# The **Future** of the Internet in Health Care

Five-Year Forecast

Written for the California HealthCare Foundation by

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# **Executive Summary**

ealth care has discovered the Internet and the Internet has discovered health care! A rapidly growing number of Internet sites are dedicated to helping consumers find the information they need to make decisions about their health and health care. Patients are creating online communities that provide peer support, information on the latest research, and personal stories about their experiences. Health care professionals are using the Internet for research, to get access to the latest information in their field, to consult with their colleagues, and to keep in touch with their patients. Almost every health care business – from insurer to hospital to pharmaceutical company – has a Web site.

Why is the use of the Internet in health care growing so quickly? How sustainable is that growth? What kinds of health-related applications will develop over the next five years? How will the Internet affect health care delivery, financing, and health outcomes? In all the excitement about the Internet, there inevitably will be unrealistic expectations about its impact on the health care industry. This forecast sorts through the current hype to give a realistic assessment of the pace and direction of change for the next five years.

# **Driving Forces**

The major driving forces that are pushing the Internet into health and health care are strong and unstoppable; they ensure that the Internet increasingly will be integrated in our health care.

#### 21st Century Health Care Consumers

By 2005, more than half of U.S. consumers will have high household incomes, some college education, and access to a computer at home or at work. Health care consumers of the future will be more actively involved in making decisions about the health care they receive. They will expect high levels of choice, control, customer service, interaction with their health care providers, and access to information. They will use the Internet to help meet those expectations.

### Consumer Experiences with Other Industries: Internet Shopping and E-Mail

Consumers' experiences in other areas, particularly the responsiveness and choice they get from Internet shopping and the interaction they get using electronic mail, will shape the expectations they bring to health and health care. Parts of the health care industry will meet those expectations with online information and services and will succeed. Others will not respond as well.

#### The Characteristics of the Internet

The Internet as a channel for health information and communications is well-suited to fulfill consumer expectations. It is inexpensive, easy to use, provides a diversity of health care information, and opens its users to a global network of people with common interests.

#### Market Forces in Health Care

Market forces have been at work in health care for a decade, in the form of managed care, employer purchasing coalitions, assertive government payers and regulators, and consumer organizations. Web technologies – intranets, extranets, and the Internet – will serve as a low-cost, rapidly deployable platform for disseminating information across vertically and horizontally integrated health care organizations. Managed care increases the diversity and urgency of information flow; more of that communication will move to the Internet. Competitive health care organizations will use the Web as a channel to promote their services.

# **Barriers**

At the same time, a number of barriers will impede the development of the Internet in health and health care. They will not stop its use by any means, but the magnitude of these barriers ensures that Internet use will not be all-pervasive in health by 2005.

#### Security Concerns

If there's one thing people are even more guarded about than their financial information, it's private information about their health. Even though technologies are in place to safeguard electronic health information, the perception of a lack of security will inhibit the use of the Internet for personal clinical information in the near term. Longer term, we will reach a combination of technological solutions, public policies, and cultural habits that allow health information to flow freely in the Internet.

#### The Characteristics of the Internet

Just as there are characteristics of the Internet that will drive its use in health care, it also has several that will impede its diffusion. The rapid pace of change in the Internet will outstrip the ability of many health care organizations to keep pace. Weaknesses in Web browser and search engine technologies, including the inability to interact well with legacy databases and to find dynamic Web pages, will limit the appeal of the Internet to health care providers.

#### The Mixed Quality of Information on the Internet

The flip side of the diversity of content that is available on the Internet is that a great deal of poor-quality information is currently available. That uneven quality will turn off some consumers and keep physicians from enthusiastically embracing the Internet.

#### Physician Ambivalence

The poor quality of some health information on the Internet is not the only reason physicians will resist. Medical culture is extremely conservative and cautious, especially when it comes to new technologies. The Internet is one such technology that could alter the doctor-patient relationship.

### The Disarray of Health Care Information Systems

The legacy information systems of most health care players – insurers, hospitals, and physicians – are not ready to be used on the Internet. Substantial restructuring and "housecleaning" must take place before the systems can accommodate and interface with browser technology.

#### Lack of Resources for Web Development

Information systems departments in most health care organizations are not Web-oriented. They are underfunded and will be distracted, at least for the next 18 months, by the Year 2000 problem. Even when they are enthusiastic about the Web, health care organizations are competing with almost every other industry for scarce Web designers, technicians, and engineers.

#### **Too Many Standards**

Health care has many standards for electronic communications and transactions. Too many, in fact. The parochial and vertically differentiated nature of standards in health care will inhibit the near-term development of electronic commerce in the industry and its move to the Internet.

### Forecast: Leading-Edge Applications

Consumer uses of the Internet – to seek information about health and health care and to create communities and support groups – will move the fastest.

#### **Consumer Health Information Services**

Consumers will seek information from the thousands of Web sites dedicated to health and health care. The number of health care Web sites will proliferate as established health care organizations, new Web-oriented health start-ups, and interested individuals put up their content. A number of approaches, including ratings services and trusted brands, will help consumers sort through the noise. Online purchases of both prescription drugs and over-the-counter items will increase during the forecast period.

#### Online Support Groups for Patients and Caregivers

Online support groups for patients with a given disease and the people who care for them will continue to develop rapidly. Patients participating in the groups will feel more in control and, for many diseases, have better outcomes. There will be points of strain, however, between patients and some physicians who feel a loss of control over their patients' care.

Use of the Internet and electronic mail by health care professionals will proceed more slowly than consumer-oriented applications.

#### Health Care Provider Information Services

Use of online information by health care professionals has become increasingly common. We don't forecast any breakthrough applications, although sites will develop that filter out most of the random, irrelevant content for them. Medical journals and, eventually, continuing medical education, will go to the Web.

#### Provider – Patient E-Mail

In certain communities, consumer pressure will push physicians to overcome their fears of being overwhelmed with electronic messages, of breaches in security, and of liability. In most places, however, physicians will be reluctant to employ e-mail with their patients. In time, despite the lack of reimbursement for e-mail communications, physicians will come to embrace it as they did the telephone in the early part of this century.

Finally, health care organizations will use the Internet as a replacement for or a complement to existing information systems, communications infrastructures, and transaction services.

#### Communications Infrastructure and Transaction Services

The justification for using the Internet to transmit electronic insurance claims, conduct remote telemedicine consultations, and transmit data from clinical trials or for FDA filings will be largely economic. The Internet will replace other communications channels that are more costly or less capable. Large claims clearinghouses, which have taken a wait-and-see approach to the Web because of security concerns, will move rapidly to the Web once security regulations are clarified. Many other health care transactions, including eligibility, enrollment, and utilization review, will take longer to move to the Web.

