How Will the Internet Change Our Health System?

Powerful though the Internet may be, its impact on health care will continue to be tempered by privacy concerns and professional resistance.

BY JEFF GOLDSMITH

Those who make their living forecasting change in social institutions are frequently humbled by the actual flow of events. Developments that seem inevitable (such as "artificial intelligence" or the picture phone) seem to take forever to happen, while seemingly unstoppable institutions or innovations (such as physician practice management firms) suddenly collapse. Sometimes, however, innovations spring, fully blown and unheralded, seemingly from out of nowhere. The Internet is one of these.

Although health care institutions may resist the influence of network computing, eventually, the Internet is likely to accelerate the "virtualization" of health care plans and systems and help to eliminate much of the clerical burden in caregiving and insurance. The core processes in health care - interactions between physicians and patients -- are likely to be rapidly and profoundly affected. From its not-so-humble origins as an experimental, Defense Department-funded, secure data network, the Internet exploded during the late 1990s into a powerful new social institution. The adoption curve for the Internet is far steeper than that of any of the established media: Although it took radio thirty-eight years and television thirteen years to reach fifty million users, the Internet reached the same number of users in only five years. According to a 1999 Louis Harris poll, 48 percent of adult Americans-about ninety-seven million people -use the Internet to communicate with one another and to acquire information, products, and services. The Internet is only incidentally a broadcast medium. Rather, it is like a flexible and powerful new nervous system for the economy and society.

One basic misperception of the Internet is that its greatest impact will be in its consumer retail applications. Consumer use is actually only the visible tip of a much larger iceberg. The underwater part of the iceberg-business-to-business electronic commerce is five times larger than consumer-based e-commerce and is projected to grow at a far faster rate. According to Forrester Research, consumers spent an estimated $8 billion (out of roughly $2 trillion in overall consumer spending) online in 1998, an amount expected to increase more than tenfold to $108 billion by 2002. By contrast, businesses did more than $40 billion in Internet business with each other in 1998, an amount expected to reach $1.3 trillion by 2002. In this paper I examine some of the areas of the health care system that are most likely to be affected by the spreading influence of the Internet.

Ultimate Knowledge Business

Health care services not only are the prototypical knowledge business but also are perhaps the most complex product of our economy. Just as health care organizations have struggled to assimilate earlier generations of information technology (IT), they are likely to struggle to adapt to and use the Internet.

Health care providers and systems are staggering inefficiency at assimilating and processing information and at converting that information to knowledge. Part of the problem is that the core knowledge base of health care, biomedical science, is expanding at a geometric rate, driven by $40 million...
billion a year in public-and private-sector research and development (R&D) spending. Also, more variability and uncertainty at the point of service exists in health care than in any other service in our economy. Although this variability does not completely defy capture, standardization, and manipulation by information systems, the technical and organizational problems associated with this process are daunting.³

As if this variability were not complicating enough, more complex, highly trained, and difficult people (namely, health professionals) collide at the point of service than is true in any other service in our economy. Each health profession has its unique view of the patient's needs, its own language, and an intensely territorial view of its involvement in the care process. This has created a balkanized information architecture, in which each profession has its own data system that processes and records for payment the services it provides.

The present information environment in most health care institutions is dozens of functional computing systems (such as pharmacy, clinical laboratory, billing, and accounts receivable) running different programs written in different languages on different hardware. A depressingly large fraction of these processes are mediated by paper (medical records, prescriptions, telephone message slips, and bills) -- incontrovertible evidence of an early 1970s information environment.

Some health care organizations are adopting enterprise-wide information systems, with a single patient identifier, a single patient record, and a common application set. As J.D. Kleinke has noted, the growth and development of enterprise systems in health care has been deeply troubled. Vendors must shoulder part of the blame for promising solutions they cannot readily deliver; however, the difficulty health care organizations have had in shifting from functional to enterprise computing is, in major part, inherent in the complexity of the organizations themselves.

