PHYSICIAN'S COMMUNICATION SYSTEMS: COPING WITH INFORMATION OVERLOAD

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ABSTRACT

This paper reviews research on physicians' information overload, integrating it with an overview of the different communication systems within which physicians acquire information: libraries, mass media, interpersonal networks and computer systems, examining their advantages and problems. It discusses some of the solutions to information problems in three general areas: changes in the professional media, new forms of information packaging through the help of information specialists, and innovations in microcomputers.

Des systèmes de communication pour médecins:
Venir à bout des surcharges d'information.

Cette communication se veut une révision des recherches sur la surcharge d'information chez les médecins, en plus d'être une revue des différents systèmes de communication par lesquels les médecins acquièrent l'information: bibliothèques, media de masses, réseaux interpersonnels et systèmes d'ordinateurs, examinant leurs différents avantages et problèmes. Certaines solutions sont discutées pour les problèmes d'information dans trois secteurs généraux: des changements dans les médias professionnels, des formes nouvelles «d'emballage» de l'information avec l'aide de spécialistes de l'information et des innovations dans les micro-ordinateurs.

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INTRODUCTION

Information overload is recognized as a generalized problem, but it is pronounced among scientists, physicians and others who must deal with a continuously growing and changing volume of facts. It is a very real phenomenon which is increasingly having an effect on the medical profession, specifically on programs and initiatives in continuing education. It is further complicated by a process of contamination, identified by Goldfinger (1982), in which competing suppliers of information attempt to provide the same educational message in different ways.

This article reviews the current literature on medical communication systems and information overload, identifying how physicians use the various systems, and how they cope with the stresses induced by overload. It suggests further approaches to solving the problem.

While there is no debate over the existence of information overload, there is not yet a generally accepted definition of the problem. It has variously been defined as: too much information in a qualitative and/or quantitative sense; a problem in the quality, complexity or novelty of information; or, more generally, as sensory overload. (O'Reilly 1980, Milgram 1970, Miller 1960, Lipowski 1974)

Albeit not clearly defined, the problem is rooted in the sheer volume of information available. In 1957, there were 3,879 serial titles and 218,734 articles published in medicine. At that time, it was estimated that, in order to keep abreast of the U.S. medical literature alone, a physician would have to read over 148 journals a day, seven days a week. (Harris 1966) Today, the problem is even more pronounced, with approximately 4,200 medical serial titles in print and over 30,000 biomedical and health-related journals. The problem is overwhelming within specialties; for example, the Journal of Immunology in 1982 published 985 papers in 5,703 large format pages. (J of Im Indexes 1982)

The overload that exists in printed communications is compounded by the continual provision of medical information to physicians in a variety of other media--radio, television, and direct exchange between doctors.

PHYSICIANS' USE OF COMMUNICATIONS SYSTEMS

Medical Libraries

The health sciences library is the centre of management systems and services for biomedical, state-of-the-art information. It is a far cry from the dusty storehouses of the 60's. In the past 20 years, there has been a quiet revolution in medical libraries--through the development of data-management systems involving knowledgeable staff, increased collections, and sophisticated data-retrieval systems such as MEDLARS.

Furthermore, the world's knowledge base is shifting inevitably from paper to electronic media at nearly a four percent

compound rate annually (Matheson 1982), and biomedical knowledge is no exception. Therefore, much important, dynamically changing information is likely to be available only through data-processing systems. The academic medical library, with its resources for searching multiple biomedical data bases, can now provide invaluable resources that are available in libraries as a result of these innovations.

In 1972, a study of the patterns of self-education of 390 physicians, interns, and residents in Toronto revealed that less than one-half of them knew how to use Index Medicus, and one-quarter had never heard of Excerpta Medica. (Woodsworth 1972) Another survey reported in 1972 that, when 622 physicians were asked about their use of medical information sources, only 9.1 percent reported turning to the library for help. (Cameron 1973)

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Physicians describe print as the most important formal source of medical information (Bryans 1981, Curry 1981, Vollan 1955) despite evidence that many devote little time to reading medical literature. Kotre (1971), for example, reported that Michigan physicians spend an average of three hours or five percent of their working week reading the medical literature; Van Dellen (1961) found that the "average physician" reads for approximately 45 minutes a day. Nevertheless, survey results indicate that journals remain the most important medium of communication between physicians. In one study, 79 percent of physicians contacted in Ontario rated journals as important or very important (Cameron 1973); a recent survey of Ontario physicians (Bryans 1981) concluded that 99 percent had access to journals and read them 2.5 to 3 hours a week.