#### **Electronic Medical Records**

Health care providers are near the beginning of a slow transition to electronic patient records. One approach to overcoming the fragmented nature of existing electronic records is to use Web technologies as a "front end" to a range of clinical systems. In those applications, the Web browser displays in a common format (but usually not well-integrated) content from several information systems. We forecast that, although there will be a lot of activity in Web-based front ends, they won't be capable of providing the type of decision support that the eventual full electronic medical record will give to providers.

# Introduction

The use of the Internet in health care has attracted a lot of attention lately. Publications from The New York Times to The Journal of the American Medical Association have featured stories on how consumers are finding medical information on the Web and changing the balance of power in the practice of medicine. Health care practitioners are also using the Internet – to keep up in their fields, to communicate with patients, and to consult with each other. But there is a dark side to Internet medicine. Inspiring stories of lives saved through the Internet get equal billing with hair-raising tales of Web-based quackery. What are we to believe?

One constant of futures research is that we tend to overestimate the impacts of changes in the short term and underestimate their impacts in the long term. In the early phases of any new development, there is a cycle of hype and raised expectations, followed inevitably by a cycle of disappointment. We believe that the Internet in general, and health care on the Internet in particular, is in one of these early cycles of hype.

This forecast seeks to sift through the hype and provide a realistic assessment of the direction and pace of change in health care on the Internet (see Table 1). The forecast begins by describing the driving forces behind some

#### Table 1

The Future of the Internet in Health Care: The Pace of Change

#### Driving Forces

21 st - Century Health Care Consumers

Consumer Experiences with Other Industries: Internet Shopping and E-Mail

> The Characteristics of the Internet

Market Forces in Health Care

#### **Barriers**

Security Concerns

The Characteristics of the Internet

The Mixed Quality of Information on the Internet

Physician Ambivalence

The Disarray of Health Care Information Systems

Lack of Resources for Web Development

Too Many Standards

#### Leading-Edge Applications

Consumer Health Information Services

Online Support Groups for Patients and Caregivers

> Health Care Provider Information Services

Provider-Patient E-mail

Communications Infrastructure and Transaction Services

**Electronic Medical Records** 

Source: Institute for the Future (IFTF)



of the high expectations – the good reasons people are excited about the Web. It then presents some of the barriers to the implementation and diffusion of health care applications on the Internet – some sobering analysis to temper the enthusiasm. Finally, it presents forecasts of six leading-edge applications for health care on the Internet.

The intended audience for this forecast is the stakeholders in health and health care – consumers, health care professionals, health plans and other health businesses, researchers, and policymakers. We have assumed a basic knowledge of the Internet and the World Wide Web, as well as of the health care industry.



# **Driving Forces**

The Internet has already made substantial inroads into the delivery, administration, and reimbursement of health care services, as well as into consumer health information. Several factors are driving this growth. These include:

- Consumer demands;
- Consumer experience with Internet shopping and e-mail through other industries;
- The characteristics of the Internet; and
- Market pressures in the health care industry.

# 21st - Century Health Care Consumers

A growing share of health care consumers are what the Institute for the Future has come to call "new consumers" – people who are actively involved in making choices about the health care they receive. New consumers have three characteristics that distinguish them from more traditional consumers: cash, college, and computers.

#### Cash

New consumers have the disposable income that comes with household earnings of more than \$50,000 per year. That disposable income gives them discretion to make choices about what they purchase. New consumers can choose between saving for their children's education or saving for a vacation. They can choose between purchasing a more expensive health plan or spending out-of-pocket for alternative medicine services. The point is, new consumers have money to spend and a multitude of businesses and services are vying for those dollars.

### College

New consumers have the analytical sophistication that comes from attending at least a year of college. New consumers apply that analytical approach to many of their purchases. They are more likely to seek information about health and health care choices than traditional consumers.

#### **Driving Forces**

New Consumers are much more likely than other consumers to turn to online sources and published medical references.

#### Computers

New consumers have access to computers, either at home or work, or both. They have experience in using computers and the Internet to help them seek and analyze information about their health decisions. They are much more likely than other consumers to turn to online health information sources and published medical references.

New consumers are a growing share of the population (see Figure 1). In the next five years, they will grow to about half the U.S. population. This means that all health care organizations will have to attend to their needs, while continuing to meet the needs of traditional consumers.

New consumers' expectations about the level of service and interaction they receive from health care service providers have been shaped by their experiences with retailers and financial services firms. They expect free choice of doctors, control over the type of treatments they receive, access to good information about their care, and extremely high levels of customer service. Many of them also expect to be able to interact with their health care providers and payors by Internet and e-mail as part of that service. They go online to get health information and expect their health care providers to be as well-versed in what's on the Web as they are.



# Consumer Experiences with Other Industries: Internet Shopping and E-Mail

The experience of other industries has helped shape the expectations that new consumers bring to health care. Part of that recent experience includes the use of the Internet for transactions – particularly for shopping.

During the 1998 holiday shopping season, consumer-oriented Web commerce exploded. Amazon.com, Dell Computers, eBay, REI, CDnow, and many others did a booming retail business on the Internet. Retail transactions on the Net exceeded \$10 billion – only 0.4 percent of total retail sales, but still a significant figure. The media covered Internet shopping extensively. And any stock with ".com" in its name traded at incredible multiples of earnings (assuming it made any profit at all).

At the same time, many consumers also are using electronic mail; there are about 80 million e-mail users in the U.S. Many older Americans – about 25 percent – now use e-mail. They often start as a way to communicate with their grandchildren. Many e-mail users go on to use the Web for other purposes.

New consumers expect free choice of doctors, control over the type of treatments they receive, access to good information about their care, and extremely high levels of customer service.

#### Not everyone will be a new consumer...

If about half of the American population will have access to a PC and the Internet at home or work by the year 2005, about half of the population won't. An ever-widening disparity between the technology "haves" and the technology "have-nots" is correlated with income, education, and ethnicity. Inner-city residents and new immigrants, in particular, have been left out of the information revolution. Such traditionally underserved populations are less likely to have electronic technologies in their homes and are more likely to get health information through talking rather than reading.

A significant sector of consumers will not have access to information and services on the Internet. Even though the cost of PCs has dropped to below \$500, some will not be able to afford to purchase the hardware and software and pay for Internet access. Others will be able to afford the computers, but will face barriers of language, literacy, and education. Still others will choose not to go online.

The Internet is particularly well-suited to meet the needs of new consumers and health care organizations.

## The Characteristics of the Internet

The Internet is particularly well-suited to meet the needs of new consumers and health care organizations. It is inexpensive, easy to use, democratic, spans long distances, and is increasingly functional.