Indeed, it would be inaccurate to describe most health care organizations as enterprises. What they really are is collections of professions loosely and uncomfortably housed in the same physical structures. A coral reef is such a structure, much more a colony than a sentient being. As a consequence, systemic innovations are adopted very slowly. Passive resistance to change is compounded by a corrosive suspicion produced by the failure of past IT applications to materially improve productivity or processes of care.⁵

Clement McDonald and colleagues compared computer networks to a rain forest canopy, where arboreal creatures (physicians) can gather fruit (information on patients and clinical problems) effortlessly by moving across the canopy (data network) without having to climb each tree (separate data systems).⁶ (The image of troupes of monkeys screaming and throwing fruit at one another is almost irresistible.)

What the Internet promises health care managers and clinicians is a flexible, external information architecture that can reach down into the dozens, even hundreds, of health care information "silos" and extract, analyze, aggregate, and redirect data, which clinicians or managers need to make decisions. Beyond clinical uses, promising business-to-business Internet applications in health care include paperless transmission, verification, adjudication, and payment of medical claims; online marketing of health insurance to individuals and small businesses; paperless prescribing of, monitoring of, and payment for prescription drugs; medical product ordering and inventory management; and outsourcing of data processing and other management functions.
Barriers To Network Computing

Sadly, many of the items listed above were achievable with technologies that have existed for years. Intranets (high-speed local-area data networks inside organizations), clinical data repositories, electronic medical claims filing, and electronic patient records all predate the Internet. Yet convincing health care managers and clinicians to use them has been difficult.

Two daunting technical challenges and a major change-management challenge stand in the way of realizing the enormous potential of network computing in health care.

**Standardized coding.** The first challenge is standardizing the coding and formats for clinical information. Information systems must recognize and translate different coding schemes for clinical encounters, using a medical logic engine that recognizes different clinical terminology for the same problem. Because new terminology and knowledge are being constantly created, the medical knowledge architecture must be flexible enough to permit continual updating with professional consensus. However, getting dozens of clinical disciplines and technology vendors to agree on needed standardization of clinical coding as well as on standardization of the technical specifications of information systems, so that systems from different vendors can "inter-operate," is akin in complexity and politics to negotiating an international trade agreement.

**Protecting privacy.** The other challenge is standardizing patient identification while protecting privacy. This standardization is the essential first step in creating an enterprise health information system; it enables a hospital or group practice to consolidate a dozen or more records on the same patient into one record. Standardizing patient identification across health institutions is the vital step needed to create an Internet-based patient record. However, placing the medical record on the Internet exposes that record, already too accessible in paper form, to potential unauthorized access by employers, health plans, law enforcement agencies, private investigators, hackers, and others. In the Kassenbaum-Kennedy Health Insurance Portability and Accountability Act (HIPAA) of 1996, Congress mandated that the Department of Health and Human Services (HHS) develop a unique health identifier for each individual, employer, health plan, and provider and promulgate guidelines for protecting the confidentiality of personal medical information.

When HHS issued draft guidelines recommending the adoption of a unique patient identifier in the summer of 1998, the ensuing firestorm of public criticism took the policy community by surprise. Lack of public confidence in public and private institutions' ability to prevent health information from being disclosed to employers, the courts, and law enforcement agencies, or to protect consumers from inappropriate use by health care providers themselves, was a major theme in opposition to the unique identifier.

Janlori Goldman recently reported that 27 percent of respondents to a Louis Harris poll believed that their personal medical information had been improperly disclosed. Of this group, more than 30 percent felt that they had been adversely affected by the disclosure. Significant numbers of Americans pay for health care outside of insurance plans or simply avoid seeking care for sensitive problems to avoid creating a record of the problem.

The barriers to protecting medical privacy on the Internet are not technological, but rather political. Properly employed, heavy encryption and password-driven access can do the job. The real problem is a lack of public trust.
Physicians: The Hardest Sell

The greatest barrier to realizing network computing's full potential is the same barrier that has hampered the spread of enterprise computing: persuading physicians to use these technologies. Historically, the physician has been the principal integrator of knowledge in health care. It will take a great deal of persuading to convince skeptical, time-starved clinicians that after all the broken promises of the past two decades, network computing actually can simplify and strengthen their practices. This is somewhat of a generational issue, since for most clinicians under age thirty-five, using network computing to acquire information and to communicate is as natural as breathing.