The breadth of physicians' reading has also been assessed. A study of physicians in a Health Maintenance Organization in the upper midwestern United States (Christensen 1979) showed that each routinely read a median of four journals, and that 30 percent read five or more. Collins and Coffey (1981) found that 75 percent of physicians surveyed in Alabama read one to five journals a week (sic), and 21 percent read six or more. Kotre (1971) reported that, in a Michigan survey, physicians typically subscribed to three or four medical journals.

In evaluating the depth of reading by physicians, Kotre (1971) found that 53 percent of the doctors he studied in Michigan read selected articles completely, 33 percent skimmed through journals, six percent read only abstracts or summaries, and none read journals cover-to-cover. In a study of physicians in six American states, Caplow (1952) found that eight percent read periodicals cover-to-cover, six percent scanned them systematically and read advertisements in detail, 46 percent skimmed in an unplanned manner, and seven percent reported that they did not read journals at all. Clearly, the use of print for learning is variable.

Mass Media

Mass media are open systems of communication that are directed to heterogeneous audiences, in contrast to the specialized focus of trade or professional journals. Between these two extremes are the

special interest television and cablecast programs that are directed to physicians, but also attract an interested, non-professional audience.

There has been continual controversy about the desirability of transmitting technical, medical information through the mass media; indeed, many physicians generally fear and disdain the lay media (Altman 1975). The reasons for this are that mass media presentations may prompt patients to seek treatment that the physician is not prepared to offer (Brander 1975), these presentations may also portray physicians improperly as risk-takers (Gerbner 1981), and they are frequently incomplete, superficial, misleading, sensational, or lacking in critical judgment (O'Keefe 1970). In addition, mass media can serve as "a professionally uncensored route through which scientists and clinicians wishing to bypass peer review may bring their message directly to the public." (Brady 1975) Nevertheless, many mass media reports are well-researched and based on facts derived from medical journals and respected experts (Crawford 1982).

However controversial, the mass media do provide a quick and continuing form of medical education to both physicians and the general public. Interviews with 150 general practitioners and specialists (Gutman 1977) revealed that 93 percent were frequently exposed to some mass media source. Seventy-two percent watched television news; 48 percent frequently read health-related articles in newspapers; approximately 25 percent learned about health-related shows with other physicians. In 1967, Shaw and Van Nevel (1967) surveyed full-time members of faculty at the University of Wisconsin Medical School and found that 60 percent of the respondents reported learning new information in their own specialties from the mass media; 92 percent of the information came from print media such as newspapers and magazines; only two percent came from radio or television. The authors speculated that "it may be that medical science stories in magazines and newspapers serve(d) as a kind of 'index' to new developments for the busy specialist, alerting him to areas where he might direct his more detailed journal reading."

O'Keefe (1970) extended Shaw and Van Nevel's work, increasing the number of variables and using a broader sample of physicians in medical schools in North Carolina. He reported that 89 percent learned about medical developments from the mass media--some as frequently as once a week. While 73 percent of the respondents believed information from all the mass media to be "fairly reliable" or "very reliable," they still rated newspapers and magazines to be the most useful sources of information provided by the mass media. In a survey reported in 1977 (Gutman), 53 percent of the physicians canvassed in Michigan rated mass media sources as "useful," and 76 percent said that they did not believe it was unprofessional to use the mass media as a source of medical information. Indeed, 52 percent of the respondents thought that the mass media were "credible source(s) of information," and 21 percent reported that items from the mass media could influence their attitudes about health. Finally, almost one-quarter of the respondents wished that the mass media would

present more health information that was applicable to their practices. Thus, research has shown that the mass media can be an important source of new medical information for the physician, but the nature and the extent of the impact of the media on the practice of medicine remain unclear.