#### Inexpensive

Access to the Internet costs less than \$20 per month, while the cost of an Internet-capable personal computer is below \$500. For the 50 percent of consumers who don't have the resources of new consumers, Internet access is increasingly common in libraries and schools.

#### Easy to use

Browser technology has made the act of navigating through complex information spaces much simpler through point-and-click interfaces. Although the sheer quantity of health information on the Web may be overwhelming, most Web sites are easy to use.

#### Democratic

Before the development of the Web, only large institutions could afford to disseminate their point of view to a wide audience. The Web has dramatically lowered the barriers to entry for people and organizations that want to spread their message. From the point of view of information seekers, it is possible to get a broad diversity of viewpoints on any health issue.

#### Long distance

The delivery of health care services has always been an inherently local phenomenon. The Internet is an inherently global phenomenon. This means that it is possible to get medical information, and even medical advice, from geographically dispersed sources. This, too, contributes to the diversity of information available.

#### Increasing functionality

The Web platform is gaining in functionality and sophistication. In addition to its core browser functions, it now includes client- and server-side Java and will soon include XML (eXtensible Markup Language). These additions will allow Web designers to create much richer user interfaces and to integrate content from many existing health care information systems.

#### **Market Forces in Health Care**

For most of this century, American health care was isolated from the kinds of market forces that pushed other industries to become more efficient and provide excellent customer service. But market forces have been at work in health care for almost a decade now, in the form of managed care, employer purchasing coalitions, assertive government payers and regulators, and consumer organizations. The system has adapted. Many of these adaptations favor the use of information technology and the Internet.

Physicians, hospitals, and health plans all have recognized that the larger they are, the more market power they can command. As a result, a wave of consolidation has swept the industry in the last three years, with, for example, about 170 hospital mergers per year and the consolidation of 18 large health plans across the country into six. At the same time, provider organizations around the country have created vertically integrated enterprises, spanning physicians, hospitals, home care, labs, imaging centers, and even health plans. Web technologies – intranets, extranets, and the Internet – will serve as a low-cost, rapidly deployable platform for disseminating information across vertically and horizontally integrated health care organizations.

Managed care has increased the flow and diversity of information about health care. The simple indemnity insurance world of charges, claims, and payments is nearly gone (see Figure 2). It has been replaced with the "hassle Web technologies – intranets, extranets, and the Internet – will serve as a low-cost, rapidly deployable platform for disseminating information across vertically and horizontally integrated health care organizations.



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factor" of managed care – discounts, provider networks, eligibility verification, pre-certification, referral authorization, drug formularies, chart reviews, and so on. Large employers, purchasing coalitions such as the Pacific Business Group on Health, accreditors such as the National Committee on Quality Assurance, and national and state government agencies are demanding that health plans and providers show they deliver high quality and good value. These factors all increase the information coming in and out of health care organizations. The Internet will be a channel for an increasing share of those transactions.

The most significant indicator of market forces in health care, perhaps, is the growth of brands. Along with the competition and consolidation has come an increase in advertising of health plans, hospitals, medical groups, specialty clinics, and pharmaceutical products. Like other advertisers, health care advertisers have promoted their Web sites on television, billboards, and print ads. Advertising has raised the profile of health care Web sites.



# Barriers

A lthough the table is set for the Internet to move rapidly into the health care mainstream, a number of barriers will inhibit its deployment. None of the barriers is fatal, but together they will slow adoption of Web technologies substantially. The pace of adoption is described in the Forecast section of this report. The main barriers to Internet adoption are:

- Concerns by consumers, regulators, insurers, and providers about the security of information transmitted on a public network;
- Technological weaknesses of the Internet infrastructure and standards;
- Distrust because of the mixed quality of information on the Internet;
- Physician ambivalence about adopting information technology;
- The disarray of legacy information systems in insurers and providers;
- · Lack of resources for Web development in health care organizations; and
- A confusing array of "nonstandard standards."

# **Security Concerns**

If there's one thing people are more guarded about than their financial information, it's private information about their health. Moving to electronic commerce in health care and using the Internet will send large quantities of private health information zinging across open networks. The perception of a lack of security (as much by providers and insurers concerned about liability and bad publicity as by consumers) will inhibit the use of the Internet for personal clinical information in the near term. The "security challenge" breaks down into six components:

- Protecting servers and databases from unauthorized intrusion or modification;
- Authenticating the identity of senders and recipients;
- Protecting the integrity of the message itself;
- Ensuring non-repudiation (that is, making sure senders cannot falsely deny they sent a given message);

The perception of a lack of security will inhibit the use of the Internet for personal clinical information in the near term.

## **Barriers**

Ongoing security procedures, such as passwords, firewalls, and controls over physical access to information, must be rigorous, but efficient.

- Establishing audit trails; and
- Ensuring the confidentiality of messages.

Various technologies and procedures are being developed to tackle these security problems, and they will increasingly be a routine part of health care network transmissions. The major approaches include:

- Data encryption to protect data integrity and confidentiality, such as DES and RSA (private key or public key encryption technologies);
- Digital signatures, hardware tokens, and biometric solutions to authenticate users;
- Firewalls, virus protection software, smart cards (that store key information on a portable card that cannot be intercepted), and other hardware and software, all designed to protect network integrity; and
- Once the technology is in place, ongoing procedures must be implemented to ensure continued security. These procedures, such as the use of passwords, multi-tiered access to different levels of information, and controls over physical access to information, must be rigorous, but efficient; they mustn't hold up the core processes of the organization.

Perhaps more significant than the interception of health care information or unauthorized release by an inside party is the possibility of institutional breaches of confidentiality; for example, the sale of individually identifiable information to marketers or the use of private data for medical underwriting by an insurer. These breaches don't lend themselves to technical solutions, but rather to laws, detection of violations, enforcement, and punishment.

The European Union already is enforcing strict medical data security standards. At some point in the next ten years, the American market, government, courts, or some combination of the three will demand improved security and confidentiality. This is one of the components of the Health Insurance Portability and Accountability Act (HIPAA) that is retarding the law's implementation. The U.S. health care industry needs to get involved in this legislative process or risk the imposition of burdensome regulations. The industry must develop an understanding of the capital and operating costs of implementing system security techniques and factor this into the business equation. Three competing tendencies will shape the perception of security on the Internet. First, health care organizations will develop, deploy, and publicize secure information systems – confidence will legitimately increase. Second, there will inevitably be several well-publicized incidents of people being harmed by public releases of their health care information – those exceptional cases will shape the debate. Third, in the end, people and organizations will learn to live with a less-than-perfect combination of technologies and policies, just as the policy of limiting the fraud liability of credit card holders to \$50 has largely allayed the fears of Internet shoppers.

# The Characteristics of the Internet

Just as there are characteristics of the Internet that will drive its use in health care, it also has several characteristics that will impede its diffusion.

