Ambulatory Computerized Physician Order Entry Implementation

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ABSTRACT

As part of a broader effort to identify success factors for implementing computerized physician order entry (CPOE), factors specific to the ambulatory setting were investigated in the field at Kaiser Permanente Northwest. A multidisciplinary team of five qualitative researchers spent seven months at four clinics conducting observations, interviews, and focus groups. The team analyzed the data using a combination of template and grounded theory approaches. The result is a description of fourteen themes, clustered into technology, organizational, personal, and environmental categories. While similar to inpatient study results in many respects, this outpatient CPO investigation generated subtly different themes.

INTRODUCTION

Computerized physician order entry (CPOE) has been shown to decrease medical errors [1-3], but it has often been met with resistance from users [4,5]. To identify success factors for implementing CPOE in the inpatient setting, we conducted fieldwork at the University of Virginia, two Veterans Affairs Puget Sound campuses, and El Camino Hospital in Mountain View, CA [6]. To further identify considerations for successful implementation, we analyzed transcripts from an expert panel discussion [7]. When the results from both of those efforts were reconciled, twelve principles were described [8]. Details of all work up to this point are summarized in [9]. Prior results provided the foundation upon which fieldwork at Kaiser Permanente Northwest (KPNW) was based. The purpose of this study was to identify success factors for implementing CPOE in the ambulatory setting.

METHODS

Site Selection

A group of experts nominated study sites based on reputation for excellence, geography, and type of organization. Although selected in 1999, KPNW was not actually visited until 2003 because we wanted to learn as much as possible about inpatient CPOE before turning our attention to the outpatient setting. The study received human subjects approval from Oregon Health & Science University and KPNW.

Site Description

KPNW is one of eight regional health maintenance organizations that make up the national Kaiser Permanente Organization. KPNW began its implementation of EpicCare as its electronic medical record (EMR) system, including CPOE, in 1994 and by 1997 all 25 of KPNW's clinics were using it. The rollout strategy included easing clinicians' schedules while they were learning to use the system, identification and use of clinician champions [10], and extensive training [11]. Clinical decision support is extensive. In 1998, KPNW won the national Nicholas E. Davies Award for Excellence in Clinical Information Systems [12] and in 2000 the American Medical Group Association Acclaim Award for Clinical Information System Implementation. In 2003, it was voted the number one health maintenance organization in the nation in a survey by a leading national consumer magazine. The Kaiser Permanente Organization is now implementing this system nationally in all its regions.

Informant Selection

Of the 25 KPNW clinics, four were selected as study locations. Three of the clinics have exam room computing and the fourth was selected because it is representative of the clinics without exam room computing. Within each clinic, we observed and interviewed primary care clinicians. Because we wanted a cross section of informants, individuals were selected because support personnel identified them as champions, typical users, or begrudging users. Many were also informally interviewed. Formal interviews were held with individuals who were administrators, technology staff, or clinicians. One focus group was held with the clinical information systems committee, comprised of clinicians, technology staff, and operations staff, and another with clinical applications support staff.

Data Gathering

Data were gathered between April and October of 2003 by a team of physicians, Ph.D. researchers, a pharmacist, and one doctoral and one informatics masters candidate. Clinicians were shadowed for a total of 29 hours and 15 hours of interviews and focus groups were conducted. Thirteen different

clinicians were observed, 12 individuals were interviewed, and two focus groups were held.

Data Analysis

Investigators transcribed their own field notes and professional transcriptionists produced transcripts of interviews and focus groups. Both template and immersion/crystallization organizing schemes were used [13]. Twelve themes had been discovered in prior research and these became a template for field notes and data analysis. All data were also analyzed in a grounded manner for new emerging themes. Qualitative data analysis software (QSR N6) assisted in analysis. An objective outside qualitative researcher reviewed all data and analysis and individuals internal Kaiser reviewed drafts of reports to ensure the trustworthiness of the results.

RESULTS

Table 1 lists the fourteen themes and representative quotes from transcripts. Since the themes that emerged from studying inpatient facilities have been described in detail elsewhere [8], we will only highlight here the unique qualities of the outpatient setting.

Technology Themes

Temporal concerns

CPOE changes the visit dynamic. It makes much more information available during each clinic visit and it may lengthen the visit. Without exam room computing in place, the patient is unaware of the time the clinician spends outside the exam room reviewing health information and entering orders and notes. However, when computers are used in the exam room for order entry, patients can see the time spent by the clinician and can even participate in information gathering and order writing.

