CHAPTER ONE

The E-Health Revolution

Websites such as WebMD.com, MedlinePlus.gov, MerckSource.com, HealthFinder.gov, and MayoClinic.com answer health-related questions and provide links to discussion groups about particular illnesses. In states such as Massachusetts, California, New York, and Michigan, consumers can visit state health department sites and compare performance data on the quality of care. The U.S. government has a website that evaluates 2,500 hospitals on mortality rates, room cleanliness, and call button response and on how their patients judge the quality of the care that they provide.[1] Some physicians encourage patients to use e-mail or web messaging instead of telephone calls or in-office visits for simple issues such as appointments, prescription renewals, referrals, or brief consultations. And digital diagnostic systems, decision-support software for health care providers, telemedicine (medical care provided by televideo or telephone), and computer-aided self-help tools also are available.

Despite the wealth of digital medicine applications available through e-mail, the Internet, and mobile devices, not many physicians or patients are taking advantage of the potential of electronic communications. Only 15 percent of the 560,000 doctors in the United States use the Internet to order medication for their patients.[2] Industry advocates claim that a move to electronic prescriptions could save $29 billion over the next decade. According to health experts, digital technology would save money and "make transactions more efficient, reduce medication errors, and entice doctors to prescribe less expensive drugs."[3]

Some observers, however, worry that these types of electronic consultations will depersonalize health care. Social medicine expert Helen Hughes Evans, for example, argues that "technology has stripped medicine of its humanistic qualities" and that doctors rely too heavily on high-tech instruments.[4] She feels that rather than advancing the quality of patient care, digital medicine has undermined the intimacy of clinician-patient relations among those who rely on electronic devices and therefore has contributed to the loss of the personal touch in the provision of health care.

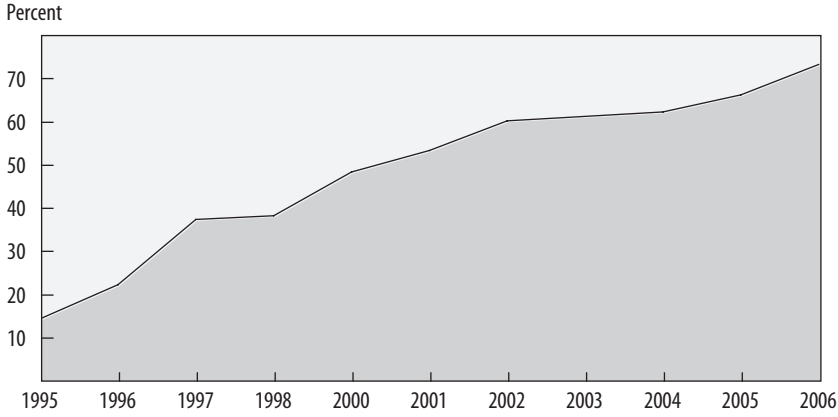
In a review of research on telemedicine, though, Edward Alan Miller finds that 80 percent of medical studies showed a favorable impact of digitally mediated contact on provider-patient relations.[5] Digital technologies facilitate access to health care for some individuals and expand the network of available health care providers. Digital communications allow people with rare diseases to find others who suffer from the same disorders and to learn from their experiences. Moreover, digital systems allow patients to take advantage of specialists in other states and even other countries. Although technology often appears to be "dehumanizing," studies suggest that it can increase resources for self-care, enhance emotional support through electronic support groups, and improve knowledge regarding special medical problems.

In this book, we examine the revolution in information technology that is taking place in health care, the presumed benefits of electronic or digital health care, and barriers to technological innovation. We argue that in order to achieve the promise of health information technology, digital medicine must overcome the barriers created by political divisions, fragmented jurisdiction, the digital divide, the cost of technology, ethical conflicts, and privacy concerns. The desired cost savings and service improvements in health care cannot be achieved without addressing those matters.[6]

USE OF ONLINE INFORMATION

Since the mid-1990s, there has been a dramatic increase in overall Internet use in the United States. According to figures compiled by the Pew Internet and American Life Project, 73 percent of respondents in 2006 said that they used the Internet, up from 14 percent in 1995. As shown in figure 1-1, Internet usage in the United States has risen steadily in

FIGURE 1-1. Internet Usage in the United States



Source: Pew Internet and American Life Project National Surveys, 2002, 2004, and 2006.

recent years. In 2006, 66 percent of respondents said that they were Internet users, indicating a 7 percentage-point gain from 2005 to 2006.

