The Impact of the Internet on 
Healthcare in Singapore

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Abstract

Advances in several key communication and information technologies are worth tracking for their impact on interactive health communication and ability to meet customers' demands. Some of these technologies include wireless technology, integrated computer telephony, improved audio-visual conferencing, speech recognition, digital TV, collaborative tools, network bandwidth, and imaging technology. These technologies enhance physician-patient communication as well as facilitate access to Web-based information and health-related transactions online. This paper highlights the current status of interactive health communication and its impact on Singapore healthcare.

Introduction

The Internet is a network of networks, linking islands of networks across organizational and geographical boundaries. Riding on this superhighway are many applications allowing information to be shared with people who have access to the Internet. The healthcare industry has been characterized as a high-technology, high-touch industry. At the heart of the healthcare process is the physician-patient relationship; it is an almost sacred relationship and is sometimes seen as the most intimate form of relationship between two unrelated persons (Christiansen, 1999). The physician knows all about the patient's body and state of health,
more so than the patient in most instances. This knowledge is the basis upon which the physician manages the patient's medical condition and helps him or her recover from illness. The physician-patient relationship, however, is an unequal one, with the balance tilted in favor of the physician, owing to the knowledge and skills the physician possesses, which have seemed unattainable to the common person.

Medical practice was simply an art when all the physician could offer was some pills, counseling and tender loving care. Today, there are many pressure points: more business-like approaches such as managed care require constant attention to bottom lines, consumerism rides high, bolstered partly by widespread availability of information through the Net, and rapid advancements in medicine outstrip the physician's ability to keep up with the latest protocols.

The gap widens between the crucial need for transmitting more information and the relatively few and often brief face-to-face opportunities for communication between physicians and patients. The quality of these personal encounters is further diminished by the need for physicians to address administrative issues, such as referrals, insurance approvals and rejected claims, during precious contact time. Inadequate communication and lack of information, now more the rule than the exception, lead to increased stress, diminished satisfaction, decreased adherence to therapeutic regimens and elevated risk for malpractice claims. (Mandl, Kohane, & Brandt, 1998).

**Technical and Social Challenges**

Health information obtained from the Internet is frequently inaccurate. Brody (1999) asserts that much of the information and advice consumers glean from the computer screen is biased, incorrect and, in some cases, dangerous. Typical Internet users do not have the expertise to assess the quality of information presented on the Web. David Satcher, Surgeon General of the United States, states there has been little evaluation or quality control of interactive health communication, because applications have developed faster than theory and assessment
tools. (Eng & Gustafson, 1999).

In the world of peer-reviewed journals, this situation is less likely to occur, because articles are thoroughly scrutinized by experts in the field before publication, and an institutional imprimatur is accorded through the process as well as by the "brand" or journal name. But the old saying, "A drowning man will clutch at straws," is highly applicable to a person in poor health, who may turn to any source which offers hope. Healthcare providers are nervous that information may be used inappropriately, leading to poor outcomes.

Confidentiality has been another area of concern for healthcare organizations. There are several issues: unauthorised disclosure of individually-identifiable health information as the electronic medical record moves patient information from one care provider to another; information hijack as data travels across the network; authentication of the identity of persons with access rights to patient records; illegal use of patient information; and data mining. The Computer Science and Telecommunication Board (CSTB) of the National Research Council (NRC) recommends procedures to authenticate the user's identity and to encrypt stored or communicated data to prevent unauthorized access (Schneider, 1999).

Perhaps the best-developed technology for authenticating messages is public-key cryptography. This technology requires that every participant be assigned a pair of "keys." One key is public and can be widely shared over the Internet; the other key is private. Messages encrypted with the public key can only be decrypted by the private key and vice versa. The patient can send a message to his clinician by encrypting it with the clinician's public key so that only the clinician can decrypt the message with her private key. Similarly, a clinician can prove that she is the sender of a message (that is, she can authenticate the message) by encrypting her name (or other identifier) with her private key. The patient can then decrypt the clinician's name only with the clinician's public key. For public key cryptography to be effective in the context of a
health-delivery system, research into rapid and secure methods for distributing keys must be conducted.

