

## Why doctors don't use computers: some empirical findings

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### Summary

The attitudes of 148 medical students, 141 residents, and 644 practising physicians towards computer applications in medicine were studied. The results indicate that physicians recognize the potential of computers to improve patient care, but are concerned about the possibility of increased governmental and hospital control, threats to privacy, and legal and ethical problems. In general, all three groups are uncertain as to the potential effects of computers on their traditional professional role and on the organization of practice. Practising physicians, however, express more concern about these potential effects of computers than do medical students and residents. While attitudes appear to be somewhat independent of prior computer experience, they significantly affect the extent to which physicians use a computer-based hospital information system. This may be a major reason for the slow introduction of clinical computer systems.

### Introduction

Despite impressive developments in computer technology, a series of articles have pointed out that computers have had little direct impact on clinical practice<sup>1-3</sup>. Freidman and Gustafson's survey<sup>4</sup> of 32 clinical applications of computers that had been reported in the medical literature over a five-year period found that 51% of the projects had been abandoned or suspended. Only 19% of the systems were in routine use in the hospitals surveyed. Young<sup>5</sup> asked 'What makes doctors use computers?' A number of reasons for the limited acceptance of computers have been suggested. Friedman and Gustafson<sup>4</sup>, as well as Lewis and Macks<sup>6</sup>, suggested that most medical computer systems are neither convenient for physicians to use nor responsive to their needs. Glantz<sup>7</sup> has questioned the cost-benefit ratios for most medical computer applications, including computer-assisted consultation systems.

These observations, however, are only partly supported by several surveys of physicians. Two early surveys of medical personnel<sup>8,9</sup> found that faculty and house staff in large medical centres generally had favourable attitudes toward computers and recognized potential benefits in applying them to hospital problems. Two more recent surveys of physicians<sup>10,11</sup> found that, while they generally accepted computer applications that enhance their ability to manage patients, they tended to oppose applications they perceived as infringing on their role as decision-makers. Finally, a comparison of the attitudes of certified public accountants (CPAs), lawyers, pharmacists, and physicians toward computers<sup>12</sup> found that physicians were generally neutral towards computers. In contrast, pharmacists

and CPAs found computers beneficial to their work, while lawyers tended to be more negative towards computers.

In general, physicians appear to readily accept the application of computers to some areas such as clinical laboratory automation, computerized axial tomography, and radiotherapy, but to be slow to accept their application to others such as medical history-taking, medical information systems and diagnostic support systems. The first group of computer applications generally support the physician's traditional role while the second set of applications alter normal practice patterns and may even threaten the physician's professional role and status. There is growing recognition that the slow introduction of clinical computing systems is related to the physician's perceptions of their effect on his/her practice. However this problem has been little investigated<sup>5,13,14</sup>.

The research reported here is part of a comprehensive study of factors that affect physicians' use of a hospital information system described more fully by Anderson and Jay<sup>14</sup>. A survey was undertaken in order to improve our understanding of physicians' perceptions of clinical computer applications. It had several objectives. The first objective was to determine the degree of acceptance of a broad range of computer applications by medical students, residents, and practising physicians. A second objective was to determine their perceptions of the potential effects of computers on medical practice. A third objective was to test the assumption that prior experience with computers affects physicians' attitudes about their clinical use. A fourth objective was to determine whether physician attitudes affect the degree to which they use a computer-based hospital information system (HIS).

### Methods

**Setting:** The study was conducted in a 1160-bed private teaching hospital. The hospital has a house staff of 146 residents and a medical staff of 860 physicians. Approximately 30 medical students are engaged in clinical clerkships each month. A computer-based hospital information system has been operational on all units of the hospital since 1977. It permits physicians and other users to enter, access, and modify patient information at a terminal using either a keyboard or a light pen.

