Transforming Information Use in Preventive Medicine: Learning to Balance Technology with the Art of Caring

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CompuHx is an Interactive Health Appraisal System (IHAPS) used in the examining room to record patient information, assist in diagnosis, and provide a legible summary of findings. This paper describes Phase I of a longitudinal study in which 22 examiners (five system users and 17 non-users) responded to detailed surveys and interviews about the system. Findings indicated that both users and non-users had mixed feelings about the system's ease of use and impact on their jobs, but agreed that it would have value for their practice. Underlying their acceptance of the system was a common concern for maintaining a caring relationship with patients and not allowing computer technology to depersonalize the examining room. Examiners also expressed concerns about the implementation process.*

INTRODUCTION

The majority of work on computer use by clinicians has focused on informatics in hospitals and in specialty medicine [1]. Furthermore, the systems in use in outpatient settings seldom involve direct clinician data entry during the patient visit [2]. Most research on the use of computers in the consulting room comes from studies conducted in the United Kingdom where it is estimated that 75-90% of primary care physicians work in computerized practices and over 60% use computers during consultation [3,4,5,6,7].

This paper extends the literature on computers in the consulting room to the U.S. by reporting on Phase I of a longitudinal study designed to examine clinician, patient, and organizational outcomes of an interactive health appraisal system. The project is particularly important because it focuses on computerization of the health appraisal process in a large health maintenance organization, a setting likely to become increasingly important as health care reform unfolds.

The portion of the study described here was designed to: (1) describe clinician reactions to CompuHx in the examining room, (2) examine the individual and organizational variables influencing those reactions, and (3) determine whether clinicians who report more stress from uncertainty in patient care have more positive reactions toward a system designed to ensure thoroughness and assist in reaching a diagnosis [8].

HEALTH APPRAISAL

The Kaiser-Permanente Medical Care Program provides a detailed, complete history and physical examination to 50,000 members per year in the San Diego Department of Preventive Medicine. The majority of these patients are the "worried well," patients whose care does not require the traditional, costly, sickness-care portion of the organization [9]. Despite this fact, however, personal interactions with the clinician are an essential part of the health appraisal process for these patients. Recent interviews with 53 patients indicated that approximately 60% came with specific symptoms, concerns, or fears to discuss [10]. All examinations are performed by a nurse practitioner or physician assistant ("examiner"), with a physician always available for consultation. The minority needing further care are guided to the appropriate physician. Five of the 22 examiners are CompuHx system users.

COMPUHX IN THE EXAMINING ROOM

CompuHx is an Interactive Health Appraisal System (IHAPS) designed to utilize artificial intelligence, data base management, and computer graphics to create a fully detailed, legible medical record. CompuHx is designed to enforce thoroughness by (1) addressing all information contained in the original patient questionnaire, (2) ensuring that all information necessary for diagnosis has been obtained, and (3) recording/storing/reproducing the information in a legible, structured, and easily accessible medium. CompuHx is intended ensure the performance of the examiners and the quality of patient care.

Two categories of information are initially stored in the data base: patient history (based upon a questionnaire completed by the patient at home prior to the visit) and lab values. Stored in the examining room computer are almost 100 screens, each specific to a question in the medical history. When queried by the examiner, the program displays screens specific to questions answered affirmatively (or left unanswered) by the

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patient on the questionnaire. Each screen has color- and shape-coded icons covering the subsidiary questions necessary to fully detail a specific medical problem. Almost all entry is mouse-driven and screens are designed to aid the examiner in obtaining the necessary information, as well as recording that information and a diagnosis.

Following the patient history screens is a series of 20 screens to be used in similar fashion during the actual physical examination. Icons prompt the examiner to record all relevant information and diagnoses. At the end of the physical exam, the computer displays a list of all findings and diagnoses. The examiner eliminates findings that have been subsumed, prioritizes the diagnoses, relating a condition to a referral if necessary, and "ties" medications to a condition if prescribed. When complete, all information is sent back to the data base and a written summary of the patient history and medical examination is generated along with a "to do" list. A summary letter to the patient discussing the implications of findings is currently in alpha testing.

SYSTEM IMPLEMENTATION

Implementation of CompuHx began in 1991 with a computer installed in one examining room and was expanded to include one additional computer and examiner within the year. When the study began in Fall 1993, five of the 22 examiners had already volunteered to use CompuHx. Their experience with the system ranged from 1 month to two years. Four are currently using the system, with expansion to six planned shortly.

The implementation process has also included technical evaluation and ongoing development of the system itself. As part of this process, all histories completed using CompuHx are reviewed in detail by the Director of the Department of Preventive Medicine, who has sponsored and guided the development of the program. These reviews include the performance of the individual examiner on CompuHx as well as potential changes to the computer program itself and to the text of the report produced for a specific patient. This implementation process and its organizational context, along with other variables described below, may influence the attitudes of individual examiners toward the implementation of CompuHx.

