



**Customer-Driven Medicine: How To Create A New
Health Care System**

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Health care today is dominated by physicians, hospitals, the pharmaceutical industry, insurance companies, and government agencies. Patients seek to navigate their health care by moving across a variety of providers, ordering prescription drugs from pharmacies, and seeking reimbursement from either public or private insurance plans. They spend hours connecting the dots and working out the best health care for themselves and their families. If they are fortunate to have good providers and effective follow-through, they receive high-quality health care.

Imagine a different system where, with the aid of the Internet, electronic medical records, cell phones, and personalized health care, the patient is in charge. People monitor their own weight, blood pressure, pulse, and sugar levels, and send test results via remote devices to health care providers. Patients store their medical records online and have access regardless of where they are in the United States or around the world. They get personalized feedback via e-mail and reminders when they gain weight, have an uptick on their cholesterol levels, don't take their medicine, or have high blood pressure. Social networking sites provide discussion forums and the benefit of collective experience from other people suffering similar problems. Patients take responsibility for their routine health care and rely on physicians and hospitals for more serious medical conditions.

This system is not a futuristic vision, but is well within our grasp. It would cut costs by reducing professional responsibility for routine tasks and record-keeping, while also making it possible for patients to receive higher quality care and be more satisfied with the end-result. The technologies for this kind of system transformation currently are available through cell phones, remote monitoring devices, video conferencing, and the Internet.

In this paper, I outline a vision for a new health care system based on mobile Health (mHealth), remote monitors, electronic medical records, social networking sites, video conferencing, and Internet-based recordkeeping. It incorporates email reminders to take medicine, a Netflix-style mechanism to rate experiences with doctors and hospitals, and websites that make ratings publicly available to employers and other patients. Today, there are nearly as many mobile phones (600 million) in existence that can browse the Internet and access email as there are personal computers (800 million).

In order to bring this system to fruition, though, several changes are needed to encourage customer-driven health care. There have to be shifts in public policy and private health care that get the incentives right for patients, physicians, insurers, and hospitals. If we make these changes, we can cut costs while also improving quality and public satisfaction with health care.

Among the specific changes that are required include:

- 1) changes in public and private insurance coverage that reimburse health care providers for mHealth care, remote monitoring, electronic

communications with physicians, e-prescribing, and downloading medical tests to cell phones and other mobile devices;

- 2) rewarding physicians who provide positive health outcomes for their patients, as opposed to paying them for the quantity of tests they have ordered;
- 3) greater patient encouragement for preventive health care, good diet, and regular exercise activities and creation of a Preventive Medicine Fund that covers gym memberships, exercise equipment, flu shots, diet advice, smoking cessation programs, and substance abuse treatment;
- 4) development of a good health rewards program similar to good driver discounts that provides benefits to patients who lead healthy lifestyles.



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A New Health Care System

Personalized medicine makes it possible to improve our health system through digital and mobile technologies that already are in existence. There have been a number of advances in communications, diagnosis, and treatment that offer the potential to revolutionize the system and create better outcomes for patients and health care providers.

What we need is to change the incentives for volume-based health care that currently exist and create incentives for good health outcomes and preventive medicine on the part of patients and physicians. With specific policy changes in reimbursement rates and insurance incentives, we can save money for the system as a whole and give consumers greater control over their medical care.

Remote Monitoring Devices

There are a number of new remote monitors for various health care conditions that put patients in charge of their own test-taking and keep them out of doctor's offices. For example, there are home pulse-taking and blood pressure devices that measure vital signs. AT&T has a new "device certification lab" that tracks health along high-speed broadband networks. Results are electronically sent to a family physician, specialist, or electronic medical record, depending on the wishes of the patient. Zeo is marketing a monitor that measures brainwaves and rates the quality of sleep. Bodybugg has an armband calorie-counter that charts the amount of energy burned through physical movements.

The Triage Wireless company has a "wearable" monitor that records vital signs and transmits them to physicians. It records blood pressure on a continuous basis, thereby providing regular information for health care providers. The Corventis corporation has a small sensor it calls PiiX that measures fluid status and respiration for runners. This helps people monitor their physical status during exercise. Intel has a "magic carpet" device that monitors physical movements.