The lack of trust is even more a problem with physicians than with consumers. All too often, information technology has been imposed on physicians "from above," by alien, imperial powers (hospitals, health systems, or health plans). Vendors and information managers frequently encounter physicians' fear that information systems will be used to profile them, gather information about their practices, and discipline them or deprive them of income. It is difficult to imagine a situation less conducive to the enthusiastic uptake of a new technology than one that consumes tremendous time and energy in its adoption, while simultaneously threatening the autonomy or livelihood of the user.

However, there are persuasive reasons for physicians to adopt network computing, including the ability to increase the ease of consultation on complex cases, to reduce wasted time and effort in connecting with colleagues and patients, and to improve patient safety. Already, enterprise IT systems have demonstrated their ability to help physicians reduce adverse drug reactions. Combining enterprise systems with Internet connectivity to physicians' offices, pharmacies, and pharmacy benefit management (PBM) firms could alert physicians to potential drug interactions and increase patients' compliance with drug therapy.

Administrative Potential

Despite the skepticism and inertia of health care managers regarding potential e-commerce applications, the Internet eventually will enable health care organizations to markedly reduce their clerical employment and improve productivity. Indeed, the maturation of enterprise computing could generate significant productivity improvements, creating the infrastructure to support network computing applications.

As administrative services are increasingly supported by computer networks, health care enterprises will increasingly outsource functions for which they can achieve economic or efficiency gains. Outsourcing in hospitals historically has been confined to hotel-type services such as housekeeping and food services. The Internet will enable outsourcing of core administrative functions such as billing and financial management, data processing, telecommunications, materials management, and human resources, as well as some clinical services such as pharmacy. There are as yet no reliable estimates on the potential productivity gains for health care enterprises from adopting network computing solutions, but my sense is that they will eventually run into the tens of billions of dollars.

Consumer Applications

Although institutional inertia and professional skepticism seem likely to slow the adoption of network computing in health care provision, consumers have aggressively embraced this new tool for acquiring health information. According to a recent Louis Harris poll, seventy million Americans used
the Internet to seek health information in 1999. Seeking health information is one of the top reasons why people log onto the Internet. In doing so, consumers are bypassing both the health care delivery and health insurance systems and seeking the information they need to frame their interaction with both systems.

The traditional relationship of a physician to a patient, relative to medical knowledge, has been steeply asymmetrical. Indeed, one can think of physician income as the rent physicians extract from their command of medical knowledge. The Internet will not eliminate this disparity in knowledge, but it will enable patients to begin their dialogue with physicians at a much higher level and provide them with leverage to influence the care process.

The growing complexity of medicine and the increasing burden of micro-accountability for clinical decision making imposed by managed care have conspired to rob physicians of the time they need to remain current in their own fields. The decay rate of scientific knowledge that physicians acquire in the basic science portion of their medical education is scarily rapid. By 1998 the number of citations in the National Library of Medicine's Medline service was estimated at 9.2 million, growing at a rate of 31,000 new citations a month.

Into this expanding knowledge vacuum charges the cyber-assisted patient. Patients have discovered that Web-based search engines and so-called health portals have given them access to the same scientific databases, clinical trials listings, new drug information, and other sources that their own physicians often do not have time to analyze carefully, along with a lot of other information of perhaps more questionable value.

The sheer volume and variability in the quality of health information on the Internet, as well as the laboriousness of acquiring it from multitudes of sources, are universally acknowledged as serious developmental problems. One wag has likened the current Internet to a "virtual Haight/Ashbury." Many physicians with whom I have interacted resent the patients who show up with articles from the Internet. Physicians often do not have time to read all of the materials patients bring them, let alone to search the Internet themselves. The idea that physicians should rely on patients to update them on developments in their own field is a stunning reversal of the traditional information flow in medicine. Yet physicians may come to discover that some of their patients are reliable bridges to emerging medical knowledge.