PREDICTORS OF USER ATTITUDES

Characteristics of individual users such as age, job tenure, previous computer experience, prior attitudes towards computers in health care, and reactions to the stress of uncertainty in patient care can often help predict attitudes toward a new information system. Outcomes, however, are not always predictable. Age, job tenure, and previous computer experience, for example, have been shown to lead to both positive and negative attitudes in different settings. Measuring these background factors enables investigators to document their influence when considering their interaction with other factors in the organizational environment [11].

STUDY METHODOLOGY

Surveys

Phase I of the study began with a comprehensive survey completed by all 22 nurse practitioners and physician assistants (100% response) in the Department of Preventive Medicine. The survey was distributed with a letter explaining that all responses were confidential and would not be available to anyone in the organization. To ensure confidentiality, completed surveys were mailed directly to the investigator not affiliated with Kaiser-Permanente.

Because research has shown that prior expectations for a system are important in understanding later reactions to it (e.g., expectations confirmed, disillusionment, etc.), the survey gathered baseline information from all examiners, system users and non-users alike [12]. Respondents were instructed to answer either from their experience with the system (users) or their expectations about what using the system would be like (non-users). Statistical analyses (e.g., t-tests) examined differences between responses of users and non-users.

Independent variables included in the survey were basic demographic information, personal attitudes about the desirability of computer applications in medical care [13], and reactions to uncertainty in patient care [8]. Dependent variables included expectations or opinions about the accuracy, format, and ease of use of the system [14]; and the impact of CompuHx on numerous aspects of individual job performance and the performance of the department as a whole [15,16,17].

Interviews

Following completion of the surveys, moderately structured 10-20 minute interviews were conducted with 11 of the 22 examiners, including 3 of the 5 system users and 8 non-users. The interviewer was not affiliated with Kaiser-Permanente and respondents were assured that their responses were confidential. Examiners were asked what they knew about the system and how they had acquired the information,

their opinions about CompuHx, learning to use the system, impacts on their job, the implementation process, interactions with patients and other clinicians, and other opinions they wished to share. Interview findings supplemented analyses of the survey data.

FINDINGS

Demographic Data

Survey responses indicated that the 22 examiners included 7 nurse practitioners, 14 physician assistants and one examiner who had both credentials. They had a mean of 8.7 years health care experience (range=1-18 years) and had worked in the department a mean of 4.4 years (range=4 months-14 years). Fourteen (64%) were female and 8 (36%) were male.

Thirteen examiners (59%) had no previous computer experience while 9 (41%) had experience with word processing or other computer applications. Three of the five CompuHx users (60%) had previous computer experience compared to six of the 17 (35%) non-users. Four of the five CompuHx users (80%) were male. Since CompuHx users had volunteered to use the system, demographic data indicate that male examiners and those with previous computer experience were more likely to volunteer. (In fact, the one woman who had used the system indicated that, while she was willing, she had initially been asked to use the system by the Director.)

Attitudes Toward CompuHx

Ratings of CompuHx System

Findings showed no significant differences in attitudes toward CompuHx between system users and non-users. Thus their data are combined in Tables 1-3 below.

Table 1
Ratings of CompuHx System
(N=22)

Scoring: 1=almost never, 3=almost half the time, 5=almost always	Mean	SD
Content	3.75	0.64
Accuracy (alpha=.90)	3.82	0.58
Format (alpha=.89)	3.68	0.77
Ease of Use (alpha=.85)	3.18	0.82

Respondents' ratings (users and non-users combined) of the CompuHx system itself are shown in Table 1. The system received higher ratings for content, accuracy and format, but was rated as "easy to use" only "almost half the time." (Cronbach's coefficient alpha, a measure of internal consistency, is also given for scales composed of multiple questions.)

Impacts on Job Performance

Respondents (both users and non-users) rated different potential impacts on job performance. (See Table 2.) Findings showed respondents were uncertain about positive effects on their job performance, but agreed that (1) their performance will be monitored more, (2) top management sees the system as important, (3) training is sufficient, (4) external relationships with departments such as primary care will improve, and (5) the system is a good teaching tool for new grads.

Table 2
Impacts on Job Performance
(N=22)

	Mean	SD
1=strongly disagree, 3=uncertain, 5=strongly agree		
Positive effects on job performance (alpha=.89)	3.15	0.58
Performance monitored more	3.82	0.73
Top management sees system important	3.86	0.64
Training sufficient/adequate (alpha=.63)	3.68	0.72
Improves external communication/ relationships (alpha=.85)	3.57	0.74
Good teaching tool for new grads	3.64	1.18
1=strongly disagree, 4=neutral, 7=strongly agree		
Makes job easier/interesting/fun/ pleasant (alpha=.89)	3.73	1.43
Makes job more stressful	4.23	1.38
Increase overall ease/quality of department's work (alpha=.89)	4.52	1.16
System worth the time and effort required to use it	4.64	1.22

Overall, respondents also felt it would make their job slightly less easy, interesting, fun, and pleasant and slightly more stressful. Higher standard deviations, however, indicated wider diversity of opinion on these questions. Finally, examiners slightly agreed that the system would increase the ease and quality of their work and would be worth the time and effort to use it.