As we open up additional channels for physicians to communicate with their patients, we need to ensure they are not overwhelmed with e-mail from patients and their families. In addition, the issue of whether physicians ought to be paid for such services should be considered. The American Medical Informatics Association (AMIA) recently published recommendations to guide computer-based communications between clinicians and patients which should be adopted where applicable. (Kane & Sands, 1998). Issues of access from the physical, literacy, language and financial perspectives need to be addressed. The Comprehensive Health Enhancement Support System (CHESS) project in the U.S. loans computers to participants who do not have one for up to a year. (Chess, 2001). CHESS computers have also been installed in community centers, health centers, college dormitories and workplaces.

Singapore seems to have solved the physical and financial issues: public kiosks and computers in schools and libraries are some solutions to overcome the problem of lack of access. WebTV is another potential means of accessing the Internet. Language problems can be overcome by the introduction of Chinese and Tamil language applications, for instance, the HealthOne project. The maturing of speech technology is a further step as voice-activated commands and text-to-speech becomes commercially viable.

**Internet-based Healthcare**

*(eHealth)*

Technology is increasingly used for patient-physician communication requirements, including informative, affective and persuasive aspects. The Science Panel on Interactive Communication and Health defines such Interactive Health Communication (IHC) as: "...the interaction of an individual - consumer, patient, caregiver or professional - with or through an electronic device or communication technology to access or
transmit health information, or to receive or provide guidance and support in a health-related issue." (Eng & Gustafson, 1999, P1). IHC applications include health and support Web sites and other technology mediated applications that relay information, enable informed decision making, promote self-care, or manage demand for health services.

Health care providers access the Internet to stay on top of the increasing amount of medical information. There are many types of resources available on the Web, including electronic journal articles, continuing medical education, pharmaceutical information, practice guidelines and information on clinical trials.

Online support groups provide an effective and informative means of serving the communication needs of individuals. They offer a place for individuals with a specific health concern to "meet" for support, interaction and information. Online support groups can take many forms. They are normally set up by health care providers, payors, or patients and their families. The level of monitoring and control also varies. One example is CHESS, Comprehensive Health Enhancement Support System, developed at the University of Wisconsin-Madison. (CHESS, 2001).

Electronic mail has the potential to meet the affective and informative needs of patients. One of the reasons for the low level of use of this form of communication is due to reluctance on the part of physicians. Several reasons are apparent, e.g., fear of a deluge of e-mail, inappropriate e-mail, untimely interventions due to patients' inability to differentiate between urgent and non-urgent medical conditions, potential security and privacy breaches in physician-patient communication and, perhaps, even loss of revenue arising from lesser need for face-to-face consultations. An example is the electronic mail communication system of the Children's Hospital in Boston, Massachusetts (USA), HealthConnect, which is tailored to the specific concerns of the physician-patient relationship. The system is now available to patients who were treated in the emergency department. (Children's Hospital of Boston, 2001).
Health care providers have begun a slow transition to electronic medical records (EMRs). The slow diffusion is due to the prohibitive costs of EMR systems, the difficulty in linking or drawing information out of legacy systems and limited data input devices that suit physicians' needs. EMRs allow providers within a health care facility to obtain information about their patients' medical condition and test results. Linking facilities together and adding communication modules such as e-mail enable even more health care providers to communicate with each other and share information swiftly. Some regional health authorities are working on such health networks to facilitate care and communication. (Alberta) Wellnet, 2001; Electronic Child Health Network, 2001).

In Singapore, recognizing the bandwidth limitations of the public Internet infrastructure, the government's IT arm, the National Computer Board (now known as the Infocomm Development Authority of Singapore) initiated the Singapore One project. This national initiative aims to deliver a new level of interactive, multimedia applications and services to homes, businesses and schools throughout Singapore. It has two distinct but integrated levels:

- A broadband infrastructure level of high capacity networks and switches. This infrastructure, based on Asynchronous Transfer Mode (ATM) switching technology capable of speeds up to 622 Mbps, will in due course link to similar networks overseas for broadband access to the rest of the world. There are two operators - Singapore Telecom (SingTel) and Singapore Cable Vision (SCV). Singtel will use the existing telephone system with Asymmetric Digital Subscriber Line (ADSL) technology while SCV will use Hybrid Fibre Coaxial cable modems. As of this writing, 99% of Singapore homes are cable-ready. In June 1999, there were 60,000 Singapore One users. The target is to achieve 100,000 users by the end of the year and 400,000 by the end of 2001. (Singapore One, 2001).
- A suite of advanced applications and services that take advantage of the infrastructure's high speed and high capacity capabilities. As of June 1999, more than 200 companies used SingaporeOne to deliver interactive
multimedia services.