#### Instability and technology churn

The underlying technology of the Web is undergoing rapid mutation – "Web-years" are measured in human weeks. Health care organizations have to devote scarce resources to keep up with the pace of change.

#### Browser technology is weak

Despite the additions of XML and Java, Web client software (browsers) are not very capable. They do a poor job, for example, of handling linking from on-screen forms to underlying databases. This will impede the linkage of the Web to the databases of health care legacy systems.

#### Search engines can't see everything

Dynamic Web pages make up an increasing share of all content on the Web. Because of how dynamic pages are created, the Web crawlers on search engines cannot see them. Also lacking are filtering agents that make truly targeted searches more feasible. This means that a person searching for health care content will miss much of what is available.

#### Low bandwidth links to most homes

Health care information lends itself well to rich content such as images, animations, and video. Most users reach the Web through modem connections at data rates that do not give responsive performance for that type of content. The underlying technology of the Web is undergoing rapid mutation – "Web-years" are measured in human weeks. Health care organizations have to devote scarce resources to keep up with the pace of change. A recent analysis of information on the Web showed that searches to answer common clinical questions produced little information that was appropriate for health care professionals, that was applicable to the question that prompted the search, or that was of high quality.

#### The Mixed Quality of Information on the Internet

The Internet provides ready access to a vast body of health information for consumers, information that at its best can equip consumers to lead healthier lifestyles, detect potential medical problems early, work more collaboratively with physicians to treat illness, and learn of effective treatments that a local provider may not have access to. At its worst, however, the information can mislead consumers into self-destructive beliefs and behavior changes, ineffective or harmful treatments, and false medical understandings that undermine relationships with their physicians.

Concerns about the quality of health information on the Internet are in some respects no different from quality issues faced in other communication channels. Indeed, advice from friends and family, never the most accurate, is perhaps the most common source of health information for consumers. Some characteristics of information on the Internet, however, exacerbate problems of quality. These characteristics include:

#### Inexpensive and easy publishing

The Internet allows many more health information publishers to gain access to a national and global audience.

#### Anonymity

It is difficult to verify, without checking outside the Internet, who is behind a particular Web site or Internet message.

#### Pace

Internet sites can be readily added and changed. Furthermore, breaking news breaks more quickly over the Internet, pressuring publishers to be less rigorous with their fact checking.

#### Transcending regulators

With physical location of little relevance in cyberspace, fraudulent operations can readily access the American market from countries with limited regulation covering fraud and other potential infractions.

Several approaches will address the quality of health information on the Web. A number of rating services, such as Health On The Net, which measures sites against its code of conduct focusing on credibility, and Health Summit Working Group, which measures credibility, content, disclosure,

#### **Barriers**

links, design, interactivity, and caveats, have been put in place. These likely will proliferate, leading to confusion about which provides reliable ratings.

Consumers will sort through the cacophony of health care sites the way they do in any crowded product category – they will gravitate toward brands. Large health care organizations with established brands, such as the Mayo Clinic, will continue to extend them onto the Internet. Some Internet-based health care businesses will establish strong brands of their own.

Finally, some physicians, consumers, or others who are concerned about the quality of health care information on the Web will seek to regulate its content. Those attempts will likely be futile.

### **Physician Ambivalence**

Medical culture is extremely conservative and cautious, especially when it comes to technologies that could alter the doctor-patient relationship. The Internet is one such technology.

Physicians (or at least physician offices) have moved significantly to adopt information technology. Computers in medical offices are commonly used for routine administrative functions, such as scheduling, electronic claims, and checking eligibility. They also are used in some clinical applications (see Figure 3).

#### Figure 3



Computers in Physicians' Offices: Clinical Applications

Source: Institute for the Future/Louis Harris Survey of Physicians, 1997

Physicians are both threatened and fascinated by the Web. Doctors' experience of the quality of information on the Internet is mixed. A recent analysis of information on the Web showed that searches to answer common clinical questions produced little information that was appropriate for health care professionals, that was applicable to the question that prompted the search, or that was of high quality (see Table 2).

Physicians are both threatened and fascinated by the Web. Many understand the value of having well-informed patients and the role the Internet can play in educating their patients. At the same time, they are concerned about losing control over the interaction with their patients. In a ten-minute office visit, they have trouble answering all the questions of a patient armed with 400 pages printed from the Internet. And they fear being overwhelmed with messages if they provide an e-mail address. On balance, their ambivalence will keep many of them from enthusiastically embracing the Internet.

#### Table 2

Poor Quality of Medical Information on the Web (Attributes of 629 pages retrieved in 50 searches to answer common clinical questions)

Don't disclose conflicts of interest	99%
Not applicable to the question that prompted the search	89
Don't give date posted or updated	82
Don't give author's credentials	80
Don't indicate author	69
Not oriented to health care professionals	60
Evidence-based resources	1

Source: Hersh, W., Gorman, P., and Sacherek, L. "Applicability and Quality of Information for Answering Clinical Questions on the Web." JAMA 1998; 280:1307–1308.

#### The Disarray of Health Care Information Systems

The legacy information systems of most health care players – insurers, hospitals, and physicians – are not ready for prime time. Clinical information systems in labs, pharmacies, and hospitals are fragmented and don't communicate well with each other. The enrollment and eligibility databases of most insurers are weeks to months out of date. The essence of electronic commerce is that trading partners can perform transactions (that is, view and change information in databases) in real time. Customers and partners expect that the information in these databases is correct and complete.

Most health care customer service departments give the illusion that the information is good by placing clever people on the telephone between the customer and the database. Once customers gain direct access through online systems (preferably *before* they get direct access), the information must be brought and kept up to date. This "data-cleaning" process will take time and money, and will delay the onset of direct transactions through the Internet.

Most transaction-intensive health care players, notably health insurers, have a mix of database and transaction systems, ranging from old flat-file, batch systems to real-time, relational databases. Some even are experimenting with object-oriented databases. To provide integrated access to information via the Internet, information from all of those databases must eventually be available in real time. At some point, those reliable old batch systems must be replaced. This is not an insurmountable problem, but, again, it will take time and money to resolve.

#### Lack of Resources for Web Development

Information systems departments in most health care organizations are not Web-oriented. They have resisted making the investments needed to build a Web presence. Many are underfunded – health care as a whole spends much less on information technology than other information-intensive industries. The legacy information systems of most health care players – insurers, hospitals, and physicians – are not ready for prime time.

Health care as a whole spends much less on information technology than other informationintensive industries. Many of their resources are being diverted (for the next 18 months) to resolving the Year 2000 problem. Although the direst projections about the chaos it will spread probably can be avoided, a lot of information systems' departmental resources will be invested in fixing the date fields in missioncritical applications. This won't preclude the development of Internet applications, but it will surely delay them for months or years as the attention of health care information professionals is focused on this urgent task.

