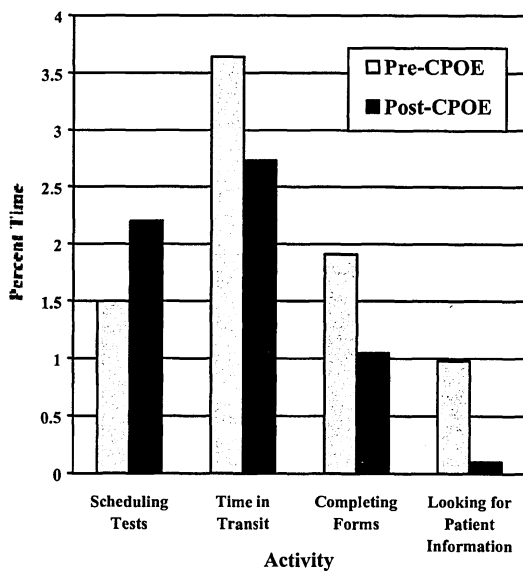


Fig. 6: Activities Potentially Reducible by CPOE

Because one of the main concerns with order entry is the possibility that it could affect house officer time with patients, we compared contact distributions before and after order entry (Figure 7). Despite earlier concerns, there appeared to be a positive trend. Time with patients before order entry represented 13%. After order entry, interns spent 16% of their time with patients. Also, there was a significant increase in the time that physicians spent alone (32% vs. 38%) with $p < .005$. In addition, interns spent less time with other physicians after order entry implementation (47% vs. 41%).

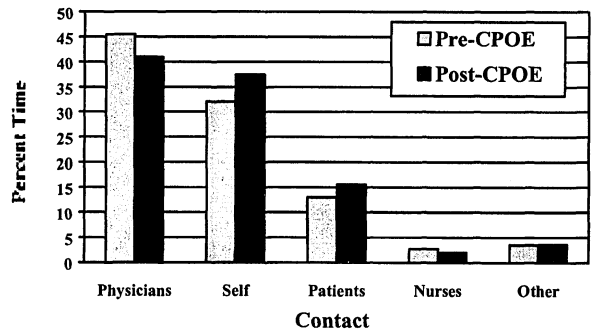


Fig. 7: Intern Contact Distribution

Discussion

While physician order entry can improve the quality and safety of patient care, it must be fast enough to be usable. We found the time required to write orders was longer with the order entry system than with pen and paper, and the net increase was about 5% of total time. However, in general, interns spent less time performing clerical duties after order entry implementation. Furthermore, interns spent less time in the hospital during Phase 2, even though they were spending more time ordering. Some of this decrease undoubtedly occurred because it was later in the year, and interns became more efficient. In addition, order entry did not decrease time spent with patients; in the second period, interns spent more time with patients and less time with other physicians.

This study focused on the most important negative effect of physician order entry, rather on its benefits. Physician order entry reduced the serious medication error rate 55% in one study (3), and in another study it reduced the overall medication error rate by more than 80% (10). Furthermore, in a randomized controlled trial it was found to result in shorter length of stay and decreased resource utilization (1). Overall, order entry results in a transfer of work: physicians spend longer ordering, but other physicians, nursing staff, pharmacy, ancillaries, and administration all benefit from orders that are clearer, more readily available, and more explicit. However, physicians in general and house officers, in particular, are already working long, stressful hours and thus are resistant to change. Therefore, during its development and implementation, the hospital should organize a major effort to properly introduce the system to providers with clear explanations of its potential benefits. In addition, it is critical that the organization demonstrate an ongoing commitment to making the application as fast as possible.

Others have also found that order entry takes longer than pen and paper (1). In particular, Tierney found that medical interns spent 33 minutes longer per day after order entry than before its implementation.

It seems likely that speed will improve with time. This will occur as a result of software and hardware developments. Some software improvements include reducing the number of keystrokes and screens required to enter one-time orders. On the hardware side, speed of processing will continue to improve, and further developments such as voice recognition in which the computer directly transcribes spoken words may make such systems even easier. In addition, as providers become more familiar with the system, they will become more facile and quick with the order entry protocols.

This study has a number of limitations. These data come from a single institution and information system. Thus, the results might not be generalizable to other settings. The random reminder system requires willing participants, as the data rely on self-report. Another limitation is that we relied on time series data that could be affected by temporal influences. Additionally, data were collected at different times of the year and interns are clearly more efficient later in their first year as they become more experienced. There is also the potential for reporting bias in which interns are more likely to self-report activities when they are the least busy. In addition, contact code data only represents interactions with a single person when the intern could actually be interacting with numerous people at once. Another limitation is that not all eligible house officers participated, and non-participants may have differed from participants.

We conclude that the present version of computer order entry on this system takes physicians longer than paper ordering. However, medical house officers recovered some of this time in other activities, such as walking and completing forms. Although there were concerns that order entry would make house officers spend less time with patients, this did not occur, and in fact, our data showed a trend toward increased contact with patients. Overall, physician order entry should improve the quality of care, particularly improving the safety of hospitals, and it will also reduce costs. These benefits justify the increase in provider time required. While improvements and familiarity with the system are likely to make the process faster, order entry represents a major process change, and organizations should recognize its magnitude when they prepare for it.

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