Promising consumer opportunities. The Haight/Ashbury stage of the Internet is nearing an end. Free but undifferentiated content will give way to filtered, structured content. Hundreds of millions of dollars in equity capital are being invested in creating medically related Internet applications, many of which target consumers directly.

The gold standard that these firms seek is for their site/search engine/portal to become the Yahoo! of health care -- that is, the first place consumers go to seek information or advice about health problems. Aggregating “eyeballs,” the odd Dali-esque e-commerce jargon for audience size, presumably creates leverage for selling advertising to firms (such as pharmaceutical and consumer products companies) that are eager to insert their commercial messages into the search process. Another important area is giving patients access to information on quality. This information is now limited to data reported to Medicare and from consumer satisfaction surveys. However, it is reasonable to expect the volume of this information to grow to include licensure and medical disciplinary files on physicians and institutions, as well as information on medical error rates. How this information is gathered, validated, and presented will be the subject of fierce controversy and
contention in the coming years.

However, the most significant consumer application of the Internet is the ability to aggregate patients with common problems into “virtual communities.”\textsuperscript{13} The Internet often is the first destination of a patient newly diagnosed with a serious, chronic health problem. The patient who types "lupus" into the search box of an Internet portal is within minutes of discovering an online community of fellow lupus sufferers, which brings a framework for collective learning about how to cope with the disease independent of one’s physician.

Colleagues who follow these activities closely believe that virtual communities of sufferers from various diseases eventually will pool their resources and hire clinical consultants to help them navigate the health system, as well as lobbyists to help them confront Congress, state legislatures, and health plans on coverage and payment issues.\textsuperscript{14} This aggregation also will have significant political consequences and will complicate the already complex politics of resource allocation for research and treatment of diseases.

Patients’ access to this emerging capability is predictably maldistributed by race, age, and income class. A recent U.S. Department of Commerce report found that although personal computers are in 80 percent of American homes with incomes over $75,000 a year, only 16 percent of homes with incomes less than $20,000 have them. The racial gap in Internet use is large and widening: Almost one-third of white homes are “wired,” compared with less than 12 percent of black households.\textsuperscript{15} Only 15 percent of the population over age fifty-five is online. This population’s online access is particularly crucial, because the elderly not only use health services heavily but are also more likely to be isolated from one another and from caregivers.

Access through schools and libraries does mitigate some of the socioeconomic barriers to Internet access, but differences in educational level will hamper persons in lower income strata in using this powerful new tool. Strengthening access to public computing sites is the most important short-term palliative measure, but it will not be enough. Technical assistance by reference librarians, teachers, counselors, and others also will be needed. Teaching young people how to use the Internet to answer health questions probably will become a staple of health education in elementary and secondary education.

\textbf{Building Bridges To Patients}

The rapid entry of new, well-capitalized actors into the traditional arena of health care has jarred both providers and insurers, which are mired, as of this writing, in serious economic difficulty. Providers see the Internet as establishing a new channel of communication with their patients, although it remains to be seen how effective that channel will be. Sadly, hospitals’ efforts to leverage the Internet have been captive to their marketing departments. Many hospitals' Web sites have a depressingly “Here We Are: Aren't We Wonderful?” quality to them.

In my informal survey, few hospitals have made provision for Internet-based scheduling, insurance verification, patient history, and other functions that could ease entry into their systems, or for enabling online updates of the condition of relatives or friends in the hospital. Hospitals that approach the Internet with an eye toward redesigning their core business processes to eliminate wasted time and paper work are probably going to be more satisfied with the results than are those that view it as a public relations device.
On the other hand, the Internet may create more options for health insurers than any other actor in the health system. As with providers, the Internet will enable insurers to eliminate many redundant clerical functions that have clogged communication with physicians and patients. The Internet can speed verification of eligibility and coverage, as well as accelerate electronic payment to providers.