It is also the case that sophisticated Web designers – and information technology professionals in general – are in extremely short supply. Health care organizations must compete with a range of other industries to attract the best Web designers.

#### **Too Many Standards**

Health care has plenty of standards-setting bodies. Overall, however, standards have been unevenly adopted. Unlike the uniform bar codes for grocery items or automotive parts, there are differing, overlapping, and competing sets of standards in many areas of health care information technology. Health care has a data interchange standard, HL7, that is widely used, but not universally so, and is imperfect in many areas. Medical equipment suppliers, pharmacists, and health insurers all have their own electronic data interchange (EDI) standards and distinct electronic commerce efforts. A critical missing piece is a single semantic and terminology standard for diagnoses, procedures, and outcomes. SNOMED, a nomenclature classification system created for indexing the entire medical record, including signs and symptoms, diagnoses, and procedures, for example, is used by many organizations, but it is proprietary and not complete.

Standards-setting in any industry is a slow, political process. The parochial and vertically differentiated nature of standards in health care will inhibit the near-term development of electronic commerce in the industry and its move to the Internet. That diversity will limit the rate of diffusion of comprehensive electronic commerce in health care, including electronic commerce on the Internet.



# Forecast: Leading-Edge Applications

A number of applications will be at the leading edge of Internet use in health care. This section presents these applications, including a description of the type of application, some of the leading examples or precursors, and a forecast of how the application will evolve in the next five years.

The applications are:

- Consumer health information services;
- Online support groups for patients and caregivers;
- Health care provider information services;
- Provider-patient e-mail;
- · Communications infrastructure and transaction services; and
- Electronic medical records.

In 1997, 43 percent of adult Internet users searched for health information online.



#### www.onhealth.com

Onhealth.com, a leading consumer health information website, empowers women to become better health care decisionmakers for themselves and their families by providing objective, timely, cutting-edge information.



#### www.netwellness.org

NetWellness is a University of Cincinnati, Ohio State University, and Case Western Reserve collaborative effort by health professionals to bring the "best of the web" in health information.

# **Consumer Health Information Services**

As Internet usage increases, so does the public's search for health information. In 1997, 43 percent of adult Internet users searched for health information online. The applications used to search the Web for health information comprise a wide range of specialized search engines and databases. People searching for health information also vary a great deal in level of interest and expertise. The same search engine may handle requests from a physician looking for the latest medical journal article on an obscure condition and those from a lay person who wants to know whether canker sores are contagious. Health information online can take the form of anything from clinical research results to advice columns written by people who aren't even health professionals. The search for health information online often leads to information overload and misinformation.

#### **Precursors and Existing Applications**

Before the Internet, consumers received health information from health care professionals, by word of mouth, from popular books and the press, and (for the diligent) from published medical references. Only researchers and physicians used dial-up online access to federal medical research databases, MEDLINE chief among them. With the development of the Internet, friendly graphical user interfaces (GUIs) replaced the command-driven, expensive databases such as the old Grateful Med. With decades of health research to offer, federal databases still hold appeal for consumers, health care professionals, and researchers around the world. And now the Internet can be used to access them. With 9.2 million references to peer-reviewed articles, the Internet-based versions of the National Library of Medicine's MEDLINE – PubMed and Internet Grateful Med – are still the most commonly used search engines for peer-reviewed medical journals. Health information online has become a hot commodity. Companies are responding to the increasing popularity of health and wellness information with services targeted to the individual consumer. The mainstream public is accessing everything from text-based, technically oriented federal databases of health information to splashy, welladvertised sites like Blue Shield of California's www.mylifepath.com, Mayo Clinic's www.mayohealth.org, and America Online/Disney's www.thriveonline.com.

Newsgroups, chat rooms, and listservers are another way for individuals to pull information from the Internet. With tens of thousands of newsgroups to choose from, an Internet user can post to the list (that is, can choose to participate by responding to elements of the "discussion" or by starting a new thread) or just "lurk," reading what others have written. Newsgroups with a high degree of interaction around a particular medical issue essentially become an online support group.

### **Forecast**

Several developments will influence consumer access to information on the Internet in the next five years.

- Plans and providers will react to the demands of "new consumers" to be involved in their care and have access to better information by providing an increasing amount of information online. Large plans and providers will be able to create their own customized content. Smaller plans and providers will contract for private-label versions of information from commercial vendors of health care sites.
- Because much diverse, inconsistent, and incoherent information is now available on the Web, opportunities exist for new approaches to collect and combine information for easier use. Consumers need help in sorting through the extensive "noise" on health care Web sites. Search engines with a stronger editorial voice – specialized health "portals" that compile and index health information rather than simply accumulate information from the Internet – will be the choice of the majority of Web searchers.



www.thriveonline.com

Sponsored by America Online and Disney, Thrive is the #1 consumer health site that offers "the best information on medicine, fitness, sports, diet, and sexuality".



#### www.mylifepath.com

Developed as a brand-builder for Blue Shield of California, mylifepath is one way the health plan is reaching out to garner member loyalty.

- A small number of trusted services that rate the quality of information on health care sites will emerge from efforts such as Health On The Net (**www.hon.ch**). Mainstream sites will comply with the raters' guidelines to get their coveted seals of approval. At the same time, the multitude of sites that don't care about ratings will continue to thrive.
- New forms of health care information on the Internet will proliferate. With the growing availability of inexpensive data and storage, more images, animation, video clips, and interactive learning systems will be put in place. Few consumers, however, will have wide enough bandwidth connections to the Internet to be able to take advantage of that rich content.
- Online purchases of prescription drugs and of over-the-counter items like vitamins and nutriceuticals (vitamin-fortified food) will increase substantially over the forecast period. Online medical commerce will be used particularly for routine refills of prescriptions (often done by mail order now), items that are difficult to locate, and potentially embarrassing items, (such as incontinence diapers and Viagra). This growth will attract much opposition and, perhaps, some regulation. Issues like the interstate practice of medicine and privacy of consumers' information will dominate.
- Health care report cards, consumer reports, and consumerfriendly ratings of health plans and, eventually, hospitals and physicians, will be available online. They will be substantially more usable than current report cards.
- Patients, especially those with chronic diseases, will begin to use personalized health records services to track their health status. These systems will allow patients to perform health risk assessments online and to track their adherence to diet, exercise, or medication regimens.

# Online Support Groups for Patients and Caregivers

Online support groups give individuals with a specific health concern a place to "congregate" on the Internet for support and information. Frequently, peer support groups are set up as alternatives to professionally-led support groups. If someone believes another approach is better, she can start an Internet-based group, discussion, newsletter, or listserver.