**Instrument:** A questionnaire was developed to measure attitudes concerning computer applications in medicine and their potential effects on medical practice. Thirteen items measured the perceived desirability of a number of computer applications to medicine. The response categories were (1)

very undesirable, (2) undesirable, (3) neutral, (4) desirable, and (5) very desirable. A second set of items asked respondents to indicate their agreement or disagreement with 28 statements regarding potential effects of computers on medical practice. The response set was (1) strongly disagree, (2) disagree, (3) undecided, (4) agree, and (5) strongly agree. Additional items were used to determine the respondents' prior computer experience, including ownership of a microcomputer, participation in computer science courses and seminars, programming ability, and the extent to which physicians used their HIS in their practices.

**Respondents:** The questionnaire was administered to 146 members of the hospital's house staff, to 838 members of the medical staff, and to 181 medical students engaged in clinical clerkships over a six-month period. Complete questionnaires were obtained from 148 (82%) medical students, 141 (97%) residents, and 644 (77%) medical staff.

**Procedure:** Means and standard deviations were computed for each questionnaire item. Also, the two sets of items that measured physician attitudes were subjected to factor analyses using the principle axes method. The resulting factors were rotated to a varimax solution<sup>16</sup>. Factor scores were computed for each individual. ANOVA was used to compare the three groups on each item and on the factor scores. *Post hoc* comparisons among group means were conducted for all significant ANOVAs using the Duncan Multiple Range Test. The results of the analysis of individual questionnaire items are available from the authors upon request. Also indices of computer experience and HIS use were created and correlated with the eight factor scores to ascertain the relation between attitudes and computer experience and HIS use.

## Results

**Desirability of computer applications:** Figure 1 displays the mean factor loadings for the three factors that indicate the perceived desirability of various computer applications. These factors account for 52% of the total variance.

The first factor includes six computer applications related to patient care. All three groups viewed these applications as desirable. Medical students and residents considered computer applications other than patient disease registries to be more desirable than did practising physicians. There was substantial agreement among the three groups on the second factor (decision-making) and the items that make it up. Computer-assisted medical decision-making was viewed as desirable but to a lesser

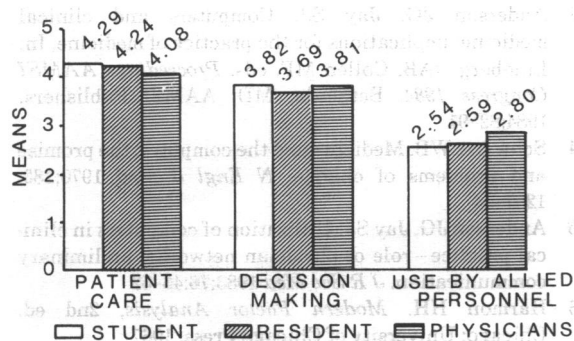


Figure 1. Perceived desirability of computer applications

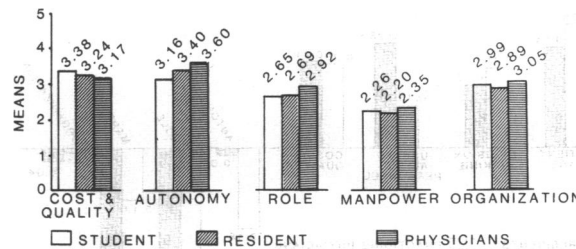


Figure 2. Perceived effects of computers on medical practice

degree than patient care applications. The three groups differed significantly on only one item. Residents were more neutral in appraising the value of computer-generated probabilities for diagnosis.

The third factor is concerned with computer applications that substitute for or permit allied health personnel to substitute for the physician in certain instances. Generally, all three groups viewed these computer applications as undesirable, especially the use of computers by allied health personnel to perform some of the physician's current functions. The only significant differences that existed between the groups involved the use of computers for continuing medical education and history-taking. Practising physicians saw more value in these applications than did students and residents.

**Perceived effects of computers on medical practice:** Figure 2 contains mean factor loadings for the five factors that reflect perceptions of the impact of the computer on medical practice. Five factors were extracted that account for 53% of the total variance.