Predictors of Attitudes toward CompuHx

Individual characteristics such as gender, age, experience, or prior computer use did not predict attitudes toward CompuHx. Opinions about the impact of computers on the role of the clinician, however,

significantly predicted attitudes toward CompuHx [13]. Respondents who felt that computers would diminish the clinician's role (i.e., be hard to learn, diminish clinician judgment, be a less efficient use of clinician time, depersonalize practice, and alienate clinicians from their patients, alpha=.89) had significantly more negative attitudes toward CompuHx. (See Table 3.)

Table 3
Correlation of Computer Impact on Clinician Role with Selected Impacts on Job Performance
(N=22)

	Diminish Clinician Role
Positive effects on job performance	r=-.63 p<.002
Makes job easier/interesting/fun/ pleasant	r=-.75 p<.0001
Increase overall ease/quality of department's work	r=-.61 p<.003
System worth the time and effort required to use it	r=-.73 p<.0001

Uncertainty in Patient Care and CompuHx

Respondents also answered 13 questions designed to measure reactions to uncertainty in patient care (alpha=.89) [8]. Higher scores indicate greater stress. While Stress from Uncertainty did not correlate with attitudes toward the system, CompuHx users (M=2.37) did show significantly less stress from uncertainty in clinical practice than did non-users (M=3.21), $t(18.5)=3.57$, $p<.003$. It is unclear, however, whether those with greater tolerance for uncertainty volunteered to be the first users or whether using the system contributed to their higher tolerance for uncertainty. In other research, males and physicians in practice longer have shown less stress from uncertainty. There were, however, no significant gender or time differences in the present study, although, understandably, examiners in this preventive medicine setting showed less stress than did physicians in other settings [8,18].

Interview Findings

Interview findings indicated that respondent attitudes toward the system clustered around four themes: (1) quality control, (2) depersonalization of patient care, (3) time concerns, and (4) the implementation process.

Thoroughness and Quality Control
Most respondents mentioned the thoroughness of the examination enforced by the prompts in the CompuHx system as a benefit for patient care. Some respondents (both users and non-users) were concerned, however, that the program might not allow enough space for open-ended responses or direct patient quotations.

Depersonalization of Patient Care
Ten of the eleven examiners interviewed brought up the potential for depersonalizing patient care when the examiner's attention is focused on a computer terminal or keyboard and not on the patient. As one respondent noted, this is a "psychological and social visit" for these patients. "They come for the time and attention." While most CompuHx users didn't feel that it was a problem, they mentioned making a concerted effort (especially while they were first learning the system) to maintain eye contact with patients. One user noted that it was too disruptive to use the computer while conducting the physical exam. Rather, he enters the data into the computer after the patient leaves. A non-user described mastering the computer system and continuing to meet patients' needs at the same time as an "art" that would have to be learned. Both users and non-users also noted that many patients may be pleased with the thoroughness of the computerized exam, feeling they get more time and attention from the examiner.

Time
Time was a third recurring theme. Both users and non-users noted that, because the program's thoroughness and enforced responses do not allow examiners to use their clinical judgment to skip certain areas of questioning, examinations using CompuHx take more time and have an impact on examiner productivity. Some non-users, however, hoped the computer system might help them speed up their history taking.

Implementation Process
The fourth area of concern was the implementation process. Because implementation has been intertwined with continuing system development and modification, considerable time is spent by both the Director of Preventive Medicine and the examiner in reviewing and correcting the final report for each patient. Furthermore, each examiner learning to use the system becomes something of an apprentice to the Director, altering their working relationship, at least for a time. Some examiners expressed unwillingness to use the system until all modifications were complete, not wanting to spend the time editing reports or, perhaps, subject themselves to the close scrutiny of the department Director.

DISCUSSION

This case study provides baseline data on provider reactions to CompuHx in a one organization. While the sample is small, 100 percent of the department's 22

examiners responded to the survey. This high response rate, combined with interview findings, provides accurate baseline information on examiner perceptions of the system and its impacts on their specific practice. Study findings are also congruent with research in the United Kingdom on computer use by physicians in the consulting room in which both the time required to gather more explicit data and concerns over depersonalization of the patient encounter have surfaced [5,6,7]. In addition, this project begins an exploration of the relationship between a system that enforces thoroughness and aids in diagnosis and the stress clinicians may feel from the uncertainty inherent in patient care. The implementation arrangement in the setting under study also had an impact on examiners' willingness to use the system. The later phases of this longitudinal project will use a variety of evaluation methods to address these issues as the study examines long-term impacts of the system on patients, clinicians, and the organization as a whole.

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