Online support groups are convenient for busy or house-bound people and can provide support at all times of the day and night. One of the greatest boons to family caregivers – such as those providing support for a family member with Alzheimer's or cancer – has been the online self-help and support group where they can meet with others performing similar functions and get expert help. Support group members go online, reaching out for information and commiseration, and, in so doing, they create an information commons. This commons is filled with anecdotes about how to deal with a new diagnosis, especially of a rare disease where there is a dearth of research. The powerful ability of the online community to transcend geography, time, and culture is a great comfort to people isolated by their, or another's, disease.

Support groups vary by level of interaction, by level of clinical monitoring and availability, and by level of public access. Most groups are either self-moderated by a patient or caregiver or by an advice nurse, who is either compensated minimally or not at all. When a support group is sponsored by a health care organization, it often is either a marketing tool or a revenue-generating tool. Some commercial groups "data mine" and resell the information collected by the group. This is a highly controversial practice that is likely to generate a serious backlash. The powerful ability of the online community to transcend geography, time, and culture is a great comfort to people isolated by their, or another's, disease.



chess.chsra.wisc.edu

On CHESS, patients read articles, tutorials about services, and brief answers to many questions; anonymously question experts; communicate with and read accounts of other patients; monitor health status; and receive decision-making support.



#### www.thebody.com

The Body's mission is to: use the Web to lower barriers between patients and clinicians; demystify HIV/AIDS and its treatment; improve patients' quality of life; and foster community through human connection. 

#### cancernet.nci.nih.gov

NIH's CancerNet offers information aimed at patients, health care professionals, and researchers, is reviewed regularly by oncology experts and is based on the latest research.



#### www.acor.org/leukemia/frame.html

Granny Barb and Art's Leukemia Links is a volunteer site put together by two individuals living with leukemia. The site is now one of the most comprehensive disease-specific portals online. With an increased focus on wellness in the health care industry, some health care organizations believe patient empowerment – brought about by support groups and increased patient education – results in reduced costs and healthier patients. People who understand and believe in their treatment will be more compliant, and ultimately, the quality of care will improve and costs will go down if patients are part of the process. Various studies have shown that support group users have fewer hospital admissions and reduced lengths of stay, translating into up to a 30 percent savings in hospitalization costs.

#### **Precursors and Existing Applications**

There are thousands of online support groups and their numbers are growing with an increase in the commercialization of health information and the focus on wellness. Mainstream companies like America Online and Time Warner have Internet health channels that point to dozens of support group listings.

One of the most well-known and oldest support group applications was created by researchers at the University of Wisconsin in 1987 to help individuals cope with the stress of a health crisis. CHESS, the Comprehensive Health Enhancement Support System, provides patient education by means of a personal computer in the home. In the first version of the program, patients connected by modem to a closed network. For a recent study of elderly women with breast cancer, patients connected to the support group via the Internet.

#### **Forecast**

Many of the concerns about the source and quality of information for consumer health information services apply to online support groups as well. In addition:

• Organizations will be cautious about offering specific medical advice because of fears of liability. Individuals will feel much less constrained about offering medical advice.

• Physician organizations may hinder the growth of online support groups, since the lack of reimbursement provides little incentive for their involvement. Online support groups will become a flash point between patient groups and physicians. Physicians will feel an incursion on their clinical turf and a loss of power as their patients gain the support of their online community.

Growth in online support for patients will expand in two major directions – more bandwidth leading to new media and a much richer set of support services.

- Patient education, compliance, and support programs will merge on the Internet. Psychosocial support groups; diseasespecific research; physician and provider assessment; information about alternative medicine; educational video and animation programs; and patient self-care support tools, such as software that tracks diet and issues reminders to take medications, will all be available in integrated, disease-specific forums. Some will be sponsored by health plans or providers, while others will be led by patient groups.
- Beyond the five-year time frame, as bandwidth to the home and workplace increases, online support groups may begin to add new media choices beyond the simple text messaging (chat) done now. Internet telephony will allow multipoint voice chats, for example. And eventually, people will be able to do video-mediated support groups, though they may stick to chat and use the video channels to share prerecorded information. Most groups treasure and will maintain anonymity until a community of trust is developed, at which point video or face-to-face meetings will occur.

Patient education, compliance, and support programs will merge on the Internet.

# With the second seco

#### www.medscape.com

Medscape, calling itself the leading professional medical supersite, also publishes a free weekly email newsletter highlighting new clinical research items on the site.



#### www.medconnect.com

Medconnect is a direct link for physicians to many online journals, jobs, and continuing medical education.

# **Health Care Provider Information Services**

ealth care professionals have to keep up with an increasing volume of medical information – one study estimates that in general medicine, a physician would have to read 19 articles a day, 365 days a year to stay current. Doctors and other health care professionals currently use a range of sources, including journals, textbooks, drug compendia, other physicians, and pharmacists. Most of those information sources fall short – they are not available when needed, are out-of-date, or are hard to search. New information tools that provide valid, timely information would be a boon to harried physicians. The Internet, to a limited extent, meets many of these information needs.

#### **Precursors and Existing Applications**

A huge and rapidly increasing number of sources of health care information are available on the Internet. Figure 4 shows the number of health-related pages indexed on the World Wide Web by the search engine Alta Vista since 1996.

Use of online information by providers has become increasingly common -72 percent of libraries in academic medical centers have Internet access, up from 24 percent in 1993. As more sources have become available, demand has jumped. MEDLINE saw its usage jump tenfold



to over 75 million searches per year when it introduced free Web access in June of 1997. In fact, technology proxies such as nurses, office staff, or research librarians often search the Web on behalf of busy physicians, and when physicians self-report that they use the Internet they are often referring to such proxies. Louis Harris reports that only 13 percent of physicians use e-mail, a smaller number than report using the Internet. Health care professionals account for 34 percent of MEDLINE's searches.

### **Forecast**

The increase in the use of the Internet for information by physicians will be largely incremental. No breakthrough applications are likely, nor are any discontinuities.

• Usage of the Web for enhancing clinical knowledge will increase as newly minted doctors who have been trained to do online searching come into private practice. Already, new graduates are making their internship and residency decisions partly based upon the sophistication of the information systems at a particular hospital. Continuing medical education, while a natural fit for the Internet, faces resistance by CME accreditors and will grow only slowly. Usage of the Web for enhancing clinical knowledge will increase as newly minted doctors who have been trained to do online searching come into private practice.



www.springnet.com

Targeted at nursing professionals, Springnet offers a wide range of services from career counseling and continuing education to support groups.