However, a suite of promising consumer applications may enable health plans to alter the perception that they are adversarial to patients' interests. HealthPartners, a Minneapolis-based health plan, was one of the first to computerize its provider network information for subscribers-including location, professional qualifications, and hours of operation of provider sites-and to make it available to subscribers via touch-screen computer kiosks. When this information moved to the HealthPartners Web site (www.consumerchoice.com), the plan added consumer-satisfaction and cost information and provided (in some of its products) financial incentives for consumers to select providers in the least expensive cost tier. HealthPartners executives refer to this as a "farmer's market" strategy.

While these new insurance products have not taken the market by storm, they do provide a glimpse of how electronic commerce can help insurers to regain market leverage in a wide-open-panel, consumer-choice environment. As comparative information on quality and patient safety becomes available, health plans are the ideal purveyors of that information to their subscribers via Internet-based "maps" of the health care system. Health plans will hold providers accountable through increasingly dense and invasive comparative quality and cost information. In an open-access market, providers will gain volume not by having it directed to them by health plans through selective contracting, but by being chosen by value-conscious consumers.

Many health plans have experimented with disease management programs targeted to high-risk populations in their subscriber base (patients suffering from asthma, diabetes, congestive heart failure, and other chronic illnesses). The Internet provides a superb platform for health plans to maintain continuous, low-intensity contact with their patients via their home computers. The economics may be compelling enough for plans to give patients with these diseases their own home computers and teach them how to use them.

Another significant potential Internet application is assisting patients and families in planning how to address an emerging health threat. A number of years ago John Wennberg and his colleagues at Dartmouth developed a process called "Informed Choice" for patients newly diagnosed with a threatening medical condition (such as prostate cancer) for which multiple treatment options are available. This process encourages patients and physicians to sort out the patient's objectives in treatment.

The Informed Choice process has both markedly increased patients' satisfaction with the care process and reduced the rates of invasive treatment and cost, two compelling reasons why health plans will adopt this or similar approaches. Although the technology was initially based on interactive laser discs, it is ideally suited for the Internet.

Health plans also may discover that giving subscribers online access to medical advice may reduce the volume of primary care physician visits and help to cut wasted motion in approving payment for services by interacting directly with patients, not physicians. They may also discover that marketing their plans directly to subscribers and businesses via the Internet could help them "disintermediate" the insurance brokers and markedly lower the cost of their product. Direct-to-consumer channels and applications promise to restructure health insurance and
fundamentally alter plans' relationships with their subscribers.

**Regulatory Issues**

**Licensing.** The traditional locus of regulation of health services and insurance—in particular, licensure of health professionals, insurance brokers, and others—has been state governments. The Internet is completely oblivious to political boundaries. The fact that consumers in one state can purchase goods or services from other states over the Internet without paying local sales taxes has already raised serious long-term fiscal policy and equity issues. These issues will eventually force a rethinking of state and local tax structure.

A similar rethinking of licensure policy may ensue. Supervision of licensure is the most powerful tool governments have in ensuring that substandard practitioners do not practice medicine. How this method of supervision remains viable in the emerging networked age is a serious policy question.

**Long-distance monitoring.** Internet technology allows patients in one state to be monitored, evaluated, and prescribed for in another. Major regional referral centers will develop aggressive telemedicine initiatives employing the Internet, eventually threatening the economic franchises of physicians and health systems in local communities. It is not unreasonable to expect a collision in state legislatures between protectionist local practitioners and health care organizations that intend to “practice” across regions. A similar struggle can be expected between politically powerful local insurance agents and emerging online insurance brokerages.

**Pharmaceuticals.** The recent emergence of e-pharmacy has raised questions about the ability of the U.S. Food and Drug Administration (FDA) and state licensure agencies to effectively control the sale and distribution of prescription drugs. The Internet spawned an almost instant black market for the drug Viagra: Physicians who never met patients face-to-face “wrote” prescriptions, which were delivered through the mail to waiting users. The combination of heavy encryption and untraceable digital cash could lead to a noticeable increase in the flow of controlled substances to illicit users, as well as a lot of potentially dangerous "self-medication." How to maintain supervision and control of prescription drugs while opening a new and valuable channel for cost reduction is a complex policy issue.