Interpersonal Communication Systems

One of the most powerful medical communication systems--the interpersonal systems that exist alongside such formal channels as journals and conferences (Waksman 1980, Menzel 1955, Coleman 1966, Katz 1963, Brandjes 1976, Ryan 1977, Weinberg 1981)--have been analysed by researchers in the social sciences. The term "invisible colleges" has been applied to collegial and friendship networks that function over great distances (Crane 1972, Lancaster 1978). Members of the networks communicate via telephone, correspondence and professional meetings, and exchange preprints, reprints and drafts of proposals. In doing so, they function as quick efficient providers of knowledge, and as opinion leaders. Regardless of the distances involved, opinion leaders typically function as interpersonal communication systems linking formal information systems with the users of information. Sociological studies indicate that the opinion leader has high status because of his contributions to the medical community and his access to information (Coleman 1966). Opinion leaders (Rogers 1971) also tend to have more education, are more cosmopolitan, and have greater contact with "change agents," such as pharmaceutical representatives, who supply new information. This simple, two-step flow of information becomes multi-step when a variable number of relays exist in the communication line from source to audience. In studying this process, Menzel and Katz (1955) found that some individuals received messages directly from media sources, and others were several times removed--the specific pattern being dependent upon interpersonal relationships, availability of the media, the type of message, and its salience.

Influenced by the multi-step model, Rogers and Shoemaker (1971) have described characteristics that distinguish interpersonal communication from communication by mass media. Although both are sources of information, mass media primarily provide knowledge, while interpersonal contacts are more powerful in influencing attitudes.

Although research has revealed that interpersonal communication networks satisfy multiple information needs for the physician and have the advantage of being quick, as a system of accurate medical information, they have severe limitations as Green (1978) has pointed out, " . . . communication with one's colleagues may transmit accurate new knowledge but in the process may also involve transmission of a great deal of false information. Indeed, the latter would seem to be substantially more frequently the case than the former."

The New Media: Telecommunications and Computers

The term telecommunications, in this context, means the

exchange of information between health-care workers using electronic media over a distance (House 1981). This system of transferring information has advanced rapidly from the early experimental use of audio-only shortwave channels (Woolsey 1958), through telephone (House et al. 1981) and radio-conferencing (Woolsey 1958) to single-frame and continuous, live, interactive televisions (Fisch 1972) linked by cable and/or satellite to many centres. There have been several studies of the effectiveness of these new types of communication.

In a 1958 study (Woolsey), 95 percent of the U.S. physicians surveyed rated the use of two-way, closed-channel radio, an early form of teleconferencing as good to excellent for continuing medical education. The researchers attribute part of the program's success to the state of anonymity given to the physicians who wished to ask questions of the moderator, but the absence of visual material reduced the participants' concentration. Since then, telephone conferences linking physicians in Newfoundland hospitals have been supplemented by precirculated visual material (House et al. 1981). This audio-visual format is interesting, speedy, economical, and convenient. Live, interactive, televised transmissions have also been used successfully to link hospitals in southern Ontario to remote locations (House 1981, Corey 1979, Carey and Russell, Carey et al. 1979, Conrath 1977, Dunn 1980, House 1977, Roberts 1977, Sophianopoulos, 1976).

In Hamilton, Ontario, a two-year experiment in interactive television included a presentation, a discussion between guest and host, plus a phone-in, question period. Eighty percent of the surveyed members of The Hamilton Academy of Medicine viewed these broadcasts at least once (Smith 1970), and 23 percent watched regularly during the first season. During the second season, 43 percent watched. Eighty-six percent rated the experience as good to excellent.

Computers have made it easier to organize and gain access to data for many reasons. Computers can perform simultaneous bibliographic searches quickly and cheaply (Graham 1981, Ledley 1966, Haas 1982), and information specialists can use them to provide the medical specialist with timely, comprehensive, tailormade information (Stableford 1982, Hillman 1969). Denfield suggests that, with the computer to assist him, the physician would have more time to devote to social and human values in his practice (Denfield 1977). Albeit a powerful tool, physicians have been reluctant to use the computer; they apparently fear a loss of professional status and lack faith in the technology (Schwartz 1970). However, those who have used computers, have evaluated them positively (Morrell 1977).