# Health care providers find many types of resources on the Web

- Medical education and continuing medical education (shine.stanford.edu)
- Electronic versions of medical journals (www.emedicine.com)
- Medical atlases (www.nlm.nih.gov/research/visible/visible human.html)
- · Information on clinical trials (www.nih.gov/health/trials/index.htm)
- Pharmaceutical information (www.fda.gov)
- Practice guidelines (www.ahcpr.gov)
- · Insurance information (www.healtheon.com)
- Online forums for patients (see page 27)



#### igm.nlm.nih.gov

Eliminating the cost and complexity of dial-up access, Internet Grateful Med now links researchers and clinicians to a multitude federal research databases.

- Physician-oriented sites that filter out most of the random content from the Internet will develop. Use of these sites will increase, particularly by physicians who don't have the information-searching skills to sort out the "noise" on the Internet themselves. Faster growth will occur among nursing and other health care professional sites where there is a stronger culture of collaboration.
- Most medical journals will have a Web site that reprints current and back issues for subscribers. Some innovative journals will begin to prerelease important articles before full peer review has been completed.
- New functionality will increase the usefulness of the Web for practicing physicians evidence-based medicine guidelines that can be linked to electronic medical records and medical atlases with animation and video images.

# **Provider – Patient E-Mail**

Physicians have been reluctant to embrace e-mail with their patients. They have expressed fears similar to those concerning the telephone in its early days – a barrage of inappropriate e-mails, an inability to assess the priority of e-mail communications, and potential breaches in security and privacy of doctor-patient communications. E-mail, meanwhile, has been enthusiastically embraced by the general public, with over 80 million subscribers in 1998. Like the telephone, e-mail will, in time, become an important channel for patient – physician communications.

## **Precursors and Existing Applications**

Many providers already use e-mail, but see it as a channel for professional communications among physicians and researchers. Nonetheless, early adopters of e-mail communications with patients have reported a number of benefits:

- Less time spent answering questions on the telephone;
- More control over their time because e-mail is asynchronous and allows them to communicate when they want to;
- The opportunity to enrich the medical record by including printed versions of e-mails of patients describing symptoms in their own words;
- Cost-effective use of resources by avoiding unnecessary office visits; and
- More efficient communication about scheduling appointments, routine guidance and education, reminders about upcoming office visits, and general health information.

Like the telephone, e-mail will, in time, become an important channel for patient – physician communications.



www.mediconsult.com

Mediconsult provides patients with access (via e-mail, for a fee) to timely, reliable information for making health care decisions.



www.americasdoctor.com

America's Doctor offers private, confidential chat sessions with physicians 24 hours a day. They also sponsor interactive events, a research library, and neighborhood resource list. On the other hand, fears about the pitfalls of e-mail communication have slowed its use by many physicians:

- Inappropriate uses of e-mail, such as messages about urgent needs or communicating about abnormal test results;
- Lack of security of e-mail communications;
- Liability through messages that are not responded to appropriately or in a timely fashion; and
- Less ability to communicate "off the record" about care.

#### **Forecast**

Electronic mail between providers and patients is going to increase rapidly, both in volume and in the type of communications.

- Communications by e-mail between physicians and their patients will increase in certain communities, with patients driving the shift. As more patients put demands on providers for e-mail, it will become more common for physicians to put their e-mail addresses on their business cards. Physicians will resist the increased level of direct communication. Initial uses of health-related e-mail will be for administrative functions, such as coordination and scheduling. In some areas, for some doctors and consumers, patient–provider e-mail will be a competitive advantage, generating word-of-mouth referrals and a patient-friendly reputation.
- Communications between consumers and physicians who are not their doctors will increase much more rapidly. Patients will seek out Web sites that offer consultations with physicians. (Many of these sites will be offered as a free service of organizations seeking to attract patients, while others will be offered for a fee.) While practicing medicine over the Web is illegal, many physicians now provide some guidance and informal second opinions to consumers. A consumer today can use the Internet to interact with physicians they have never seen to get prescriptions for some medications. Besides professional and ethical problems, there are jurisdictional problems with interstate or even inter-country transactions.



#### www.oncolink.com

Founded by University of Pennsylvania cancer specialists, OncoLink has comprehensive information about specific types of cancer, updates on cancer treatments and news about research advances for patients, families, health care professionals and the public.

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#### www.salus.com

Salus Media combines clinically proven medical content with group support and electronic case management.

- Disease state management (DSM) communications will increase as a number of health plans, specialized DSM companies, and pharmaceutical DSM companies use e-mail for the protocol-based management of chronically-ill patients. We forecast an increase in employer-driven demonstrations and trials in chronic diseases such as congestive heart failure, asthma, and diabetes. Among other things, e-mail will be used to track a patient and collect information on outcomes, health status and quality of life.
- Leading-edge provider organizations will put in place a range of applications to make patient-physician e-mail more effective:
  - Form-based e-mail that helps a patient characterize the priority and type of request;
  - Alerts to use the telephone or make an office visit for urgent conditions;
- Flow tracking and control to ensure that all messages are followed up;
- Automated responses for simple communications and frequently asked questions (FAQs);
- Linkages to online health risk assessments; and
- Explicit guidelines about how any message will be used, including whether it will be placed in the medical record, to whom it will be forwarded, and how long it will be kept.

As more patients put demands on providers for e-mail, it will become more common for physicians to put their e-mail addresses on their business cards.

# Communications Infrastructure and Transaction Services

All of the applications described up to this point capitalize on the unique characteristics of the Internet; they represent new approaches to communicating about health care. A range of other applications use the Internet as a replacement for or a complement to existing communications infrastructure or transaction services. These include:

- Electronic claims transmitted via the Internet instead of using the widearea network (dial-up or leased phone lines);
- Remote telemedicine consultations that use the Internet to transmit data, voice, video, and images;
- Transmission of clinical information in clinical trials; and
- Submission of FDA filings by pharmaceutical and medical equipment manufacturers.

The justification for using the Internet will be largely economic – it will replace other communications technologies that are more costly or less capable. We look at two of these applications in particular.

### **Precursors and Existing Applications**

Since the early 1990s electronic claims processing has gone from being a fringe activity to the dominant mode of claims submission (see Figure 5). Most claims today are submitted through claims clearinghouses, which accept electronic (or paper) claims from small health care providers, "clean" the claims (make them conform with the submission rules of the payers), aggregate claims from several providers, then transmit them to payers.

A number of clearinghouses, such as Claimsnet.com and MedEAmerica are now accepting claims via the Internet. The largest claims processors, such as Envoy/NEIC, NDC, and HBOC, have not yet embraced the Internet as a medium, but all are studying it.

Telemedicine is the use of communications and video technology to bring specialized clinical expertise to remote sites for aid in diagnosis and treatment, and for educational purposes. Telemedicine over the Internet

#### Figure 5



Electronic Claims Are Dominant

Source: Faulkner and Gray, Directory of Automated Medical Payments

is already happening at hundreds of sites around the globe as clinicians "store and forward" images to one another. The Internet provides flexibility of routing images to any Web browser rather than point-to-point in a closed network. Using the Internet means cheaper phone charges, and storeand-forward technology means clinicians can pick up images at any time rather than waiting for the dedicated line to be free.