Technology

Investment in an adequate number of computers and printers is necessary. To reap the benefits of the EMR, a computer is needed in each exam room and in each provider's office. Careful placement of equipment, plus a high level of system integration, leads to less disruption in workflow. When computers are in the exam rooms, they should be placed so that both the physician and patient can see the information on the screen. A close and cooperative relationship with the vendor leads to timely modifications and customization. Modifications and upgrades can cause annoying problems for the users, however, since they are forced to learn new screen designs and workflows. "Electronic clinics," far from being paperless, may use more paper than before, but it is "better paper." Before each visit at KPNW, a short summary of patient information is printed from the EMR to provide the physician a "bird's eye view" of the patient. In addition, paper "after-visit summaries" provide instructions and educational information to the patient at the end of the visit.

Meeting information needs

Much of the depth and breadth of information accessibility at KPNW is because the integrated information system fits the integrated health care delivery system. For example, since KPNW provides a pharmacy benefit, most patients obtain their medications from the KP pharmacy. This allows the EMR to show what has been ordered and also picked up by the patient. Many of these benefits could be extensible to other types of clinics, especially if the NHII concept becomes a reality. Because of the complete integration of healthcare information, a clinician can quickly gain a comprehensive view of the patient's health.

Increasing patient involvement

With exam room computing, the patient often becomes more involved in the information flow and decision-making, sometimes correcting information in the system or discussing options with the clinician in the context of the decision-support provided by the system at the time of order entry. The doctor-patient relationship is enhanced, with the computer playing an active role in facilitating communication and mutual decision-making.

Multidimensional integration

The integrated information system allows all patient information to follow patients between geographically disparate sites, specialties and even levels of care. In addition, because clinicians can access the latest clinical reference information from within the EMR application, adherence to evidence-based clinical guidelines is increased. Thus, the system, by integrating patient information and medical knowledge across distance, time, and even levels of care has become an essential hub with a pervasive presence.

Cost

Beyond the initial cost of the system, training, maintenance, and support costs are considerable. Recognizing that there would be initial, and perhaps ongoing, productivity decreases when CPOE was implemented in each clinic, KPNW reduced physician schedules to allow them time to adapt. In retrospective analyses, KPNW was able to demonstrate a reduction in the number of lab tests

ordered decreases in costs to maintain and transport paper medical records. Kaiser Permanente (National) has recently reported on the KPNW and Kaiser Colorado experiences with the EMR [14]. Primary care visits declined by 11% and specialty care visits by 6% in the Northwest.

System Security
There is a heightened awareness of system security issues at KPNW, perhaps because training emphasizes its importance. There is, however, a tension between the added time it takes to enter user names and passwords and the desire for security. Users do not always remember to log off the system.

Personal Themes
Value to users
The greatest value to clinicians is the availability of more complete information about patients when and where they need it. With exam room computing, this information can also be shared with patients and families more directly. Clinicians vary a good deal in their acceptance of exam room computing. Many clinicians are not comfortable with it because they feel it interferes with the doctor-patient relationship. They may need more evidence of patient acceptance before they find value in it. With the addition of Personal Health Link (i.e., patient access to portions of their electronic medical record and the ability to securely contact their physicians via the Internet), patients will begin to benefit in even more ways. The system supports the alignment of patient and provider goals of health maintenance and preventive care by embedding real-time clinical reminders for recommended health interventions.

Essential people
There are two major categories of essential people, heroes of successful implementation—clinical and administrative leaders championing the effort and the support personnel who bridge the language gap between the clinical and IT staff. Critical roles are: a chief medical information officer to provide clinician leadership and a link between clinical, administrative, and IT staff; and senior leaders who provide consistent sponsorship and vision regarding the importance of information technology. The multidisciplinary clinical information systems committee, with a very stable ongoing membership, has fielded input from users and guided the decisions made in system implementation. Even the "curmudgeons" who seem to make things more difficult can be seen as beneficial by providing useful feedback. The training and support personnel at KPNW have always been numerous and talented, and even today they are readily available in house in each

clinic to provide help "at the elbow" where needed. Finally, the vendor has played an important role in responding quickly and effectively to make important modifications to their software in response to identified needs.

Organizational Themes
Foundational underpinnings
This organization had a solid foundation of successful information technology innovation prior to implementation of CPOE—a clinical results reporting system, for example. It had a history of supporting innovation and had given small grants to clinicians to develop clinical computer applications. There is also trust between clinicians and management, so that clinicians generally believe that the leadership sincerely wants to help them improve patient care.