THE RESPONSE TO INFORMATION OVERLOAD

Over the years, physicians and scientists have developed a variety of defense mechanisms against the effects of information overload, ranging from filtering mechanisms to complete withdrawal (Brody 1975). A good example of a filtering mechanism is the referee system which selects information to

be published, consequently reduced information flow and, presumably, enhances the quality of what ultimately appears in print (Brody 1975). Reviews, however, slow the process of information transfer and, it is well known, often have delayed the publication of key discoveries. Paradoxically, the journals, which now contribute to information overload, were developed in the 19th century in an attempt to overcome it. As Lancaster and Smith (1979) have noted:

> . . . the original purpose of journals was not to publish new scientific papers so much as to monitor and digest the learned publications and letters that were too much for one individual to cope with in daily reading and correspondence. In turn, when the number of journals grew too large for one person to monitor, the abstract journal emerged in professional societies.

Far from reducing the problem, the emergence of the abstract journal has actually contributed to it. For example, Chemical Abstracts published its first million abstracts over a period of 32 years; by the 1970's, it published a million abstracts in little more than three years (Lancaster 1961). In many cases, according to Waksman, "the real articles are now the abstracts." Recently, "letters journals" have appeared in an effort to speed the dissemination of early research results (Lancaster 1979).

Another attempt to deal with the problem has been the accelerated development of interpersonal networks of communication; in fact, the increasing mass of published material has led to a shift toward small, elite meetings and personal contacts (Waksman 1980). Physicians have often ranked highly either colleagues or pharmaceutical representatives as the original sources of new drug information (Coleman 1966, Stross 1979, Ferber 1958, Caplow 1954, Dresden 1959), and physicians rank pharmaceutical representatives first and other physicians second as sources that influence attitudes towards the prescribing of drugs (Coleman 1966, Ferber 1958, Gaffin 1956). The high rating of pharmaceutical representatives is surprising and may be because many physicians believe that pharmaceutical representatives are reliable sources of information inasmuch as they typically have some scientific background and knowledge of physiology, pharmacology, and the current literature (Dresden 1959).

Discussion

Today's physician not only feels the effects of information overload, but also stands at the juncture of two kinds of communication systems; the old one--a complex of print-based journals, the interpersonal systems, and the mass media--and a new complex of personal computers and data-base systems that potentially increase access to more journals and other sources of information. However, these new resources, like all previous innovations in disseminating scientific information, may increase the sense of information overload; but, generally, one can be optimistic because partial answers have been suggested in the literature. These include: increased use of the professional and mass media, the medical library, the use of local

information specialists, and the computer.

1. The Media. An evolving fusion of the functions of the different media channels will possibly provide an answer to both underutilization and overload of information. For example, the problem of underutilization might be reduced by the addition of the general information from the mass media to the professional medical media. In fact, a recent editorial, commenting on the relatively small amount of time physicians spend reading professional journals, suggested that reading time could be increased by including non-medical articles, thus creating "crossover" readership (Wood 1982). In this way, the medical journals might compete more successfully with the mass media for the physician's time, while the mass media might serve as an index to refer the physician to more detailed sources. Certainly, the physicians' positive reactions in the television experiment in Hamilton (Smith 1970) suggests a potentially successful fusion of medical sources and mass media.

2. New Forms of Information Packaging. Information overload creates the necessity for innovative ways of "packaging" information because, as has been pointed out, "Information needs have not been adequately identified or met by the traditional institutionalized librarian" and that information specialists must "reach out" and become "visible" to professionals in need. Information packaging means providing information geared to the specific needs of varied professionals; it is an active, rather than a passive approach, one that seeks to make information acquisition more conveniently available than it has been. This approach may involve creating roles outside of library and medical institutions that interface with them and with the practicing physician.

An example of this kind of involvement was demonstrated in research comparing two groups of cell biologists, one of which--the experimental group--was provided with information specialist service. At the end of ten months, there was a considerable difference, with the experimental group spending less time reading the literature, skimming articles, or talking with colleagues, but more time reading in depth, and reading more outside of their core area. The service also saved them time and identified relevant material that would not have been found otherwise (Neway 1982). Similarly, research at the Cook County Hospital in Chicago in which an information specialist made possible greater exposure of clinicians to current medical articles, patient care was improved by speed and access to the literature, and physicians learned to work independently in the library (Roach 1975).