Many experimental applications are rural. Because of limited availability of wide bandwidth communications, especially in rural areas, live videoconferencing over the Internet is still a long way off. The most common application for telemedicine is teleradiology – consultations by radiologists (surprisingly, most often in dense urban areas) using fixed images transmitted either over a wide-area network (WAN) or the Internet.

### **Forecast**

The Internet is likely to play a valuable role in health care's move to electronic commerce, especially for claims processing, but also for other paper transactions that can be done much faster and less expensively electronically.

- The large claims clearinghouses and their customers have taken a waitand-see approach to claims on the Web because of security concerns. Assuming that the Health Care Financing Administration (HCFA) sticks to its revised ruling supporting encryption for electronic claims and that the Health Insurance Portability and Accessibility Act (HIPAA) rules, when issued, acknowledge some form of encryption as sufficient to safeguard security, we will see a rapid shift toward the Web.
- The Internet will not replace the clearinghouses. They will have a continuing role tracking and auditing claims submissions, providing customer service, cleaning and editing claims (especially until there are real data standards and until practice management systems become more sophisticated), and consolidating and dispatching claims. Their relationships with smaller provider organizations will be especially strong. Even though it would be possible for small providers to use the Internet to transmit claims to each of their payers, the cost and convenience advantage of using the clearinghouses will remain compelling.

The large claims clearinghouses and their customers have taken a wait-and-see approach to claims on the Web because of security concerns.  Claims and encounters, especially for hospitals and pharmacies, and materials and inventory management already are moving rapidly to electronic commerce and will move to the Internet. Other transactions, including eligibility and enrollment, coordination of benefits, utilization review, precertification, referral authorization, and lab and radiology will begin to move to the Internet in the next two to five years.

Telemedicine applications will develop more slowly.

- It is unlikely that any significant proportion of health care will be delivered remotely in the next decade. Nonetheless, several factors, such as dropping communication costs and provision in Medicare funding for telemedicine in underserved rural areas will provide the push telemedicine providers need to get remote care out of the pilot phase. This will mean growth in video-based consultations, remote radiology readings, and remote education – the traditional telemedicine applications.
- The lack of reimbursement for most telemedicine consultations and interstate medical licensing conflicts will limit the deployment of telemedicine services.
- Bandwidth limitations on the current Internet will limit the use of live video. Telemedicine developers will look to the entertainment industry as it figures out how to send live video over the Internet without delays or gaps in coverage.

# **Electronic Medical Records**

ealth care providers are at the beginning of a slow transition toward electronic medical records (EMRs). Most applications of computers in medical offices and hospitals are for administrative rather than clinical functions. Clinical functions of computers have typically been in departmental "islands of automation," usually in the pharmacy, lab, and radiology departments. Most physicians would not consider using a computer during an office visit and would not take the time to transcribe their notes on a keyboard after the visit.

A number of vendors and large institutions have developed and deployed full electronic medical records. Some, such as Oceania (a Redwood City EMR vendor), rely on physicians to enter data. Others, such as the Scott and White Hospital and Clinics in Texas, transcribe physician dictation into an electronic document that is integrated into the computerized patient record. Many of these systems are largely homegrown and proprietary. We estimate that fewer than 5 percent of physicians are now using a comprehensive electronic patient record.

### **Precursors and Existing Applications**

One of the difficulties of constructing an electronic medical record is the range of existing information systems – the islands of automation. Provider organizations must either go with a single vendor (which may not have the best software module for every department in the organization) or construct a "front end" that presents information from the disparate systems.

A number of institutions have developed their own Web-based front ends for their electronic medical records (see Table 3). Most of these systems get information from legacy information systems and present it on a browser front-end. They do not integrate data from across legacy systems, but simply present it in a consistent format. Health care providers are at the beginning of a slow transition toward electronic medical records (EMRs).

#### Table 3

Institutions Using Web-Based Front Ends for Electronic Medical Records

- Wishard Memorial Hospital and Clarian Health Partners, Indianapolis
- University of California, San Diego
- Columbia Presbyterian Medical Center, New York
- University of Minnesota, Minneapolis
- University of Missouri, Columbia
- University of Washington, Seattle
- Partners of Boston
- Care Group of Boston
- University of Wisconsin, Madison
- Children's Hospital of Boston
- Mayo Clinics
- Centre Hospitalier, Rennes, France

Source: McDonald CJ et al. "Canopy Computing: Using the Web in Clinical Practice." JAMA. 1998,

#### Forecast

Web-based front ends to electronic medical records will attract a lot of attention and development effort in the next five years.

- Just as hospitals and clinics were not able to push vendors of clinical information systems to create open architectures in the 1980s and 1990s, they will have difficulty in getting the vendors to build interfaces to the Web. Vendors will resist installing a technology that makes it easy to substitute competitors' systems.
- Standards work, which always proceeds slowly, will have to be done to get vendors to agree on how applications should link to the Web. Health Level Seven (HL7), a standard for health care information, will likely incorporate XML (eXtensible Markup Language) as its browser markup language. XML documents have the same general look as conventional (HTML) Web documents, but have more capability to represent structured records from databases.
- The efforts to build tools that agglomerate and represent information from disparate systems' electronic medical records will not result in systems that integrate information well enough to provide effective, real-time decision support for physicians. Integration at the display and interface level will not be sufficient.
- Although there will be a lot of activity in electronic medical records for the next five years, the Internet will not provide solutions that are sufficiently compelling to drive widespread adoption. Fragmentation in electronic medical records will continue.



# Conclusion – The Pace of Change

n brief, our forecast of the pace of change of the Internet in health and health care is this:

- The driving forces that are pushing the use of the Internet in health care are strong and inevitable. Like the Internet itself, health care on the Internet will be advanced by the needs of consumers who are hungry for information about their health and for control over the health services they receive.
- The health care industry, though, is not quite ready to accommodate the Internet. Information systems, organizational structures, the incentives and training of physicians all will act to restrain the use of the Internet.
- Consumer applications of the Internet to seek information about health and health care and to create communities and support groups – will move fastest. Health care professionals will also use the Internet for information and professional communications. Many, however, will resist direct electronic connections to patients, for example through electronic mail.
- Health care organizations will make use of the Internet as a communications channel and for transaction services; for example, to transmit insurance claims. Those uses will not have the potential to be transformative – they will, instead, create more efficient communications. The Internet's use in electronic medical records will attract much attention, but will not provide a fundamental breakthrough in medical record keeping.



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