Patients face a dizzying variety of new ways to communicate with medical providers and gain information about health care problems.[7] They can search websites devoted to medical ailments, e-mail health care professionals, buy medicines and health care products online, and engage in interactive communication with medical providers. Such options offer people more control over their health care while also improving the quality and affordability of treatments.[8]

However, few Americans are taking advantage of health information technologies. In a Wall Street Journal Online/Harris Interactive Health-Care Poll of 2,624 adults across the nation, only a small number of respondents indicated that they used electronic technologies to communicate with health care providers. Four percent got reminders through e-mail from their doctor when they were due for a visit, 4 percent used e-mail to communicate directly with their doctor, 3 percent scheduled appointments through the Internet, 2 percent received the results of diagnostic tests through e-mail, 2 percent had access to electronic medical records, and 2 percent relied on home monitoring devices that allowed them to e-mail blood pressure readings directly to their doctor's office.[9]

When asked whether they would like to employ such technologies, large majorities indicated that they would do so if they had the opportunity. The survey shows that respondents would like the following options:

TABLE 1-1. Health Topics Searched for Online by Internet Users
Percent of users

Health topic	*2002*	*2004*	*2006*
Specific disease	63	66	64
Certain medical treatment	47	51	51
Diet or nutrition	44	51	49
Exercise	36	42	44
Medical drugs	34	40	37
Particular doctor or hospital	21	28	29
Health insurance	25	31	28
Alternative treatments	28	30	27
Mental health	21	23	22
Environmental health	17	18	22
Experimental treatments	18	23	18
Immunizations	13	16	16
Dental health	—	—	15
Medicare/Medicaid	9	11	13
Sexual health	10	11	11
Quitting smoking	6	7	9
Drug/alcohol problems	8	8	8

Source: Pew Internet and American Life Project National Surveys, 2002, 2004, and 2006.

—to get an e-mail reminder when they are due for an appointment (77 percent)

—to use e-mail to communicate directly with their doctor (74 percent)

—to receive the results of diagnostic tests through e-mail (67 percent)

—to schedule an appointment through the Internet (75 percent)

—to have an electronic medical record (64 percent)

—to use a home monitoring device that allows them to e-mail blood pressure readings to their doctor's office (57 percent).[10]

Those who went online for medical information most commonly searched for information on specific diseases. As shown in table 1-1, of those who went online, 64 percent said that they searched for information on particular illnesses, 51 percent for information on certain medical treatments, 49 percent for information on diet and nutrition, and 44 percent for information on exercise; 37 percent sought advice on medical drugs, and 29 percent looked for particular doctors or hospitals. The number of people searching online for medical information increased in most categories during the 2002–06 period covered by the surveys.

Of those who went online for health or medical information, 58 percent indicated that the information affected their health care decisions,

55 percent said that it changed their approach to health care, and 54 percent reported that it prompted them to ask new questions of their medical providers. When asked how the information made them feel, 74 percent said that they felt reassured and 56 percent felt more confident, but 25 percent indicated that they were overwhelmed by the amount of online information, 18 percent were confused by the information, and 10 percent were frightened by information.[11]

From those findings, it is clear that some people have positive experiences that help them learn more about illnesses and treatments but that others have difficulty dealing with the new world of online information. They do not feel comfortable searching for information online, and they get confused or overwhelmed by what they find at medical websites. Although the positive views outweigh the negative, significant segments of the population still feel queasy about employing digital medicine to meet their own health care needs.

BENEFITS OF ELECTRONIC HEALTH

Concerns about health care quality, affordability, and accessibility have led policymakers in recent years to see more widespread adoption of health information technology as a way to improve the efficiency and effectiveness of health care and to cut costs. Through Internet websites, broadband access, e-mail communications, online procurement, and electronic record keeping, national leaders see digital technology as a valuable tool for bringing U.S. health care into the twenty-first century.[12]

The United States spends $2 trillion a year on health care, which is around 16 percent of the gross domestic product.[13] That is twice the amount spent in 1995, when spending topped $1 trillion for the first time. With health care spending increasing at 6.7 percent a year, expenditures are projected to rise to 20 percent of GDP by 2015.[14] Medicaid spending has increased by more than 45 percent, to $311 billion, since 2000. Medicare spending has risen by 38 percent and now exceeds $400 billion.[15] Health insurance premiums have shown double-digit increases in recent years, well above the rate of inflation.[16]

Rising costs have placed enormous pressures on public and private health care systems. Although individual consumers typically report a high level of satisfaction with their personal care, the United States performs poorly on a variety of aggregate health indicators.[17] Forty-five million

Americans (about 17 percent) lack access to health insurance.[18] U.S. life expectancy trails that of other industrialized countries.[19]

In such circumstances, many people worry whether they are receiving adequate care and treatment, especially in light of widespread reporting of adverse drug events and other problems.[20] Around 98,000 Americans die each year because of medical errors.[21] Others distrust managed care and the incentives it offers health providers to control costs by restricting treatment.[22]

To deal with competing demands for economy, efficiency, and effectiveness, expenditures on health information technology are rising rapidly. In 2000, the United States spent around $19 billion in this area; according to the American Hospital Association, the figure jumped to $31 billion in 2006. The typical health care organization devotes a modest 2.5 percent of its annual budget to information technology, about the same as public sector organizations in other policy areas.[23] Much of that investment is designed to deliver services while keeping expenses at reasonable levels.

In 2004, President George W. Bush signed an executive order creating the Office of the National Coordinator for Health Information Technology, which is charged with devising medical policies that use technology to improve health care quality, reduce costs, and coordinate medical care among different medical professionals. The goal is to use new technologies to facilitate a variety of functions, including diagnostic support, computerized physician order entry and verification, electronic claims processing and eligibility checking, secure communications, alternative information gathering, and electronic reminders.

Former U.S. House Speaker Newt Gingrich sees information technology as a panacea for service problems and rising health care costs.[24] Gingrich believes that patients can be empowered and errors in patient records reduced through electronic medical records and digital communications with doctors. Rather than allowing medical costs to continue to spiral out of control, health care professionals can use these new tools to cut costs while giving consumers more control over health care information.

During her presidential campaign, Senator Hillary Clinton placed health information technology at the center of her American Health Choices Plan, which called for universal coverage that would cost around $110 billion to implement. Half of the money to finance coverage would come from "public savings generated from Senator Clinton's broader agenda to modernize the health systems and reduce wasteful

health spending." The savings would include money recouped from the use of electronic health records and other forms of digital medical accounting systems.[25]

In 2008, then senator Barack Obama argued that electronic technology could improve health care quality, affordability, and efficiency. He proposed investing $10 billion annually over the next five years "to move the U.S. health care system to broad adoption of standards-based electronic health information systems, including electronic health records." Obama claimed that if the nation committed sufficient funds, it would save up to $77 billion each year "through improvements such as reduced hospital stays, avoidance of duplicative and unnecessary testing, more appropriate drug utilization, and other efficiencies."[26]

Medical experts estimate that effective implementation of electronic medical records could save $81 billion a year by improving health care efficiency and safety. Financial savings could grow to twice that amount by facilitating the prevention and management of chronic disease through health information technology.[27] A study of eighty controlled clinical trials to evaluate the efficacy of distance-technology supplements to conventional clinical practice found a strong association between positive health outcomes and use of computerized and telephone communications for follow-up, counseling, reminders, screening, after-hours access, and touch-tone interactive systems. Sixty-three percent of the studies reviewed found improved performance or other significant benefits.[28]

In a separate randomized controlled trial, patients using an Internet portal through which they could send secure messages directly to their physicians as well as request appointments, prescription refills, and referrals demonstrated increased satisfaction with communication, convenience, and overall care.[29] Another study of national health care quality indicators found that adoption of health information technology reduced medication errors and improved productivity.[30] Such results suggest that health information technology offers great hope for the future to individual consumers.

Some parts of the U.S. health care system, notably Veterans Administration (VA) hospitals, already have embraced digital technology. Whereas only 15 percent of U.S. physicians employ computer order entry, 94 percent of veterans' outpatient prescriptions are ordered electronically, as are nearly all inpatient medications. A comparison of VA and non-VA facilities in twelve communities found that VA patient care "scored higher on care quality, chronic disease care, and preventive care."[31]

Ordinary Americans believe that health information technology will improve medical care. In a 2006 Wall Street Journal Online/Harris Interactive Health-Care Poll, 68 percent of those polled in a national study indicated that the use of electronic medical records would improve the quality of care that patients receive by reducing the number of redundant or unnecessary tests and procedures; 60 percent thought that electronic medical records could significantly reduce health care costs; and 55 percent believed that such records could significantly decrease the frequency of medical errors.[32] Those figures demonstrate that the potential for improvements in health care treatment through digital medicine is quite high.

BARRIERS TO INNOVATION IN TECHNOLOGY

Technology offers great hope for the future, but a number of barriers remain to successful implementation in the health care arena. The real problem in health care is not technology per se but political, social, and economic challenges that complicate the adoption of digital technologies. Ordinary people have been slow to embrace technology in managing their personal health care. Consumers worry about the confidentiality of medical records, and professionals fear that the costs of technology will outweigh the benefits.

Research suggests that patients worry that the emergence of digital medicine will lower health care quality and lead to unmet health care needs. Work by Sciamanna and colleagues, for example, suggests that patients like to be able to schedule appointments online but worry about the quality of care provided online; some patients in primary care practices were concerned, for example, that they would not receive all the tests and treatments that they might require if they relied on Internet consultations.[33]

Such obstacles have made it very difficult to gain the benefits of health information technology for the system as a whole. Individual applications often sound very promising at first. Consumers like the convenience and efficiency of digital medical resources, but unless patients, insurers, health care professionals, and public officials are able to overcome the major barriers, the electronic revolution in health care will be quite limited. As discussed below, a variety of factors have slowed the adoption of health information technology in the United States.

Political Divisions

Health care is a highly politicized policy issue that has aroused intense conflict between the major political parties and among powerful interest groups, ordinary consumers, hospitals, insurers, pharmaceutical companies, and the different levels of government. Change is difficult because most of the major actors are suspicious of the motives and aims of their adversaries. Given the intense partisanship and divisive conflict surrounding health care, it is difficult for technology advocates to convince policymakers, health officials, or ordinary folks to incorporate new information technologies into service delivery.

President Bill Clinton attempted to reform the U.S. health care system in 1993–94 but failed to get Congress to take even a single vote on his plan. Although Democrats held the presidency, Senate, and House, they were unable to reach consensus on key aspects of a new system. Opponents successfully attacked the proposal as "big government" and "inefficient bureaucracy." Support for the proposed plan for health care reform started out strong but faded over time as people learned more about it.[34]

Historically, the United States has adopted major changes in health care only about once every generation. The political divisions are so severe that, short of a crisis, it is hard to build a coalition for change. People may be dissatisfied with specific aspects of health care, but it is difficult to mobilize individuals with diverse sources of dissatisfaction into a winning coalition. The widespread polarization around this issue keeps most leaders from attempting fundamental reform or succeeding if they seek to make meaningful change. Even with costs continuing to rise and millions of Americans uninsured, political leaders remain immobilized on this key issue.

Fragmented Jurisdiction

Reform has been complicated further by the fractured responsibility for the nation's health care system and telecommunications infrastructure that exists among the different levels of government. Jurisdictional uncertainties have contributed to limited investment in health information technology by both the federal and state governments. The United States lags far behind such countries as the United Kingdom, Germany, and Canada in speed and use of broadband capabilities.[35] As "laboratories of democracy," states have long been innovators in health policy;[36]

however, different regulatory environments and interstate inequities in health care make it difficult to rationalize government efforts to coordinate technology development and implementation.[37] That is one reason why countries with more centralized health care systems have proven far more successful than the United States in adopting uniform health information standards.

Indeed, the problem of communication between incompatible digital systems is a major challenge in a decentralized system. Dubbed "interoperability," this issue is aggravated in the United States because different government jurisdictions have different legal requirements and health care providers often employ hardware and software systems that are incompatible with those of other providers. The lack of uniform technical standards across the country makes it difficult to move forward with health information technology. In centralized and hierarchical systems, authorities can mandate common technologies for health care providers. But in the United States, it has been difficult to produce agreement regarding how digital medicine should unfold. Sometimes care seems to be provided within a tower of Babel. Every locality and every hospital has a different computer operating system and none is able to connect well with others. The result has been low use of information technology. No one wants to be stuck with the equivalent of a Betamax recording system at a time when the world has moved toward other formats.

Digital Divide

Not all Americans share in the advantages of technology. National estimates indicate that between 31 and 40 percent of adults use the Internet to search for health information, 5 percent use the Internet to purchase prescription drugs online, and 5 percent use e-mail to contact health care providers.[38] Taken together, those findings indicate that the online revolution is taking place at a slower rate than hoped for by policymakers.

Researchers convened by the American Medical Informatics Association have found that "a digital divide remains for vulnerable populations most likely to be underserved."[39] There are well-documented gaps in health care in the United States, and many of the disparities have carried over into the world of digital medicine.[40] Individuals who have low incomes, who are poorly educated, and who live in rural areas have less access to quality medical care than those who have higher incomes and education and live in metropolitan communities.

One reason is that members of underserved groups are less likely to use the Internet, visit health care websites, or have broadband capability.[41] Rather than overcoming inequality, technology reinforces existing systemic inequities based on age, gender, race, income, education, and geographic location. Indeed, preliminary results indicate that poor, older, rural males who are poorly educated make less use of digital communications. Such lack of access and use limits the ability of health information technology to make a positive difference in people's lives.[42]

In addition, access to technology's benefits is limited because most online health information is written at a reading level that is well above that of many users or because it is inaccurate, incomplete, or inconsistent.[43] Higher reading levels reinforce disparities in use because, according to the most recent national statistics, literacy levels differ by income, education, race, and ethnicity.[44]

Those disparities are especially salient because of the clear links between poor health literacy and inadequate understanding of medical treatment.[45] Although barriers to adoption may be especially difficult to overcome in regions that lack the infrastructure and resources necessary to sustain health information technology use and development, the promise of e-health for improving access to health information and services should be available to everyone.[46]

The extent of the disparities also is important because of its direct relationship to service delivery and costs. Use of health information technology must increase much more if the full potential of digital medicine is to be realized. It is impossible to obtain economies of scale unless the use rate is high enough to spread the costs of technology over a wide population. Unless policymakers can overcome the gaps based on race, gender, age, education, income, and geography, it will prove difficult to achieve the gains promised by information technology proponents.[47]

Cost of Technology

The high cost of electronic technologies has slowed the digital revolution. Not only is there concern about the overall cost of new devices, there is anxiety among doctors, patients, hospitals, and insurers over who will pay. The national cost of adopting electronic health records in the United States is estimated at between $276 and $320 billion over a ten-year period. For a medium-size hospital, such a system would cost about $2.7 million in development expenses and $250,000 a year in maintenance.[48]

The overall cost of a national health information system is thought to be around $156 billion in capital investment over five years and $48 billion in annual operating expenses. About two-thirds of the investment would cover system development, while one-third would go toward making systems interoperable. For medical organizations with limited financial resources, the costs are high enough to be considered prohibitive. The result in many health facilities has been failure to invest in information technology.[49]

The major barrier to investment has been that costs are concentrated while benefits are spread out among many people, which makes it difficult to build the political coalition necessary for financing major expenditures. It is easier to delay spending due to high costs, and it is difficult for hospitals, doctors, and other medical providers who would receive funding to convince others that such funding is an effective use of public monies.

Network-based health care suffers from a problem similar to that which plagued the early days of telephony. It is hard for providers to reap the true benefits of innovation until others join the digital revolution. Just as owning a telephone offered few benefits until the owner's friends and family members also had a phone, health care providers cannot achieve all the service enhancements and cost savings of technology unless others join the network. Patients whose doctors cannot access digital records will not benefit even if the most modern systems are implemented.

Congress passed legislation in 2006 that authorized a mere $125 million in expenditures for health information technology in 2006 and $155 million in 2007. It has been estimated that the country needs to invest billions in capital and operating funds to create an adequate system, and these paltry sums show the inadequacy of proposed federal spending.[50] Much more in the way of financing needs to be invested for an industry that comprises such a substantial part of the nation's GDP.

Of the member countries of the Organization for Economic Cooperation and Development, the United States spends the most on health care but lags behind the others in adoption of health-related technology.[51] It also is behind much of the developed world in adoption of electronic medical records. According to a survey undertaken by the Office of the National Coordinator for Health Information Technology, only 10 percent of physicians use a "fully operational" device that collects and stores patients' records.[52]

Financial costs are one of the major barriers to adoption. Dick Gibson, the chief medical information officer of Providence Health System, said that adoption "is not a financial play for them right now. Most docs who do it say they do it because it's the right thing to do. We know that the patient gets most of the benefit, the health plans get the rest, and the doctor is the one who has to pay for it."[53] Gibson's remarks suggest that is is not financially viable for health care providers to invest in new technology.

Ethical Conflicts

Innovation in technology also is constrained by real or perceived conflicts of interest. Although there have been few systematic studies of the quality or accuracy of viewpoints represented, private sites are much more likely to feature product ads and to push products manufactured by site sponsors.[54] In contrast, most public sector sites accept no commercial advertising or offer products on a for-profit basis.[55] Consumer concerns about the accuracy and quality of health care information, especially on commercial sites, limit public use of and confidence in these resources.

Some studies have questioned the reliability and accuracy of medical information stored on electronic devices. A research project by Eysenbach and colleagues, for example, shows that medical websites vary enormously in the validity of their online information.[56] Although the amount of accessible information has risen dramatically in recent years, there are few content standards. Some information is incomplete or inaccurate, or it is sponsored by pharmaceutical interests with a financial stake in particular treatments.

Potential conflicts of interest are important because national surveys have found that 75 percent of Americans report that they rarely check the source or date of medical resources found online.[57] Internet users are apt to take what they see online at face value instead of doing any fact checking or raising questions about the objectivity of the material viewed. Such behavior restricts consumers' ability to derive full benefits from digital information sources.

In addition, disturbing variations exist in website quality by sponsorship status. Private sector sites have the highest level of real or potential conflicts of interest because they are sponsored by for-profit entities, such as medical equipment and pharmaceutical manufacturers. We

demonstrate that it is difficult for private site visitors to protect themselves from self-interested medical advice or commercial advertising because of the way in which the information is presented on these sites. For example, it often is difficult to distinguish impartial advice from sponsored links.

Private sites also are more likely than public sector sites to follow niche strategies. Rather than seeking to serve all constituents, for-profit sites focus on particular illnesses that offer them the opportunity to make money or on expensive prescription drugs manufactured by site sponsors. That means that medical information found online must be taken with great caution.

Privacy Concerns

A final problem that constrains technology adoption is worry about privacy and security issues related to the use of electronic devices. According to survey data, many Americans are concerned about the confidentiality of online medical information,[58] and 62 percent of adults in a recent national poll felt that use of electronic medical records makes it more difficult to ensure patients' privacy.[59] Seventy-five percent of Internet users worried that health care websites would share their personal information without their permission.[60]

A significant percentage of web visitors said that they do not take advantage of online medical resources because of fear that their information will be compromised. Forty percent said they will not give a doctor online access to their medical records, 25 percent said that they will not buy online prescriptions, and 16 percent said that they will not register at medical websites. Overall, 17 percent refused to seek medical advice online due to privacy fears. Nearly 80 percent claimed that a detailed privacy policy would improve their interest in taking advantage of online medical resources.[61]

Americans fear that confidential information stored on digital devices will be compromised and communicated to others. While those fears also exist with regard to paper records, the concern about electronic information makes people less willing to adopt digital records and use them to store sensitive information. A Pew Internet and American Life Project found that 85 percent of U.S. consumers fear that their health insurance company might raise their rates if the company discovers what health care websites they have visited. Sixty-three percent believe that placing medical records online is "a bad thing," even if the material is protected

by a security password.[62] Seventeen percent of people in a Harris Interactive survey reported that they withhold information from medical personnel due to concerns that those individuals would disclose the data to others without unauthorizztion.[63]

Research has found that security breaches of computerized information are more common in the United States than in Europe.[64] Many European nations have strict privacy laws that protect patient confidentiality, but the United States has a patchwork of state and federal rules that are not always effective in doing so. Data collection is a growth industry in the United States, with a number of firms such as ChoicePoint and Acxiom selling people's private information. Commercial firms in Europe face many more restrictions on their ability to compile information without someone's personal consent.[65]

OUTLINE OF THE STUDY

In order to evaluate the claims of health information advocates, it is important to collect empirical data regarding online content, sponsorship status, public usage, the relationship between use of e-health information sources and attitudes about health care, and experiences with technology outside the United States. Digital medicine is an area in which claims often are made without adequate testing of key propositions. Only by having basic knowledge about the supply and demand sides of digital medicine is it possible to understand the realistic potential for electronic health.

This research relies on several original data sources to investigate the promise and benefits of health information technology. One source is a November 2005 national telephone survey of 928 Americans eighteen years of age or older (see appendix A for poll methodology and questions) that assesses use of health care technology, disparities among different social and economic groups, and obstacles to use of information technology in the health care arena.

Using results from this survey, we compare use of conventional in-person and telephone interactions with physicians and other health care providers with use of digital communication strategies such as e-mail contact with providers, health website visits, and online purchases of prescription drugs and other medical products. We find that most people feel more comfortable using conventional personal and phone-based interactions than health information technology, and we document

disparities in health-related Internet use by region and by user's socioeconomic status and attitude. We also assess potential reasons and strategies for addressing prevailing disparities.

We employ a national survey because the public perspective is important to the future of digital medicine. How people feel about technology, what drives their reactions, and what obstacles they see to the use of health information technology are crucial. Aggregate studies of technology use that compare it with health outcomes cannot assess an individual's experiences and motivations. Even when clear positive or negative relationships exist, it is not clear why they develop. One of the virtues of public surveys is that they let researchers discern why people feel the way that they do and determine what would induce them to make greater use of information technology than they currently do. That is especially important given the worries that many Americans have expressed about online security and privacy.

Whether people who rely on digital resources have attitudes and behaviors that differ from those of people who do not is an important question. Rather than accept the word of technology advocates, it is crucial to investigate the impact of digital medicine on consumers. Is there any association between type of interaction with health care professionals and how people judge quality, access, or affordability? For example, are those who visit websites, communicate electronically with doctors, or order medications online any more likely to say that they experience good quality health care that is affordable and accessible? Surveys allow us to investigate those perceptions and link them to demographic background and social and political variables.

If there is no difference in attitudes between those using digital and conventional medical care, it casts doubt on whether electronic health technology can deliver the benefits claimed by its advocates. E-health must offer the hope of improved services and cheaper medical care; it makes little sense to invest substantial resources in technology innovation otherwise. It costs large amounts of money to create electronic medical records, build the broadband infrastructure necessary for maintaining quality websites, and devise two-way communications systems between doctors and patients. Digital medicine needs to provide benefits greater than those provided by the current system in order to justify the upfront costs of implementing new technology. Policymakers need to know what the greatest benefits are as they consider alternative strategies for promoting technological innovation.

To assess the impact of site sponsorship, we analyze the content of government, commercial, and nonprofit health websites. We focus in particular on the kind of information and services online, potential or real conflicts of interest in the material provided, and the extent to which sites can be accessed by disabled people, those who are not proficient in the English language, and those with low literacy. This part of our study investigates health department websites maintained by the fifty U.S. state governments as well as the most popular commercial and nonprofit sites (see appendix B for the list of U.S. websites examined). In particular, we are interested in how health websites maintained by nongovernment entities handle advertising, sponsorship disclosure, access for people with disabilities and those who do not understand the language, and readability (see appendix D for details on the content analysis).

We use Watchfire WebXM software to evaluate the accessibility of websites for those who have physical impairments (especially those who are visually impaired) and the Flesch-Kincaid readability test employed by the U.S. Department of Defense to determine whether websites are written at a grade level that those with limited literacy can understand. We check to see what languages are represented on health websites as a means of evaluating non-native speakers' access to information. We search sites to determine the quality of privacy or security policies and whether they prohibit commercial marketing of visitor information; use of cookies, which automatically create electronic profiles of website visitors; disclosure of personal information without prior consent of the visitor; and disclosure of visitor information to law enforcement agents. We suggest remedies based on our findings that will improve the accessibility, privacy, and security of health information posted online.

Finally, to study global political and social dynamics, we present a content analysis of national government health departments around the world (see appendix C) and non-U.S. case studies of health information technology to determine what works and what does not in the area of health information technology. The content analysis looks at the same considerations as in the U.S. study. We study websites to see how they handle privacy and security, whether sites can be accessed by people with physical impairments and non-native speakers, and whether sites accept commercial advertising.

Using non-U.S. examples, we study how officials in various countries have implemented health information technology. Asian and European countries, for example, have placed a tremendous amount of health

information online using high-speed broadband technology that allows them to read X-rays, CT scans, and other materials included in electronic health records at a distance, thereby improving the speed and quality of health care delivery. We draw on those experiences to help understand innovations in delivery of health care information in a variety of political, social, and economic settings and to compare the U.S. experience with that in other countries.

By looking at survey data, website content information, and case studies of successful use of technology, we seek to understand where the United States is in the technology revolution and what steps need to be taken in order to extend the benefits of digital medicine to all people. Right now, numerous obstacles need to be overcome. Through better understanding of the e-health revolution, it will be possible to move rapidly into the future and overcome many of the barriers that currently exist.