To date, local healthcare providers have not leveraged information technology to the same extent as U.S. healthcare providers. Most healthcare providers have set up their own Web sites. (Ministry of Health, Singapore, 2001a). The Ministry of Health (MOH) Web site enables online search for general practitioners nearest the patient's home (Ministry of Health, Singapore, 2001b). Singapore General Hospital has a patient education section with information on diseases it manages. (http://www.sghhealth4u.com.sg/health4u/Main/SGH_Patient_Education2.htm). An NCB industry collaborative to make interactive appointment scheduling through the Web, known as CARES, was not successful. The difficulties in simplifying current operations managed by trained staff and physicians to facilitate self-help by the patient proved to be a difficult task. In addition, the technology used to deploy the application was not scalable. Finally, the lack of general practitioners to make use of the system also led to its slow diffusion.

sHealth Online, a for-profit health resource organization, seems most advanced in its design and delivery of health services. Its services include organizing video conferencing between patient and care provider, enabling patients and physicians to access medical records on systems hosted by the company, and a professional forum. (http://www.hol.com.sg). Health education is an area in which many public and government organizations are targeting the Internet as an excellent vehicle for wider and more effective reach. One such site is healthylife.org.sg, developed by the Committee on Healthy Lifestyle, National Health Education Department (2001). The Web site promotes healthy lifestyle in Singapore through health guides and information for the public. Another site in this group is healthanswers.com.sg, a commercial Internet portal which sources its general health content from several medical Web sites (2001).
The Government is leading in engaging the entire population in its nation-wide electronic Citizen (eCitizen) program launched on Singapore One. The Center integrates information and services from various government agencies to help users handle common events in life (eCitizen, 2001). One module in eCitizen focuses on health. The nature of services available in this track is mainly administrative, such as rescheduling appointments, providing admissions information and informing hospitals of a change in address. The link to backend systems, which makes the service complete and therefore interactive, is still unavailable. However, plans are in place to put in such interactive transaction-related services before the end of 2001.

One of the services currently available through the MOH home page is a link to the Hospital's home page, and cannot be truly defined as an S-One application. The author knows of only two health-related applications on Singapore One: CyberCure, an interactive multimedia application for children produced by KK Women's & Children's Hospital (1998) and Health One, a health information resource for the public and health professionals available in English, Chinese and Tamil languages. The application is developed by a group of academicians from the National University of Singapore. (www.health1.nus.edu.sg/).

The Minister of Health, Lim Hng Khiang, recently announced the implementation of an electronic lifelong medical record using the Singapore One infrastructure. This project, when implemented, has the potential to facilitate communications between health care providers and improve the availability of a patient's medical record. Another area the Ministry of Health is emphasizing is health education. The Ministry announced on April 1, 2001 the formation of the Health Promotion Board as the arm of the Ministry to develop and implement national health education and promotion programs. The Health Promotion Board will develop and manage a Health Information Portal that will provide the public with reliable and authoritative information on health promotion and lifestyle-related diseases. The portal will also act as a gateway to reliable health Web sites and databases. The Health Information Portal became operational in April 2001 (http://www.gov.sg/moh).
Conclusion

The Singapore health industry is in a unique position to take full advantage of these technological advances. Political will is evidenced by the leadership position taken by the government in its computerization efforts: the technological infrastructure such as Singapore One, appropriate legal infrastructure, especially security and intellectual property rights (http://www.s-one.com.sg). There are compelling reasons for health organizations to identify ways they can tap the potential of Internet and the Web. In the next millenium, the health industry, like any other consumer-oriented industry, will be dealing with a different breed of buyers, highly informed and computer-savvy. They can and will translate the service qualities and standards they have received from other industries to healthcare providers.

Health organizations need to rethink the ways they conduct businesses. Technology has its most profound effect when it alters the ways in which people come together and communicate. In their enthusiasm to adopt and invest in these new forms of technology, health organizations should be mindful of the limitations of technology and have a deep understanding of the information search behaviors of their target audience. At its core, health care is still a high-touch profession. This aspect of care must never be forgotten as we press on to leverage information technology to improve patient care and services.

References


About the Authors

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