Factor I includes a number of statements that concern the effects of computers on the cost and quality of medicine. Statements that load on Factor II reflect concern about potential loss of control by physicians; while those statements that load on Factor III suggest that computers may adversely affect the physician's traditional role. Factor IV contains statements that suggest that computers may reduce the need for medical manpower. Finally, items that load on Factor V deal with the potential effect of computers on the organization of health care.

In general, the three groups perceived the use of computers in medicine as having the potential to reduce costs and improve the quality of health care—medical students and residents more so than practising physicians. At the same time, they indicated that computers may increase governmental and hospital control of their practices, may threaten privacy, and may result in legal and ethical problems. These concerns were most paramount among practising physicians, least among medical students.

Overall the three groups were uncertain as to the potential effects of computers on their traditional professional role and on the organization of practice. Again practising physicians expressed more concern about these potential effects of computers than did students and residents. Generally, all three groups did not view computers as resulting in a reduction in the need for medical manpower. Again, however, practising physicians were more concerned than students and residents that the computer might reduce the need for their services.

**Relation between physician attitudes and computer experience:** The factor scores that measure physicians' attitudes toward medical computer appli-

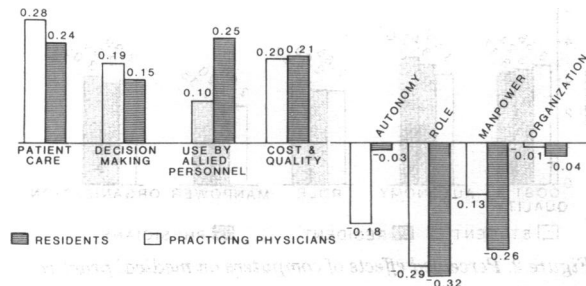


Figure 3. Zero-order correlations between physician attitudes and their use of the HIS: residents and practising physicians

cations and their potential effects on medical practice were correlated with an index of the physician's experience with computers. Generally, the correlations were low, accounting for less than 6% of the variance. Among practising physicians, prior experience appeared to result in a slight decrease in concern about the potential negative effects of computers on their autonomy and traditional role. On the whole, however, prior computer experience had less of an effect on physicians' attitudes toward medical computing applications than had been thought.

**Relation between physician attitudes and HIS use:** At the same time, attitudes were significantly related to the degree to which residents and practising physicians used the HIS in treating hospitalized patients (Figure 3). All but one of the attitude measures were significantly correlated with the index of HIS use. In general, physicians who viewed the application of computers to medicine as desirable, utilized the hospital information system to a greater extent in their practices. This was especially true of physicians who recognized the advantages of the computer in managing patient care.

Moreover, physicians who used the computer-based HIS were more convinced of the potential of computers to reduce costs and improve the quality of care. These same physicians were less concerned about the potential negative effects of computers on the physician's traditional role and autonomy.

### Discussion

Students, residents, and physicians who participated in this study are clearly aware of the importance of computer applications in medicine. In general, they support those applications that enhance their ability to manage medical information and patient care. They tend to view computer applications that affect their role as medical decision-makers with ambivalence and to be opposed to their use by allied health personnel for decision-making. At the same time, they are uncertain as to how computers are likely to influence their traditional professional roles and the organization of health care. While they view computers as having the potential to reduce the cost and improve the quality of care, they express concern about their potential loss of autonomy and privacy.

Contrary to popular belief, these concerns that physicians have regarding medical computer applications are not attenuated by prior exposure to computers. Physicians who own and use microcomputers and who have been exposed to computer science courses and seminars expressed the same reserva-

tions as their colleagues with little or no prior experience with computers.

An important finding of this study is that physician attitudes are significantly correlated with the degree to which they use a computer-based hospital information system in providing patient care. This may be an important reason for the slow introduction of clinical computing systems. A major implication of this finding is that the successful implementation of computer systems in clinical medicine requires the direct involvement of users in the design, modification, and implementation of these systems. Physician involvement will ensure minimal changes to current clinical practices. Physician acceptance can be greatly facilitated if physicians feel they have a stake in the systems, a point made by Young<sup>5</sup>. Moreover, failure to consider the concerns of physicians may render otherwise well designed systems unacceptable.

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