What makes doctors use computers?: discussion paper[1]

D W Young FRCP MFCM
St Chad's and Dudley Road Hospitals, Birmingham

Introduction

'What is the cause of this state of under achievement [implementation of clinical computing systems] when the need is so great and the technology so powerful?' asked Barnett & Greenes in 1969. This question has continued to be asked. Of 32 systems in clinical medicine surveyed in 1977, half had been abandoned or temporarily stopped and only 19% were used routinely (Friedman & Gustafson 1977). Enormous numbers of diagnostic systems have been developed (Wardle & Wardle 1978), yet the dissemination of any single system is limited.

Resistance to innovation cannot explain the limited spread of clinical computing systems. New drugs are introduced almost monthly, diagnostic methods are refined, and the fashion of medical practice changes ceaselessly. This background of almost continuous innovation highlights the slow introduction of computer-based information systems. The contrast is even more startling when medical audit has shown marked deficiencies in medical practice, and it is recognized that computer-based methods could, at least in some cases, help to correct these deficiencies. Furthermore, attitude surveys of medical staff have shown an almost universal enthusiasm for the use of computers (Melhorn *et al.* 1979, Singer *et al.* 1983, Teach & Shortliffe 1981).

This combination of a receptive attitude to new technologies and an enthusiasm for computer methods makes the patchy introduction of clinical computer systems even more unexpected. It can only be explained by very deep-seated reasons. The limited spread of computing systems must reflect the medical profession's valuations of these systems (Lincoln 1983).

Some reasons for the failures of computing systems

Initial reasons advanced for the failure of clinical computing systems fell into three categories – technical problems with the computer, poor management of computer projects, and inadequate systems (Bush 1979, Collen *et al.* 1976, Giebink & Hirst 1975). All these features are correctable. In the development of computing systems of all types over the past 30 years, these problems have appeared in areas outside medicine. They have been tackled with vigour and no longer pose serious difficulties.

There is increasing recognition of the vital and supreme role of the users in the acceptance of computer systems. The nature of the doctor's work, his attitudes, interests and enthusiams are increasingly recognized as important constraints. Though this fact was highlighted by Barnett & Greenes (1969), in recent years it has become apparent that it is the major reason for the non-acceptance of computer systems (Bush 1981, Lindberg 1979, Mishelevich *et al.* 1980).

Doctors as a group are independently-minded with often idiosyncratic views, expecting to act independently of direction and most resistant to external forces of change (Fischer *et al.* 1980). These qualities do not make a standard approach easy.

Fear of job security, reduction in status, or a change in patients' attitudes towards doctors are not features which cause problems (Teach & Shortliffe 1981). The problems are much

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deeper than these and relate to the actual way the doctor thinks and organizes his thought processes, plus the interaction of these processes with his written aids. His use of the medical records is not properly appreciated. The written record is not just a repository of information; it often forms part of the doctor's thought process, so that the style of writing, the position on the paper of particular items, abbreviations, the sequence of information, use of margins, may all have an important significance for the individual practitioner – a significance which goes beyond the actual facts recorded, and which is impossible to capture in an orderly typed report or video display unit. It is the loss of these individual aspects of the medical record which causes most problems. The advantages of structured, typewritten reports commonly do not outweigh the loss of the extra information which is conveyed to the individual practitioner by the above features.

These difficulties are outlined in several reports. A review of hospital information systems in 23 hospitals revealed that only 20% of physicians admitting patients actually used those systems, even though all junior staff were trained to operate them (Anderson *et al.* 1981, Jay & Anderson 1982). At another centre, after one year of operation, 42.9% of users were against their information system (Watson 1974).

User resistance may go beyond non-use, especially in situations where the user is not given an alternative. A review by Dowling (1980) revealed many cases where actual sabotage or misuse of the system had occurred. His survey concentrated on non-medical personnel, but the evaluation of the PROMIS system (Fischer *et al.* 1980) showed that some doctors went to great lengths to circumvent the workings of the system.

It is now clear that the basic issue for the implementation of information systems is user compliance. Technical sophistication and cost benefit considerations are all secondary.

Who objects to the systems?

Two studies revealed that interns are the group who most object to using computers (Fischer *et al.* 1980, Startsman & Robinson 1972). They complained that using these systems was more time-consuming than using the traditional medical records, though investigation showed that this was false. In fact, more time was spent talking to senior doctors who avoided using PROMIS, and because of this less time was spent with patients (Fischer *et al.* 1980).

Newly qualified doctors are under great pressure: they are learning to apply knowledge acquired over the previous few years; they are responsible for patients and to more senior doctors; and they are usually working in an unfamiliar environment. In these circumstances the imposition of anything which does not seem immediately to ease these problems will be poorly tolerated by them. This attitude may be modified if the senior doctor is enthusiastic about using computers.

Even though these systems do help the doctor to care for his patients in the longer term, the short-term extra effort causes user resistance. Amongst the specialties, physicians have been found to be less willing to use these systems than surgeons and obstetricians (Watson 1974). This may reflect the greater options available to physicians and hence the greater effort expended in, for example, the ordering of drugs and investigations (Watson 1974).

Anderson *et al.* (1981) found that two groups of doctors tended to use an information system more than others. First, there were the older doctors who played a role in acquiring these systems. They also tended to be more outgoing, to take on more administrative duties and to have a more open outlook on medical innovation than their peers. Younger doctors with a heavier patient load and who were more involved in training junior staff comprised the second group. Possibly they were more ambitious and scientifically orientated than their peers. The possible common link between these groups may be the individual's perception of the help these systems can give, in association with views on the likely development of medical practice.

Factors which increase acceptance

It is instructive to compare the features of technologies that are acceptable with computer systems that seem not to be. The contrast in popularity between computerized axial tomography and the majority of computing systems is well known (Bush 1979, Hanmer 1980). Consider the differences between them. Cost and benefit in their usual meanings can be dismissed. Scanners are expensive to buy and expensive to run. Their capital cost is often much greater than all but the most elaborate of computing systems. Three reasons are advanced: (1) production of information leading to an improved clinical service; (2) minimum cost to the user; and (3) almost immediate availability of information.

CAT scanners provide unique information. The value of this can be seen immediately by the requester. Isotope brain scans will show solid lesions above a certain size, but will not reveal their nature. The images from CAT scanners contain more information and often allow a precise diagnosis. The provision of this type of information allows the radiology department to offer a better service.

The change in work practices can be regarded as an increased cost. The information from CAT scans is produced at little personal cost to the doctor. For clinicians it is just a question of ordering another investigation and reading the report when it appears. Radiologists have a considerable amount to learn before scanner pictures can be interpreted. However, this knowledge is an extension of existing knowledge rather than entry into an entirely new field, thus minimizing the difficulty in acquiring this new knowledge.

Different types of information have different natural time-scales which affect their usefulness. Diagnostic and monitoring information should be available as soon as possible, whilst a few weeks or months are satisfactory for audit or resources control. Information not produced within the appropriate time-scale is useless. CAT scans produce diagnostic information within a short space of time and contribute directly to the ongoing care of patients.

Improved clinical service occurs in other often-used computer systems: radiotherapy dosage, laboratory systems, vaccination and immunization call and recall, cervical cytology call and recall, are examples of much used and successful computer applications (Blackburn 1981). Many others also improve the doctor's performance but are not so frequently used, for example, drug prescribing, diagnostic, medical audit, medical history-taking. The difference between the successful and unsuccessful groups is twofold. The first group all support the doctor's role, they do not in any way replace it. They help him to practise more effectively by performing essential tasks more accurately. In no way do they interfere with his normal mode of working, or impose new burdens upon him. The second group either alter his normal way of working and so increase his perceived workload, or affect directly his decision-making function by replacing part of that function.

Drug prescribing systems which automatically check prescriptions for unambiguous spelling of the drug, correct dosage, correct route of administration, possible interactions with other drugs or other conditions the patient may have are certainly supportive to doctors and at face value seem highly desirable. However, their limited spread suggests they violate one or more of the factors given for an acceptable computer system. The most likely reason is the increased personal cost in using these systems. A terminal has to be found, a series of instructions followed to write the prescription which may be initially rejected because it is incorrect. At least a 10% error rate is recognized for prescriptions. In manual systems these are corrected by the pharmacy after a telephone call to the doctor. In a computer system the doctor makes his own corrections.

Though diagnostic systems of all types function better than the average practitioner, their use is still very limited. If performance is enhanced, the likely reason is that these systems replace rather than support the doctor. They also usually work by methods that are alien and not understood by him.

Two surveys showed that activities supportive of the doctor are more popular than diagnostic systems, systems which offer specific advice, or systems which duplicate the doctor's role as a decision maker. There was a clear preference for literature searches, the

provision of information about specific problems and the availability of data on actual patients for medical audit and analysis (Singer *et al.* 1983, Teach & Shortliffe 1981, Keer 1983).

Systems which enhance the status of the operators are more acceptable. Status is associated with the visible deployment of a skill, and a contribution to fundamental decisions. The PROMIS system was most popular amongst nurses and pharmacists whose influence on patient care increased (Fischer *et al.* 1980). Status is an external judgment; job satisfaction is the personal interpretation of the factor which affects status. If status increases, so too will job satisfaction.

Doctors, in general, are unlikely to have their status increased by computer systems. Indeed, because the skill of other groups increases, the relative status of doctors may actually seem to decrease. Particular groups of doctors may have increased status: radiologists can give a more relevant service with CAT scanners, emergency care groups are helped by monitoring systems (Sheppard & Kouchoukos 1976), or information systems (Siegel *et al.* 1980). Their increased effectiveness is translated into greater esteem and enhanced status. Patient administration systems are popular with clerical officers because of increased job satisfaction, and the use of high technology improves their status. They are not so popular with doctors who feel they are performing clerical duties and servicing administrative systems (Singer *et al.* 1983).

Acceptance can be facilitated if those involved feel they have a stake in the systems. User involvement in the design, modification and implementation is most important. Systems that are imposed from above function inefficiently (Jackson 1980), and there is evidence of sabotage of imposed systems (Dowling 1980). Participation by those affected by these systems is vital for their successful implementation.

Conclusion

Clear reasons for the slow introduction of clinical computing systems relate to the personality and psychology of the users. This problem, though little investigated, is increasingly recognized. Perhaps the combination of a better clinical service, supportive of the doctor's role, at minimum cost and with timely data, is an association of characteristics worth exploring.

The role of the medical record in patient care is not fully recognized. It plays a more active and intimate role in a doctor's thought processes than as a repository of information. Unless there are marked and immediate advantages in using computer outputs as the basis of the medical record, doctors will be resistant to them.

There should be minimal change in personal commitment associated with the introduction of computer systems. The greater the change, the less likely the system will be accepted. The ideal system is one in which procedures are unchanged, requiring no alteration in the recording of information, with presentation occurring in a logical, readable format, and providing instantly available data plus extra information to aid interpretation or make more effective decisions.

Workable systems may not satisfy all these criteria, but if the perceived burden exceeds the perceived benefit it is unlikely they will spread beyond their originators.

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