Collaborative project management
Implementation was truly accomplished collaboratively through what KPNW refers to as "the three legged stool" approach. Administration, or clinical operations, information technology, and clinical personnel are the three legs that worked cooperatively together. The multidisciplinary clinical information systems committee was critical to success, maintaining close relationships with users and providing rapid feedback to developers. Project management was disciplined and careful.

Terms, concepts, and connotations
There seems to be a common understanding of terms and concepts related to the clinical information system, more so at KPNW than we have seen elsewhere, perhaps because the system is such an integral part of the lives of the users and because the training and communication about the system are so broad and on-going.

Improvement through evaluation and learning
Both the organization and the vendor were willing to react to and learn from the inevitable problems that will arise when implementing CPOE. With the clinical information systems committee and the chief medical information officer serving as conduits for feedback, the system was iteratively improved by the organization and the vendor working in a partnership characterized by some as "a marriage," and by others as "two kids growing up together." There were periods of rest and recovery (for both clinicians and IT personnel) when no changes were made while users (and the implementation staff) were adjusting.

Environmental Themes
Motivation and context

The unitized chart was the overarching motivation for implementing the EMR. KPNW has long held the belief that there should be one, and only one, medical record for each patient, regardless of the location or level of care. Prior to the EMR, KPNW spent much time, effort, and money creating a centralized medical record facility and transport mechanism (i.e. hundreds of KP vans to deliver records) that were still inadequate. They saw the EMR as the only way to ensure 100% chart availability despite location or schedule.

DISCUSSION

Two new themes emerged from our work in the outpatient setting. "System security" is perhaps a greater issue in this setting because screens are more visible to patients, computers are more numerous, and patients are often left alone in the exam room with the computer. Therefore, it is not surprising that users are thoroughly trained and constantly reminded of these security issues. "Technology," though important in inpatient settings, arose as a separate outpatient theme, perhaps because the computers are so invasive, so much a part of work life here. Twelve of the themes found in prior work were found here as well, but with subtle differences. For example, there are qualitative differences in the user perceptions of "Time" based on workflow. For example, in the in-patient setting, the clinicians generally arrange their work according to their own time constraints and while they are equally as busy as their out-patient counterparts, they do not appear to be as pressed to complete all their work in a short period of time. On the other hand, in the outpatient setting, the patients are much more involved and have far more control over what happens and when. If computers are not in the examination room, the clinician does not get "credit" for the time he/she spends reviewing the patient's electronic chart outside of the exam room. Other differences between KPNW and inpatient sites we have studied are perhaps less due to the outpatient setting and more because of the pivotal importance of the EMR in the comprehensive, integrated structure of the Kaiser Permanente care delivery system.

CONCLUSION

Results of this study indicate that there are subtle differences in themes uncovered in outpatient and inpatient settings. There are also lessons here about how to do a successful implementation. At KPNW these included gradual rollout, careful project management, investments in essential people and clinician incentives, shared motivation, and constant improvement As one researcher commented, "we have seen the future--when an information system can fit a health care system so well that it becomes a virtual hub of all activity."

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Table 1. Themes and Quotations

The Themes	Representative Quotations
Technology Themes	
Temporal concerns	"It clearly drives your existence forward" "It takes a few minutes longer on each patient"
The technology itself	"The only problem we have with it is when it goes down 'cause then we're like 'what do we do?'"
Meeting information needs	"Dealing with incomplete information is dangerous; more information means more confidence"
Multi-dimensional integration	"You get maximum benefit only if you have a highly integrated system"
Costs	"It's time to put the pencils down and begin working to make the system useful"
Security and system checks	"even now I don't log off; I realize I should but I don't; that would take another ten seconds"
Organizational Themes	
Foundational underpinnings	"when people got results reporting they could really see the power of information"
Collaborative project management	"there was really this idea of a three legged stool [clinical, operations, and IT]; different people have different perspectives and views on things"
Terms, concepts and connotations	"we didn't call it 'coding;' we called it 'enter the diagnosis [which was more acceptable]'"
Improvement through evaluation and learning	"It's a very iterative process with them as a vendor. You give them a lot of ideas. They give you back their ideas. You work together to co-develop"
Personal Themes	
Value to users	"It gives me a bird's eye view"
Essential people	"You need the leadership to say 'this is the direction in which we're going' and not change their mind halfway into it"
Training and support	"I remember [when we went live] hearing expletives followed immediately by the scamper of little feet and a specialist going and finding out what had happened"
Environmental Themes	
Motivation and context	"It didn't pencil out in a traditional return on investment kind of approach [but leaders X and Y said] 'we're gonna do it because it's the right thing to do'"