The reference service of the Canadian College of Family Physicians, in the Sciences Library of The University of Western Ontario, is another example of a relatively recent attempt to package information. This library service is a convenient, computerized, easily accessible (by a simple phone call) system to supply up-to-date literature reviews, bibliographies, abstracts, and photocopies of new articles. However, only three percent of the 6,500 members of the Canadian College of Family

Physicians use it. Even so, the service is currently overloaded and can barely meet the demand. Thus, we are led to suggest a second kind of custom "packaging" that can be initiated by the physicians and small groups locally, by engaging a competent, free-lance librarian or information specialist to monitor the most sophisticated general and relatively specialized media, to flag articles of interest, and to provide regular, up-to-date bibliographies, reprints and selected condensations. Furthermore, the service could be "future-oriented," providing an index of future professional events, lectures, and meetings in specified topics.

3. The New Microcomputer Systems. Reports of brisk sales of microcomputers to physicians indicate that, potentially, they are increasing their ability to search general and special data-bases to secure up-to-date information rapidly. These systems are "user-friendly" and easy to operate, thereby enabling the practitioner to adapt sophisticated retrieval systems to his own needs--providing his own key words (e.g. diseases and medications) to call back notes or additional references instantly. Furthermore, these small systems can be linked to very large data-bases, such as those in health sciences and national libraries, for rapid access to extensive information. Recent findings of a national study of practising and academic physicians indicated that 42 percent believed a computerized data-base would result in a significant improvement in their access to medical information, compared with six percent who believed there would be no improvement (Singer 1983).

Eugene Garfield of the Institute for Scientific Information has described the new two-fold data retrieval system available now for such microcomputers as Apple (Garfield 1983). The system, called Sci-Mate, using automatic telephone modems, makes it possible for the busy practitioner automatically to almost create his own constantly up-to-date data-base by logging into giant data-bases such as Science Citation Index and Medlars. He could then key the material to his own research, or even to specific patient-care management.

This has some parallels with Lawrence Weed's "Problem-Knowledge Coupler," a computer program that, based on facts obtained from the unique patient, mobilizes information from the literature on a given problem, and then presents it to the physician and patient for further "coupling" with the patient's history and symptoms (Weed 1980). Weed has argued that such a system is necessary for optimal diagnosis because " . . . a single human mind cannot grapple successfully with all the complexities involved in defining and solving medical problems in the total context of an individual patient's life any more than single-celled organisms can do what a sophisticated multicellular organism can do."

Still another development extends and modernizes the influential if criticized interpersonal networks, and sharpens the advice and information provided by providing a printed record of it. The recently developed electronic conferencing techniques, such as Participate, available on a microcomputer data-base network called The Source, make possible a new kind

of continuing medical education that occupies a niche between the concept of interpersonal communication networks and the new electronic journals--"a network of computers being used by people with common interests to exchange, evaluate and store information (Franklin 1982), mixing comments with actual journal papers, articles, and news items. A parallel example has been presented in a report by the Association of American Medical Colleges, in which the physician uses a "filtered" system--his office computer to contact a librarian for information, either urgent and specific to a case, or for general research, requesting simultaneous transmission to his colleagues with whom he may then consult in short order (Matheson and Cooper 1982).

Perhaps the ideal long-range solution for dealing with information overload would be the one proposed by Matheson and Cooper (Matheson 1982). This would involve the establishment of complex, highly-organized health sciences centres on university campuses. These centres, with the health sciences libraries at the core, would utilize the full range of technological and personnel resources at every level. They would be linked into a comprehensive medical resources network by a national agency, working in conjunction with other public and private organizations. The implementation of such a broad multi-levelled concept would surely go a long way toward dealing with the problem of burgeoning information. However, the ideas we have suggested here could be initiated at the individual, local and institutional levels rather quickly. The solutions we propose are different--ranging from new ways of using media, to the employment of information specialists and computers--but they share with the more comprehensive plan of Matheson and Cooper, the objective of helping the physician to cope with information overload by giving him a much greater sense of control and the ability to manage information in a selective, individual way.

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