Geared for senior citizens at risk of a fall, it tracks people as they walk on a mat to determine who is vulnerable to falling down.

In the area of diabetes, it is crucial that patients monitor their blood glucose levels and gear their insulin intake to proper levels. In the “old days”, patients had to visit a doctor’s lab or medical office, take a test, and wait for results to be obtained. That process was expensive, time-consuming, and inconvenient for all-involved. Having to get regular tests for this and other conditions drives up the costs of medicine.

However, it is possible to use remote monitoring devices at home that record glucose levels instantaneously and electronically send them to the appropriate health care provider. Patients are using with FDA-approved “Glucos Phones” that monitor and transmit glucose information to caregivers while also reminding patients when they need to undertake glucose tests. This puts people in charge of their own monitoring and keeps them out of doctor’s offices until they need more detailed health care. It is estimated that over 11 million Americans use home monitors for their glucose. Health authorities believe there are over 24 million diabetics in the United States, and the disease is the seventh leading cause of death.

Tiny monitors with magnetic nanoparticles have been developed by researchers at the Massachusetts Institute of Technology to track the development of cancer tumors. Small particles the size of a rice grain are injected during biopsies. Through follow-up MRI’s, doctors can measure whether these monitors clump with the tumor and grow in size. This allows them to get immediate feedback on the size of cancers and whether a specific therapy is working.

Cardiologist Steven Greenberg of St. Francis Hospital in Roslyn, New York uses a wireless pacemaker made by St. Jude Medical connected to a home monitoring device to track heart rhythms and vital signs. Patient information automatically is transmitted to his medical office, which allows him to see which patient has abnormal heart beats and therefore is in need of immediate treatment. He feels this enables him to “stay a step ahead of potentially life-threatening problems.”

Personalized Reminders and Feedback

One of the biggest problems in medical treatment is patients forgetting to take their prescription drugs. It is estimated that only 50 percent of patients take their medication as prescribed. Either they forget to take the drug or they do not take it at the time or dosage set by their physician. This means that we lose half of the benefit of prescription drugs through human error. This costs the systems billions in poor health outcomes.

Digital technology has the potential to help with this and other communications problems. Patients no longer need to visit doctors’ offices to be reminded to take their medicine. They can get personal reminders via e-mail, automated phone calls, or text messages. One enterprising physician named

David Green of Cape Town, South Africa noticed that his patients did not always take the prescribed Rifafol medicine for their tuberculosis. He knew that for the drug to be effective, people had to take the pill on a consistent basis. Otherwise, it would have little effect. Doctor Green set up a text messaging service called “On-Cue Compliance” for each of his patients that sent them a daily SMS in English, Afrikaans, or Xhosa. Over the six-month course of treatment, his service would send a message at a pre-determined time each day reminding them to take their Rifafol.

In the United States, Dynamed Solutions provides “HealthTrax” software that reminds patients to take medications, set up appointments, and track compliance with medical instructions. This and other types of “virtual health assistants” are particularly helpful with those suffering from chronic illnesses. These individuals need to keep close track of their medical condition and stay in touch with their caregivers. The software is integrated with electronic medical records and can store information in patient’s personal records.

Physicians at Children’s Hospital Medical Center in Cincinnati send teenagers text messages reminding them to take their asthma medication. For young people on the go, remembering to take medication is one of the biggest challenges. Researchers have found that text reminders is effective at therapy compliance and that it helps teenagers develop good “self-care habits.”

A company called Proteus Biomedical has a tiny “digestible chip” that can be swallowed along with a prescription drug to notify health care providers that patients took their medication. Using a sensing device, it electronically transmits that information to physicians, who then know for sure that the individual is following the prescribed course of treatment. It is especially helpful with patients suffering memory loss because those individuals have a high incidence of not taking their medicine regularly. Patients loved the idea of getting personalized reminders from their medical providers. One person wrote that these messages “keep you informed and mean you never forget to take your drugs.”

In general, American patients say they would like to employ digital technologies in their medical care. For example, 77 percent in a national survey said they would like to get reminders via e-mail from their doctors when they are due for a visit, 75 percent want the ability to schedule a doctor’s visit via the Internet, 74 percent would like to use e-mail to communicate directly with their doctor, 67 percent would like to receive the results of diagnostic tests via e-mail, 64 percent want access to an electronic medical record to capture information, and 57 percent would like to use a home monitoring device that allows them to e-mail blood pressure readings to their doctor’s office. The good news is that the technology is in place for each of these applications. It is just a matter of altering reimbursement schedules and getting physicians to adopt the technology.

Mobile Smartphones

Cell phones and other mobile devices have gotten smarter and faster. Smartphones such as Apple's iPhone, Research in Motion's Blackberry, Nokia's E71, and Palm Pre offer advanced features such as mobile e-mail, web browsing, and wireless communications. The sophistication of these devices has spawned a variety of new medical applications that help doctors and patients stay in touch and monitor health care needs.

For example, Sprint has a mobile application that allows physicians to get test results on their mobile device. They can look at blood pressure records over time, see an electro-cardiogram, or monitor a fetal heart rate. AirStrip Technologies markets an application that makes it possible for obstetricians remotely to monitor the heart rates of fetuses and expecting mothers. This allows them to detect conditions that are placing either at risk.

These applications make doctors more efficient because they don't have to be in the physical presence of a patient to judge his or her condition. Digital technology allows people to overcome the limitations of geography in health care and access information at a distance. This makes it possible for patients to get a second opinion without visiting another physician by sending that person relevant medical tests. If a personal conference is required, doctors can use video conferencing to speak to patients located in another city or state.

Electronic Medical Records

Medical records used to be stored on paper in dusty files. This required a lot of storage space and was hard to access at a distance. Physicians did not have records at their fingertips and patients had little control over their own medical records.

Today, medical information can be stored on Internet sites or portable devices. Microsoft Health Vault and Google Health have online medical records that patients maintain. People can record and chart cholesterol levels, blood pressure, glucose readings, weight, pulse, and other health data. Permission to view various levels of this information can be given to primary-care physicians or medical specialists. And in cases of emergency, vital records can be made available to the treating doctors or nurses.

Internet Information

There has been an explosion of websites with detailed medical information. Websites such as WebMD.com, MedlinePlus.gov, MerckSource.com, HealthFinder.gov, and MayoClinic.com answer questions and provide links to discussion groups about particular illnesses. In states such as Massachusetts, California, New York, and Michigan, consumers can visit health department sites and compare quality performance data on provider care programs. Nationally, the

U.S. government has a website, www.hospitalcompare.hhs.gov, that evaluates 2,500 hospitals on mortality rates, room cleanliness, call button responses, and how patients judge their quality of care.

The most common Internet searches occurred in regard to specific diseases. Of those who went online, according to a Harris Interactive survey, 64 percent said they searched for information on particular illnesses, 51 percent looked for certain medical treatments, 49 percent surfed for material on diet and nutrition, 44 percent named exercise, 37 percent sought advice on medical drugs, and 29 percent looked for particular doctors or hospitals.

This information had a positive impact on many people's medical decisions. National survey data demonstrate that 58 percent indicated that online material affected their health care decisions, 55 percent said the information changed their health care approach, and 54 percent claimed the electronic resources made them ask new questions about their medical personnel. When asked how these materials made them feel, 74 percent said they felt reassured and 56 percent felt more confident, but 25 percent indicated they were overwhelmed by the amount of online information, 18 percent were confused, and 10 percent frightened by the medical material they uncovered.

From these findings, it is clear that most people had positive experiences that helped them learn more about illness and treatments. But others had difficulty dealing with this new online world. They do not feel comfortable searching for online information and get confused or overwhelmed by what they find at medical websites.

Social Networking for Medical Care

Social networking sites offer great potential to improve care by sharing information among chronic condition sufferers. For example, a network developed by the company PatientsLike Me has 23,000 patients who have signed up to share information regarding five different illnesses: mood disorders, Parkinson's, multiple sclerosis, HIV/AIDS, and Lou Gehrig's disease. These individuals describe their symptoms, discuss various therapies, and talk about what works and doesn't work very effectively. Not only does the site serve as a vital support group for these serious illnesses, it promotes better understanding through the detailed case histories based on personal experiences.

A similar idea draws on crowd-sourcing for feedback regarding medical care and treatment side-effects. It often takes years for patients, physicians, and medical researchers to get definitive results regarding the assessment of drugs and medical therapies. Clinical trials are expensive and time-consuming, and involve randomized assignment to various groups. Results sometimes are unclear and it is hard to recruit sufficient subjects to participate in the evaluations.

While it is important to maintain rigorous approaches to medical research, it is helpful to take advantage of new techniques for getting feedback. Crowd-sourcing

is a concept that takes advantage of the collective experience of large groups of people. It allows a variety of individuals to comment on and post experiences with specific treatments. This helps others compare data and see information on what works or doesn't work.

Dr. Amy Farber has developed an online resource called LAMsight that encourages people suffering from the LAM lung disease to share their symptoms and treatment experiences. Web operators take this patient-provided information and compile online databases that are used by researchers to find out what works, what doesn't work, and what drugs generate unwelcome side-effects. Particularly for rare illnesses where it is hard to generate the patient numbers required for clinical trial, she says "patients have been a tremendously underutilized resource." While large clinical trials with randomized assignment clearly need to remain central to drug assessment, digital technology that helps providers and researchers identify worrisome trends represents an additional way to gain useful feedback.

Consumer Evaluations of Health Care Providers

A big challenge with contemporary health care is the lack of information among patients about the quality of physician and hospital care. There is some outcome-based information on how many mammograms or other medical tests various facilities perform, but few assessments of the quality of care from specific providers.

Digital technology has the potential to empower the consumer voice in health care and to tie patient assessments to doctor performance. In the entertainment area, for example, the commercial company Netflix has devised a system by which film watchers order movies for home viewing. Upon returning the movie to the company, customers received an automatic e-mail asking them to rate the movie on a five-point scale. This information is anonymously aggregated, and publicly available to other consumers so they can see which movies receive the highest ratings in various categories.

It is possible to create a similar system for rating physicians, hospitals, and other health care providers. Following physician visits, consumers can fill out an e-mail form allowing them to rate different dimensions of medical treatment from timeliness and personal attentiveness to level of knowledge and satisfaction with the overall visit. These quality measures are aggregated and be accessible at a public website so others could see the quality assessments.

Consumer Reports has an online hospital rating service of 3,400 facilities based on the national government's Hospital Consumer Assessments of Healthcare Providers and Systems Survey. Among the items examined include "overall patient experience, doctor and nurse communication, room cleanliness, discharge information, hospital staff attentiveness, communication about new medications, pain control and noise level." Preliminary results suggest that caregivers communicate poorly about new medications and that only one-third of hospital

staff is inattentive to patients.

Required Policy Changes

There is little doubt that the technology for customer-driven health care is already available. What are needed are policy changes that alter the incentives for patients and health care providers to adopt necessary shifts, and reward good behavior and good health outcomes as opposed to volume health tests. There are a variety of policy changes needed to encourage personalized medicine.

Reimbursement Changes in Insurance Coverage

Few Americans currently take advantage of health information technologies. When asked in a Wall Street Journal Online/Harris Interactive Health-Care Poll of 2,624 adults across the nation, small numbers indicated they currently used any of these electronic tools. Four percent got reminders via email from their doctors when they were due for a visit, four percent used e-mail to communicate directly with their doctor, three percent scheduled doctors' visits via the Internet, two percent received the results of diagnostic tests via e-mail, two percent had access to electronic medical records, and two percent relied upon home monitoring devices that allowed them to e-mail blood pressure readings directly to their doctor's office.

Part of the problem is that neither public nor private insurance plans cover most mHealth, digital communications, or wellness programs. Physicians, for example, often are not reimbursed for e-mail or phone consultations. We need policy changes that encourage high quality medical care and make it possible for health providers to be reimbursed for the health they provide.

We should reward good behavior and reduce the incentives for wasteful or unnecessary treatment. For example, rather than paying providers for each test or office visit they provide, insurance companies could provide an annual sum to family doctors based on the person's age and health status. This would encourage both patients and providers to monitor overall health and make decisions on where best to allocate health care dollars. According to a July 26, 2009 Washington Post article, "pilot projects have shown that paying a medical team for total care - monitoring blood-sugar levels, giving eye and foot exams - rather than paying for each visit to an ophthalmologist or podiatrist is better for the patient and costs less."

The Geisinger Medical Center tested a "medical home" initiative among Medicare patients and found an 8 percent drop in hospital admissions and a 4 percent reduction in overall health costs over the first year. In this concept, patients are assigned a family physician who acts like a "personal health coach." This coach oversees a group of providers who monitor people's medical condition and use e-mails and text messages to encourage people to lose weight, stick to

healthy diets, get exercise, and seek relevant care when their status deteriorates.

A Focus on Positive Health Outcomes

Right now, doctors and hospitals make money by ordering tests. Virtually all the current incentives favor volume-based health care. With the “fee for service” basis of contemporary health care, the goal of health providers is to see a lot of patients and provide treatment, some of which may be duplicative or unnecessary.

In this system, there is little attention on health outcomes, either for individual health care providers or the medical system as a whole. Doctors don’t get rewarded for healthy patients or preventive medical care. Indeed, one of the challenges in the current system is the lack of performance data on how patients do. The federal government collects statistics by city and state on causes of death, numbers of procedures, and other such information. But there is little outcome information for specific doctors or other health care providers. This makes it difficult to judge quality or create incentives for healthy outcomes.

We need to supplement the current “fee for service” with a “fee for performance” that links insurance reimbursements to positive outcomes. Doctors whose patients remain healthy should receive a bonus and should be encouraged to continue preventive medical care.

Rewards for Good Behavior by Physicians and Patients

We need rewards for good behavior, modeled after “good driving” discounts on car insurance. Drivers who do not have accidents or are not cited for speeding or other traffic violations earn a 10 percent discount on their insurance. The program is cost-effective for car insurance companies because safe drivers have fewer accidents and therefore cost the company less in accident repair reimbursements.

Americans eat too much, get too little exercise, and have diets that are too fatty. The result is an obesity epidemic that will push health care costs higher in future and limit people’s quality of life. According to the American Obesity Association, over 30 percent of children today are over-weight. This ticking-time bomb threatens to explode and have dramatic consequences for national health care spending.

Insurance companies and government programs should offer “good health” rewards to patients and physicians. For example, health programs could provide a preventive medicine fund that would reimburse people for regular exercise, good health practices, flu shots, diet advice, and smoking/alcohol/drug cessation programs. This would encourage patients to lead healthy lifestyles.

Some writers such as David Leonhardt of the New York Times have gone so far as to propose a “fat tax” that would charge higher health insurance for individuals with a high “body-mass index.” This would penalize those who are overweight and perhaps provide financial incentives for them to lose weight. And it would

reward those with healthy lifestyles by offering 20 to 30 percent discounts on insurance premiums.

After Safeway Inc. instituted a “Healthy Measures” program of cholesterol screenings, blood pressure measurements, and weight loss initiatives, its health costs dropped by 13 percent. More than three-quarters of its employees enrolled in the program and they saved 20 percent on their individual insurance premiums. Pitney Bowes provides \$100 gift cards to employees who enrolled in health courses. Senators Max Baucus and Tom Harkins have proposed employer tax credits for company programs that provide health screenings and lifestyle counseling.

Saving Money and Leading Healthier Lives

The ultimate goal of policy changes is to save money and get people to lead healthier lives. As Senator Sheldon Whitehouse has pointed out, the United States spends \$6,102 annually per capita, much more than the \$3,165 spent by Canada, \$3,159 by France, and \$2,083 by the United Kingdom.

Yet America ranks 42nd among developed nations in life expectancy. Our average life expectancy of 77.9 years falls well below that of Andorra, the Cayman Islands, and most European countries. We spend a higher percentage of Gross Domestic Product on health than most other nations, but get weaker results in terms of medical well-being.

With America’s health care system now costing \$2.4 trillion, we no longer can afford delays in making needed changes. As Peter Neupert of Microsoft’s Health Solutions Group has written, “let consumers do some of the work that expensive health-care professionals shouldn’t be doing anymore. In the past 10 years, technology has removed travel agents, bank tellers and so on from the middleman position. Online systems, such as Kaiser Permanente’s, have increased patient satisfaction and allowed the work of expensive professionals to be replaced.”

One of the reasons America spends more money per patient than other countries, but gets weak results, is our low usage of health information technology. