

Toward a Consumer-to-Healthcare Provider (C2H) Electronic Marketplace

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Abstract

Recent technological advances and the heightened expectations of e-health consumers are about to transform the U.S. health care industry. As consumers demand more online services, physicians respond by adopting information technology into their daily routines. In this paper, we first present recent developments within the telemedicine field that necessitate the establishment of a consumer-to-healthcare provider (C2H) electronic marketplace. Next, we discuss the services this marketplace should offer to both consumers and physicians for it to thrive in this extensively regulated industry. Finally, we compare these services with those provided by what we call a “first-generation C2H marketplace”—a comparison that clearly outlines practical implications for the C2H marketplaces of the future.

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I. Introduction

It has become obvious that e-health consumers are no longer the traditionally passive and compliant “patients” and that they are about to transform the U.S. health care industry. As this new class of consumers compare the online services offered in other industries, such as banking and travel, their expectations from health care providers also increase (see Figure 1). Empowered and energized by the Internet, e-health consumers demand various online services that would make their interaction with health care providers a more worthwhile experience. In a recent article in *Communications of the ACM*, Wilson (2003) discussed how asynchronous health care communication between doctors and patients would drive the growth for both telemedicine and e-health. In this article, we present recent developments in e-health, which seem to be directed toward the establishment of a consumer-to-healthcare provider (C2H) electronic marketplace. By providing a one-stop shopping experience, the C2H electronic marketplace of the future will likely be the definitive response to the heightened expectations of e-health consumers.

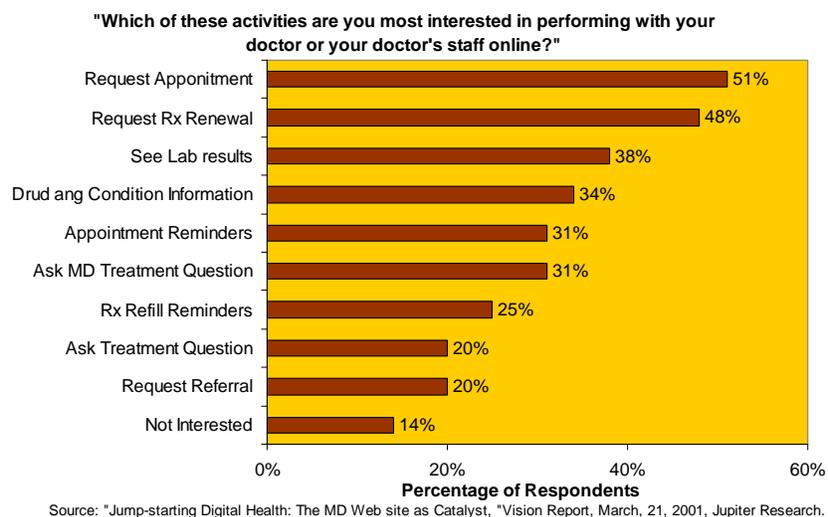


Figure 1. Consumer's interest in conducting various e-health activities

Telemedicine is the use of telecommunications to facilitate consultations between healthcare providers and remote patients and between specialists and primary care physicians

using a virtual private network. E-health is the use of the Internet to deliver access to healthcare information, commerce, clinical care, and other health services (Maheu et al., 2001). Patients are typically the objects in telemedicine systems rather than active participants as in e-health. E-health is a newer field and has been growing faster than telemedicine (Wilson, 2003). This article focuses on provider-delivered e-health, which is the domain of e-health that is related with a patient's own healthcare provider rather than generic health information sources such as WebMD.¹ Major forms of provider-delivered e-health include the provision of online medical information, electronic medical records, online consultations, and electronic prescribing. In the following sections, we discuss consumer expectations and recent developments in each of these e-health areas, which collectively suggest the need for the establishment of a C2H marketplace. We then describe the services this marketplace will have to offer and the implications for information systems (IS) researchers.

II. Search for Medical Information on the Internet

A growing number of Americans gather information about medical conditions online, often even before their own doctors diagnose their ailments. According to a survey released by the Pew Charitable Trust's Internet and American Life Project, 80 percent of adult Internet users in the U.S. searched for at least one of 16 major health topics online by December 2002, compared to only 54 percent who said they had looked for health and medical information online by March 2000 (Fox and Fallows, 2003). This trend transforms, and sometimes strains, the traditional physician-patient relationship because those who use the Internet frequently ask their physicians more specific questions and suggest specific illnesses and treatments. The Switzerland-based international watchdog—Health on the Net Foundation—surveyed consumers, health care professionals, and medical professionals from the United

¹ We are grateful to the department editor for this clarification.

States, Europe, Canada, and South America in May and June of 2002 (Vallis, 2003). The results of this survey suggest that 62 percent of consumers discussed their internet findings with a doctor and 47 percent used the Internet for a second opinion. Thirty-seven percent used online consultation services. Of the medical professionals, 83 percent used the web to search for information on drugs and 63 percent recommended medical web sites to patients. These figures suggest that medical information is a highly demanded good on the Internet, which could be provided as a value-added service in a C2H marketplace.

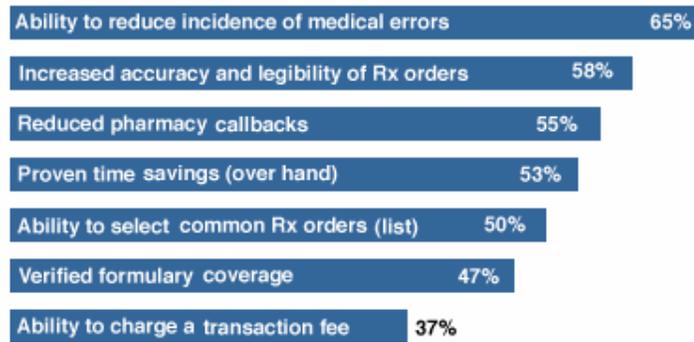
III. Electronic Prescribing

Medical literature reports that electronic prescribing has several advantages. The Agency for Healthcare Research and Quality estimates that up to 95% of adverse drug events can be prevented by reducing medical errors through computerized physician order entry systems (Ferguson, 2003). Similarly, the Canadian Institute for Health Information's annual report shows that hundreds of lives could be saved every year if Canada had an electronic drug prescription system (Vallis, 2003). The report notes that approximately 700 deaths are caused by preventable drug errors each year in Canada, many of which could have been avoided if more doctors had prescribed drugs online. The factors that drive the use of e-prescribing include the ability to reduce incidence of medical errors, increased accuracy and legibility of prescription orders, reduced pharmacy callbacks, time savings, ability to select common prescription orders and to verify formulary coverage and drug interaction, and ability to charge a transaction fee. Despite these advantages, only a small percentage of the 3.1 billion prescriptions in the U.S. are sent via electronic means today. Major organizations such as RxHub, a nonprofit eHealth initiative, are trying to encourage doctors to prescribe electronically.

E-prescribing is the fastest growing online patient-care tool according to the Boston Consulting Group's (BCG) recent report, "Vital Signs: e-health in the United States"(Von Knoop et al., 2003). BCG argues that e-prescribing will have a major impact on the entire health care industry over the next three to five years and may potentially transform relationships between managed-care players and pharmaceutical companies. According to their survey, 36% of patients now desire computerized prescriptions, while 31% of doctors are using or planning to use the tool. In a separate survey released by Medical Mutual and Medco Health Solutions, Inc., 83% of Cleveland-area physicians believe that within the next seven years, more than half of all medications being prescribed will be done through the use of e-prescribing technology (21% said this milestone would be reached by 2005) (Business Wire, 2003). This perspective is not only held by younger physicians, who may be more apt to use technology, but is shared by 46% of physicians over the age of 50, an age group considered by many to be more adverse to switching from written prescriptions to e-prescribing. Another recent survey of 1,042 American adults conducted by Harris Interactive finds that 82% of them prefer electronic transmission to handwritten prescriptions and 40% value e-prescribing's ability to minimize errors associated with handwritten prescriptions (Ferguson, 2003).

Given the strong demand for e-prescribing, several projects are underway to make e-prescribing a reality. Perhaps the most important of these projects is the formation of the Chain Pharmacy Advisory Council in June 2003 to provide strategic and technical input for a technology platform that simplifies the e-prescribing process for pharmacists and physicians. The Council's members include CVS Corp., Walgreen Co., Rite Aid Corp., Wal-Mart Stores, Inc. and Eckerd Corp., which together represent more than 68% of the 34,000 chain pharmacies in the United States (Ferguson, 2003). Figure 2 outlines the drivers of electronic prescribing.

What doctors who aren't e-prescribing think will drive the trend...



Source: Manhattan Research

Figure 2. Future drivers of electronic prescribing

IV. Electronic Health Records (EHR)

Health-care policy experts have been urging medical institutions to digitize their paper-based records to reduce medication errors and other mistakes caused by erroneous and incomplete patient information. Further, President George W. Bush set the nationwide use of electronic health records (EHR) as a priority in his State of the Union addresses in both 2004 and 2005,² called for widespread adoption within the next decade, and announced plans to have this effort led by a new, highly visible federal position—a national health information technology coordinator who would report directly to the Health and Human Services Secretary. Surveys by Deloitte and Touche indicate that over half of the hospitals in the US are in the process of implementing electronic patient record systems (Anderson, 2000). In February 2003, Kaiser Permanente, the nation’s largest nonprofit health-maintenance organization, announced that it planned to spend \$1.8 billion to automate its patient files. Medem ([medem.com](http://www.medem.com)), a for-profit venture of the American Medical Association (AMA) and several other medical societies, also announced that it would integrate its databases of patients’ records, allowing access by doctors both in private practice and at hospitals. According to Manhattan Research L.L.C.,

² See <http://www.whitehouse.gov/stateoftheunion/2004/> and <http://www.whitehouse.gov/stateoftheunion/2005/>.

physician use of EHR software exceeded 20 percent by April 2005 (Manhattan Research, 2005). While the digitization and integration of medical records will help doctors in providing better care, it will also improve patients' access to their personal health information and their ability to seek care from other, potentially remote, experts. Sharing EHR across various stakeholders would also improve efficiency by eliminating redundant treatments and directing patients to better providers. Employers would be able to cut costs of employee benefits, while the federal government and the states could reduce Medicare and Medicaid fraud and abuse through better tracking of patients, providers, and procedures (Bender et al., 2006).

EHRs represent the ability to easily share medical information among various stakeholders (patients, healthcare providers, employers, payers/insurers, and government) and to have a patient's information follow him or her through the various modalities of care engaged by that individual (Garets and Davis, 2006). Table 1 highlights some of the initiatives in different states that provide an EHR infrastructure to health care organizations. According to Landro (2004b), more than 600,000 patients in New York's Hudson Valley are blazing a trail with a new regional medical information network that lets area hospitals, doctors, labs, and pharmacies share medical records securely over the Internet.

NAME	LOCATION	NETWORK
MA-SHARE	Massachusetts	Allows state emergency departments to access patient medical and prescription drug histories and use e-prescribing technology.
Santa Barbara County Care Data Exchange	Santa Barbara, Calif	Shares patient data electronically among 75% of leading health care providers in county.
Tri-Cities Care Data Exchange	Tennessee; Virginia	Exchanges health care data electronically in Appalachian region.
Connecting Colorado Communities eHealth Initiative	Denver	Shares data from four health care systems in Denver affiliated with University of Colorado Health Sciences Center and Kaiser Permanente that serves more than 550,000 residents.
Indiana Health Information Exchange	Central Indiana	Community-wide clinical messaging system allows regional doctors to use electronic mailbox to share patient data.

Source: Landro (2004b)

Table 1. Some prominent EHR initiatives

The creation of a healthcare information infrastructure requires the integration of existing and new architectures, application systems, and services, and thus is a costly initiative. Bender et.al 2006 estimate that building and updating the IT infrastructure to implement EHR could require an initial investment of \$200 billion. Such an infrastructure would facilitate patient-centered care through EHR systems, continuity of care through sharing of patient information across networks, and outcomes measurement aided by the greater availability of and specificity of healthcare information, and is expected to generate total annual savings of about \$100 billion from increases in efficiency and effectiveness in the delivery of care. However, to make the diverse components of the infrastructure to work together, healthcare information standards (classifications, guides, practices, and terminology) need to be developed. A technical committee of the International Organization for Standardization (ISO) is currently working on standardization of healthcare models, healthcare records and care functions, privacy, confidentiality, security, and healthcare communications and application functions.

V. Online Consultations

Benefits. Given the recent decline in patient satisfaction with primary care clinical practices and physician-patient communications (Safran, 2003), physicians can offer online consultations as a supplementary service to remedy the problem. In fact, a recent report of the Institute of Medicine, *Crossing the Quality Chasm*, states that “patients should receive care whenever they need it and in many forms, not just face-to-face visits ... access to care should be provided over the Internet, by telephone, and by other means” (Institute of Medicine, 2001). Major benefits of online consultations for patients include a greater degree of control over medical records, the ability to compose questions better and save e-mails to

re-read instructions, and a less intimidating venue due to the “relative anonymity,” which allows some level of disinhibition for patients to ask questions they may not ask otherwise.

Amenable Services. Online consultations are reported to be especially useful for management of chronic conditions, such as diabetes, asthma, hypertension, and heart problems (Freudenheim, 2005). Therefore, these services should be offered to chronic disease populations for whom prescription refills, appointments, and laboratory tests are most frequent, rather than to healthy populations with intermittent illnesses requiring diagnostic evaluation. Online consultations should not be used for emergencies and other time-sensitive issues, such as chest pain, shortness of breath, bleeding, or active solicitation of highly sensitive information. To ensure this, patients need to be educated and frequently reminded about the rules of use, and a mention of this education be documented in the medical record (Kane and Sands, 1998). Issues of race/ethnicity should be taken into account while educating patients, especially given the documented link between greater healthcare satisfaction and race concordance of doctors and patients (Laveist and Nuru-Deter, 2002). Figure 3 shows the services currently rendered via online consultations, most of which are geared toward addressing low-profile symptoms, chronic conditions, and medication-management issues (Landro, 2004a).

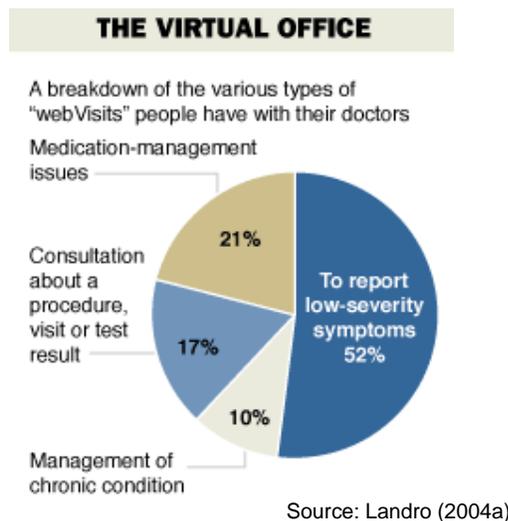


Figure 3. Services offered via online consultations

Liability for Online Consultations. At this juncture, the liability concerns generate more questions than answers. To address the potential online liability issues, 30 malpractice carriers representing more than 70 percent of the nation's insured physicians, more than a dozen medical societies, and representatives of state medical boards established the eRisk Working Group for Healthcare in June 2000. Its guidelines announced in October 2002 suggest the following:³

- Physicians should develop specific rules for online communications, such as avoiding emergency use and setting appropriate expectations for response times. These rules should become part of the legal documentation and medical record.
- Since all physician-patient interactions are subject to requirements of state licensure, physicians should not communicate with individuals located outside the state(s) in which they hold a license.
- The physician providing the clinical information should make his or her identity clear to the patient.
- New diagnosis and treatment of conditions, conducted solely online, may increase the liability exposure. Therefore, physicians should distinguish between online consultations related to pre-existing conditions, ongoing treatment, follow-up questions, etc., and solely online new diagnosis and treatment.

Current Practices. A study of 1,200 physicians conducted in 2002 by Deloitte and Touche and Fulcrum Analytics indicates that 23 percent of physicians said they used e-mail to communicate with patients, a 4 percent increase over 2001 (Ferguson, 2003). However, doctors also said they expected an average of \$57 reimbursement for a 15-minute e-consultation. Fifty-four percent of those who did not use e-mail expressed a need for

³ See http://www.medem.com/phy/phy_eriskguidelines.cfm.

reimbursement to stimulate use. A Harris Interactive poll indicated that 40 percent of patients were willing to pay for online consultations (Ferguson, 2003).

Many web sites facilitate online consultations; perhaps the most notable one is that of RelayHealth. The site (relayhealth.com) lets patients search online for doctors who offer e-mail consultations and has enrolled more than 4,000 physicians by July 2005. Some of the top experts in the nation provide online second opinions for important diagnosis and treatment issues. The Cleveland Clinic, a multi-specialty academic medical center in Cleveland, developed an online second opinion service, the eClevelandClinic, in 2002 as an addition to its face-to-face service. The eClevelandClinic serves patients who need advice, and possibly a major intervention, but who cannot easily access the doctors in person. The online second opinion option is limited to life-threatening and life-altering conditions that can be safely assessed online, such as cancer diagnoses, cardiac procedures, joint replacements, and neurological problems. Three Harvard University teaching hospitals have also initiated a similar service. Interestingly, a recent review of cases found that the Harvard doctors disagreed with the initial diagnosis only 5 percent of the time, whereas they disagreed with the treatment plan 90 percent of the time (Parker-Pope, 2003). Table 2a provides information about some of the current online consultation providers mainly for initial consultations and minor illnesses. Table 2b shows second opinion providers on the web.

WEB SITE	PRICE	WAIT TIME	SERVICE
NetLiveMd.com	\$15; \$49/year	Within 24 hours.	A single opinion.
AskADoctor.com	\$19.95	Within 48 hours.	3 doctors' opinions.
ECureMe.com	\$19.95	Within 2 business days.	3 doctors' opinions.
MedicalWeb.com	\$19.95	Within 24 hours.	A single opinion.
MyPhysicians.com	\$19 (primary-care physician); \$15 (specialist physician)	Within 24 hours.	A single opinion.

Table 2a. Consultations on the web

WEB SITE	PRICE	WAIT TIME ¹	SERVICE
eclevelandclinic.com	\$565 - \$745	5 to 7 business days	Cleveland Clinic doctors offer advice directly to patients facing life-threatening and life-altering diagnoses.
econsults.partners.org	\$450 - \$750	5 business days	Doctors at three Harvard teaching hospitals consult with the patient's physician.
mdexpert.com	\$2,800 - \$3,200	5 business days	Top cancer doctors around the country consult with the patient's physician.

¹ Upon receipt of all relevant clinical information and a complete patient history, as reported by the site.

Table 2b. Second opinions on the web

To receive an online second opinion from these institutions, patients provide a personal medical history and the original diagnosis, as well as other relevant materials, such as test results, MRI, films, x-rays, and a consent form. After receiving the materials, the providers assign the case to one of the specialists based on expertise and availability. While patients observe the identity of the specialist that handles their case, they cannot choose the one they actually want. In fact, the process seems to be mainly geared toward extending the reputation of the leading institutions to untapped geographical markets, without adding significantly to the workload of the world-class specialists employed by these institutions. Understandably, top specialists may not want to be inundated by incoming online consultation requests. On the other hand, consumers have a right to know beforehand from whom they will get advice. This problem can be solved by restricting online consultations to existing physician-patient relationships. That is, if a consumer wants to consult to a world-class specialist, she will have to establish herself as a patient of that specialist before submitting an online consultation request. Only then can the prior uncertainty about the identity of the responding doctor be eliminated.

VI. What does the Future Hold?

The C2H electronic marketplace will benefit patients as medical information and expertise become more accessible and as medical errors decline. The related parties, including doctors,

pharmacies, insurance companies, and health care professionals, need to develop strategies about how to participate and provide value in such an environment. A careful analysis of these strategies is very important in light of the fact that the demand for online health services is alive and well, despite the end of the dot-com boom, and will likely change the health care sector significantly.

What we see today are the indications of a networked community of health care providers trying to respond to the expectations of today's Internet-enabled consumers. These developments seem to be directed toward the establishment of a C2H electronic marketplace (see Figure 4). In order to bring together patients, doctors, health insurers, hospitals, pharmacies, and medical suppliers, the C2H marketplace will have to provide sufficient incentives to each of these entities. In what follows, we outline the services that would be of interest to these entities.

Services to Physicians

The marketplace should offer the following services to physicians to ensure their participation:

- *A reimbursement mechanism.* The marketplace should incorporate a payment mechanism so that physicians can command a return for the consultations that are substantive, clinical in nature, and specific to the patient's personal health status.
- *Confidentiality and security of patient information and management of physician liability.* An extensive coverage of federal legislation and the privacy of health care data, such as the Health Insurance Portability & Accountability Act of 1996 (HIPAA), has increased the concern about privacy issues. In order to comply with the privacy regulations of HIPAA, the marketplace will have to employ stronger security features than provided in standard e-mail, which may include server-based messaging, firewalls, encryption, advanced methods of user authentication, and auditability of records. A perfect

transcription of properly administered email consultations will provide an excellent defense in malpractice suits. The marketplace should also take measures to restrict online consultations to established physician-patient relationships, abiding by any applicable state license requirements.

- *Customizable group workflow features.* Triage methods (i.e., using medical staff to read e-mails and thus incorporating electronic communication more effectively into the work flow of the practice) may be essential for group practices. Customizable message routing rules, role-based permissions, establishing email addresses for the practice rather than for individual physicians, are all ways to reduce the involvement of physicians in the communication loop. Future research might compare the perceived value and relative use of physician-directed and triage-based online communications from the perspectives patients and providers (Houston et al., 2004).
- *Integration with third parties.* The marketplace should offer integrated electronic prescribing so that physicians can conveniently submit prescriptions to their patients' preferred pharmacies after they perform an automated check of formulary and drug-interaction information. Integration with payors, on the other hand, would allow physicians to handle both patient eligibility checking and submission of claims to participating health plans.
- *Support for physician-to-physician communication.* The ability to share research results, exchange ideas on treatment options, and refer patients electronically is essential for the physician community.
- *Virtual 3D surgical patients.* Surgeons have recently started to practice with virtual 3D surgical patients before they operate on certain life-threatening cases. This same technology can also be used to perform long-distance robotic surgery, where surgeons use computers and the Internet to perform surgery on a patient at a remote site. The

marketplace, potentially in collaboration with alternate hospitals and software companies, could provide this value-added service to doctors over its secure network. Doctors can comment about their experience with the service to inform other doctors on what works and what does not. The virtual 3D surgical patient technology could be used as an education tool by both doctors and students.

Services to Patients

The patient services of the marketplace should include:

- *Insurance coverage for online consultations.* Since most patients are willing to pay up to only \$10 for an online consultation (Harris Interactive, 2002), the marketplace should make arrangements with payors to cover the remaining part of the bill. This should not be difficult, given that several health plans are already beyond the feasibility-testing stage in this regard. For example, Anthem Blue Cross, Cigna, Blue Cross and Blue Shield plans in California, New York, Florida, Massachusetts, New Hampshire, Colorado, and Tennessee have started to pay doctors \$24 to \$30 for each online consultation (Freudenheim, 2005).
- *Rich, trusted medical content.* For the marketplace to offer a one-stop medical experience to patients, it should provide a sufficiently large library of medically reviewed content. Such a library would also allow physicians to broadcast new developments to their patients in a targeted fashion.
- *Integration with physician practices.* The marketplace should be able to communicate with systems within the clinical enterprise, such as electronic health records, scheduling, registration, and billing. This will allow patients to conveniently schedule appointments, get lab and test results, provide updated personal health information to the doctor's office, and make payments. Furthermore, only through integration between the marketplace and physicians' EHR systems can all patient data be stored and maintained locally.

Otherwise, at least some data would have to reside on the servers of the marketplace, causing patients to worry about network outages and the privacy of their data.

- *Reliable information on physicians and their affiliated institutions.* Information on the quality of health care is crucial for patients to make informed decisions, and the availability of this information will further empower patients in their relationship with physicians. In addition to patient satisfaction and physician-rating survey results, the C2H marketplace should provide such information as the gender of the physician, the medical school he or she graduated from, the number of years since graduation, residency and internship, fellowship, licensure, board certification, institutional affiliations, and governmental disciplinary actions, if any, with comparisons to national data when appropriate. The quality of area hospitals and medical centers, which may be obtained from Centers for Medicare and Medicaid, may also be provided so that patients can gauge the quality of the overall health care service they may experience with a certain physician. As patients make more informed provider choices in the marketplace, physicians will be forced to continuously improve their practice.

Services to Pharmacies

If the marketplace can attract physicians and patients, other entities will likely follow. Still, the services outlined below would provide a significant value to pharmacies:

- *Access to a database on drug interaction side effects.* Such a database would help pharmacists check drug complications and inform consumers about potential side effects, which would be important especially when patients receive prescription from multiple doctors.

- *Integration with insurance companies.* Integration would allow pharmacies to determine the correct co-pay for each patient based on their insurance coverage. This would also allow them to seamlessly file claims.
- *Automated prescription refilling.* The marketplace would keep track of prescription refill dates and those that are already filled, helping pharmacies to provide individualized service and improve patient loyalty.
- *Recording patient data.* The marketplace could also allow pharmacies to log the details of their interactions with patients so that they can improve future service.

Services to Hospitals

Hospitals would benefit from the following services:

- *A secure infrastructure to store and share patient information.* The marketplace should facilitate storage and sharing of every conceivable patient data, such as lab results, radiology images, data feeds from home-monitoring systems, and diagnoses. This infrastructure would provide access to relevant patient information, wherever it may be originally stored.
- *Tools to monitor and treat patients from a distance.* By facilitating both the secure transmission of patient data and the utilization of hospitals' resources at remote locations, the marketplace can significantly expand hospitals' effective market size.

Services to Insurers

Valuable services for health insurers would include:

- *Access to patient and provider information.* Insurers currently rely on their own limited patient and provider data in designing and measuring the profitability of their plans. The

storage and sharing of disguised patient data over the marketplace's network will enable insurers to utilize data on a larger pool of patients. In addition, quality metrics on physicians will allow insurers to adjust their provider rates based on performance.

- *Electronic payments.* Quick processing of claims via the marketplace's secure network will help insurers improve both patient and provider satisfaction.

Services to Medical Suppliers

Medical suppliers would benefit from the following:

- *Just-in-time delivery.* Medical suppliers can send medical shipments just when they are needed, increasing efficiency and effectiveness of hospitals and doctors. They can develop forecasting methods to estimate when, for example, a hospital would need certain supplies.
- *Electronic payment.* Besides sending supplies just in time, medical suppliers could get paid just in time as well. So, there are more incentives for them to be efficient.

Implementing the above services is not an easy task and will likely be costly. As indicated earlier, a national EHR infrastructure will itself cost billions of dollars. However, the significant benefits of the C2H marketplace will outpace costs over the long term. In an interview, Health Human Services Secretary Tommy G. Thompson claimed that health information technology would improve the quality of care, reduce medical errors, lower administrative costs, and produce savings of 10 percent of the U.S. total annual spending on health care. He has also announced four goals for his health initiative, namely, bringing information tools to the point of care, building an interoperable health information infrastructure, using health information technology to allow consumers more access and involvement in health decisions, and expanding capacity for public health monitoring and

quality of care measurement. The C2H marketplace of the future, depicted in Figure 4, will support all of these objectives and will seamlessly integrate various forms of provider-delivered e-health and provide them to all the stakeholders. Furthermore, the importance of a C2H marketplace will be more profound as consumers are asked to shoulder an ever-greater proportion of their healthcare costs through high-deductible insurance policies paired with health savings accounts. As employer-sponsored and other health plans continue to raise co-payments and cut benefits, and as the federal administration promote consumer-driven healthcare, consumers will have financial incentives to use information resources of the C2H marketplace in order to “comparison shop” wisely for healthcare.

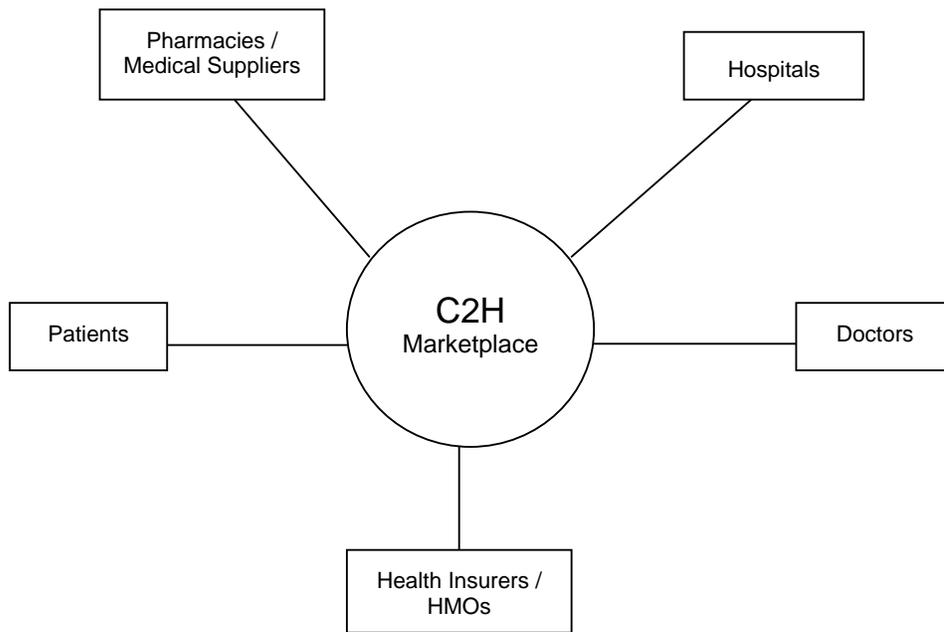


Figure 4. The C2H marketplace

RelayHealth may be considered an example of the first generation of such a marketplace. It provides a directory of medical experts, hosts some medical content, and allows online consultations with integrated electronic prescribing, while emphasizing security and confidentiality. Table 3 compares and contrasts the services of RelayHealth with the physician and patient services expected from a true C2H electronic marketplace. Figure 5

depicts the information flow among patients, pharmacies, doctors, and health plan that RelayHealth facilitates.

SERVICE	OFFERED?	COMMENT
Reimbursement mechanism	Yes	Enables providers to charge for their time.
Confidentiality and security of patient information, and management of physician liability	Yes	Maintains a customizable practice web site that is HIPAA compliant. Allows online consultations for established physician-patient relationships only, following any applicable state license requirements.
Customizable workflow mechanism	Yes	Allows triage methods
Integration with third parties	Yes	Provides built in e-prescribing and billing with payors that cover online consultations.
Support for physician-to-physician communication	Yes	Allows e-referrals
Virtual 3D surgical patient	No	Does not provide such a service yet.
Insurance coverage for online consultations	Partly	Already allows coverage for some health plans. Is in discussion with others.
Rich, trusted medical content	Partly	Provides self-care medical information, but not a full-fledged clinical library.
Integration with physician practices	Partly	Allows appointments and prescription refills. Is not integrated with EHR systems at physician practices.
Information on physicians and health care institutions	No	Offers a simple directory with little information on physicians and no information on institutions.

Table 3: The services offered by RelayHealth

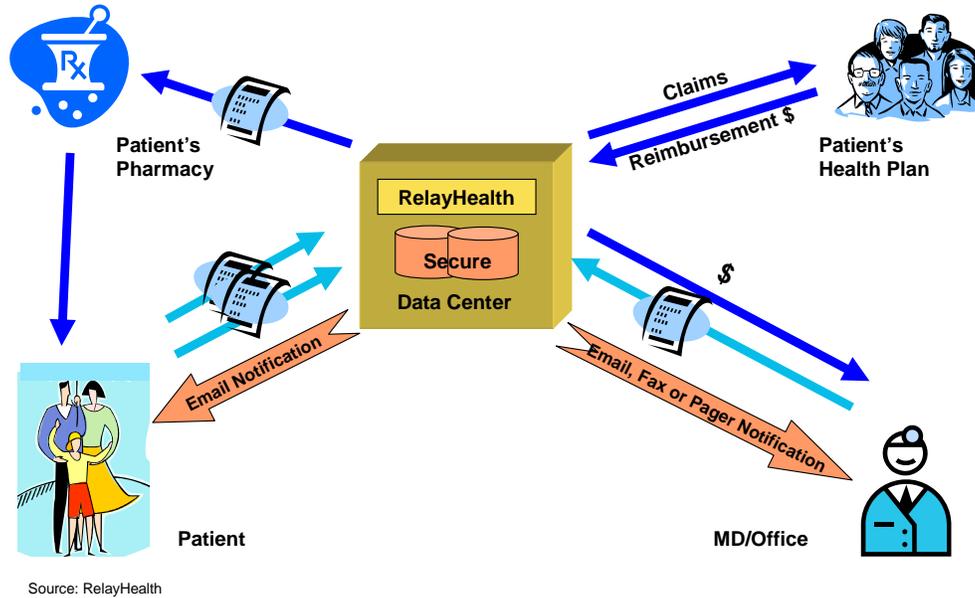
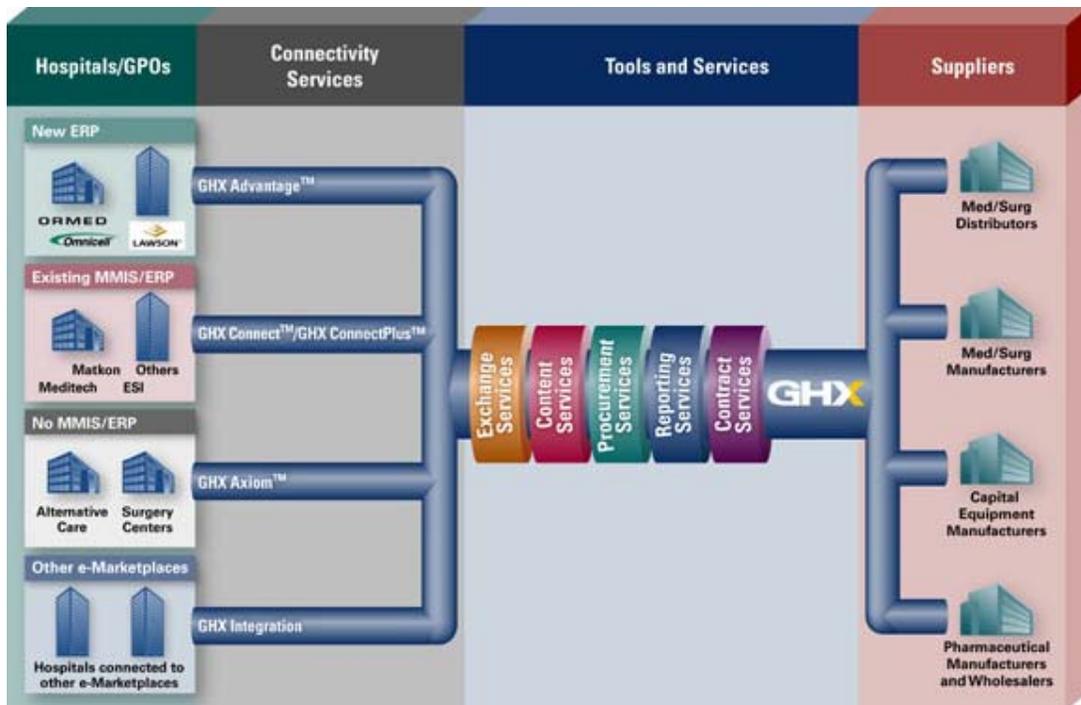


Figure 5. A RelayHealth web visit

While our discussion has focused mainly on business-to-consumer issues, the online business-to-business domain of the health care sector is also active. The largest trading exchange in this market is Global Healthcare Exchange (ghx.com), which connects over 1,400 hospitals to more than 100 medical suppliers (see Figure 6). Not surprisingly, complexities of the health care sector pose unique challenges to the provider-supplier integration, an area that provides ample opportunities for future research.



Source: Harvard Business School case #9-804-002 on Global Healthcare Exchange

Figure 6. Global Healthcare Exchange

As an extension of this work, we aim to develop an economic model to examine the design of a two-sided marketplace that provides compatible incentives to doctors and patients, while improving the social welfare for the overall economy. Enabled by information technology, this marketplace has a strong potential to bring together doctors, patients, and other constituencies, and to eliminate some of the inefficiencies that exist in the healthcare sector at present. The C2H marketplace will support both business-to-consumer and business-to-business processes that occur among patients, physicians, pharmacies, hospitals, and medical suppliers.

In every network of users and providers, there is the issue of critical mass and positive and negative externalities. In the C2H marketplace, one needs to subsidize the initial subscriptions so that different entities would find it worthwhile to join the system, hoping to reduce their costs and gain some benefits. This is closely related to externalities where, with more subscribers already in the system, the next subscriber joining will receive a higher

benefit because of the already built-in critical mass. This positive externality goes hand in hand with the negative externality arising from the difficulty of managing a larger number of subscribers.

VII. Implications for IS Researchers

IS researchers can play a critical role in the quest to provide the services discussed in the previous section. Here, we discuss some of the many challenges ahead that can be tackled by IS scholars, especially those who focus on health-IS topics.

Medical Information on the Web. A recent review of the published literature on the Internet and consumer health found that health professionals are concerned with the quality of online health information (Powell et al., 2005). Therefore, as consumers increasingly use the Internet for health-related purposes, there is a need for research that takes the user perspective and investigates the effect of consumer use of the Internet for health information.

Electronic Prescribing. The current incentives are likely to lead health care providers to adopt systems that are narrowly focused on improving office efficiency. Thus, the first e-prescribing systems to achieve widespread adoption may lack many of the features with the greatest potential to prevent medication errors and chronic disease complications (Bell and Friedman, 2005). Given the importance of the development of standards on health information exchange, health-IS researchers should seek rigorous evidence that could guide the development of such standards for advancing e-prescribing functionality. In addition, much more needs to be learned about the design factors that would enable e-prescribing systems to actually improve patient safety and health outcomes without introducing new risks or complications.

Electronic Health Records. Advances in EHR are contingent on multi-disciplinary research efforts, and contributions by experts on human-computer interaction (HCI), security, and

databases will be essential. For example, providing uniform access to multimedia clinical information through the EHR environment will require human-computer interaction (HCI) experts to address the provision of the appropriate viewer components through the EHR graphical user interface. In addition, due to the vast amount of information that will be displayed through the user interface of the EHR, innovative HCI metaphors need to be employed via a friendly user interface to avoid information overload (Tsiknakis et al., 2002). Currently, security and privacy are provided via virtual private networks. More research is needed to improve the security levels to protect the privacy and confidentiality of patient health records. Also, large-size electronic health records will need to be transmitted securely and reliably, and efficient techniques will be required for storing, searching, analyzing, and manipulating multimedia clinical information.

Online Consultations. Economic research on physician reimbursement is needed to maintain the viability of online consultations. Along these lines, Ozdemir (2006) showed that under certain conditions medical experts may expect to charge a higher price for an online consultation than a face-to-face one. In addition, Ozdemir et al. (2006) investigated the pricing of first and second opinions on face-to-face and online channels and found that the emergence of online consultations would lead to a relative increase in the delivery of second opinions. Further research is needed to understand the quality and price of these services and the quantity that will be demanded. Designing health insurance-provider payment systems optimally in light of the emerging demand for online consultations is also another interesting future research direction.

The C2H Marketplace. The marketplace can provide the various e-health services only over a flexible and scalable national health information infrastructure (NHII). Specific attention should be given to developing the information system architecture for the NHII. This infrastructure must primarily provide the framework for the effective integration of

distributed and heterogeneous components, while advances in network technology should advance and enhance applications. The NHII should also provide integrated support to clinical, organizational, and managerial activities, and a single user interface to all health-care related information space (Tsiknakis et al., 2002). System design methodologies can be used to address the development and implementation of the NHII and searchable image data warehouses. As more and more e-health services are provided via the marketplace, established IS theories such as Technology Acceptance Model can be employed to understand the best strategies to encourage the adoption of the integrated systems by patients, medical providers, and other constituencies.

VIII. Conclusion

Although efforts to build electronic health record systems and to facilitate remote consultations have been around for several decades, only very recently have these systems become both technologically and commercially feasible and have started to impact our lives. Among others, major business schools have noticed this change and have even published cases on the transforming effects of technology on the U.S. health care system.⁴ The C2H electronic marketplace of the future will benefit patients as medical information and expertise become more accessible and as medical errors decline. Reduction of medical errors will also improve the quality of health care while cutting costs over the long term. Therefore, all related parties need to develop strategies about how to participate and provide value in such an environment. The demand for online health services is alive and well and will likely change the health care sector in a major way for years to come.

⁴ See, for example, Harvard Business School case #9-805-021 on RelayHealth and case #9-804-002 on Global Healthcare Exchange.

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