**Quality of Information.** There is much concern about the variability of quality of advice and information on the Internet. However, it is difficult to see regulation of Internet content as a policy goal worth pursuing, particularly given that filtering information and setting information quality standards is likely to be a key differentiation strategy for competing health portals and suppliers of health information. Tort liability for poor advice rendered in specific patient cases seems likely to apply to virtual medical care encounters, so the courts will provide some measure of accountability for patient-specific advice. The courts will almost certainly become involved as more invasive measures of quality and patient risk are published on the Internet, and raise questions or concerns about specific institutions.

**Cost Issues**

Will access to medical information over the Internet increase the demand for health care and thus its cost? Certainly manufacturers of drugs, medical products, and technologies think so, as they have moved aggressively to create Web sites and to advertise in emerging e-health venues on the Internet. However, it remains to be seen if advertising on the Internet will generate sufficient
measurable returns to justify large advertising expenditures for pharmaceutical and product companies. Unlike with passive media such as radio and television, consumers can simply click past Internet advertising to the content they seek.

The Internet's potential to create demand for medical services will be closely studied in the next few years. In my opinion, these studies will find that in a consumer-guided search for solutions, self-care and alternative medicine will be given equal standing with invasive, high-cost solutions to health conditions. Many consumers whose encounters with mainstream medical care yield only expensive options may find less invasive, less risky solutions to their health problems.

The Internet will also provide disease-specific consumer feedback on new treatments that may dampen demand. The Internet is a superb medium for gathering and monitoring information on adverse reactions to newly released drugs or therapies. As discussed earlier, the combination of Internet connectivity with institutional (enterprise-level) electronic monitoring of the prescribing process also has strong potential for lowering the number of adverse drug events and the associated cost.

Overall, the cost impact of the Internet may be closer to neutral than most people suspicious of technology's impact on health costs believe. Network computing may save as much money by eliminating middlemen, clerical costs, redundant processes, and medical error as it generates in increased demand for care. Interactive disease management for patients with chronic diseases may yield significant savings in the costs of avoidable care.

The Internet has a greater potential to fundamentally transform both the structure and the core processes of medicine than any new technology we have seen in the past fifty years. Professional resistance to adoption of the technology and political problems associated with protecting the confidentiality of patient records pose the two biggest hurdles to fully realizing this potential. I see the Internet generating some demand for new products and services. However, that demand is likely to be counterbalanced by a more careful weighing of potential benefits, reduction in medical errors, and the elevation of less expensive substitute therapies to parity with traditional invasive medicine, as well as savings from improved disease management. As a consequence, the Internet's impact on health care costs may be surprisingly benign. The most important effect of the Internet will be to strengthen the consumer's role in relation to practitioners and health care institutions, and to create a powerful new tool to help people manage their own health risks more effectively.

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NOTES
1. “Americans Seek Health Information Online,” Reuters Health (5 August 1999).
3. For a superb discussion of these challenges, see J.D. Kleinke, “Release 0.0: Clinical Information Technology in the Real World,” Health Affairs (Nov/Dec 1998): 23-38.
4. Ibid.
5. For a skeptical analysis of the impact of computing on business productivity, see W. Gibbs,


9. "Americans Seek Health information Online."


11. For a comprehensive if breathless look at the companies developing these sites, see S. Fitzgibbons and R. Lee, “The Health.net Industry: The Convergence of Healthcare and the Internet” (San Francisco: Hambrecht and Quist, January 1999).


16. Aetna/U.S. Healthcare had also an early and aggressive Internet presence (www.aetnaushc.com). The firm also collaborated with the Johns Hopkins University in creating a Web health portal (www.intellihealth.com).

17. See J. Ray and J. Sydnor, "Disease Management: The Future of Managed Care" (New York: First Union Capital Markets, 12 April 1999). A pioneering, Web-based, interactive disease management effort is CHESS (Comprehensive Health Enhancement Support System), developed by David Gustafson and colleagues at the University of Wisconsin.


19. The company that owns the rights to the Informed Choice process, Fairview Medical Services Corporation/Health Dialog, has negotiated a half-dozen licensing agreements with health plans and is in discussion with many others.


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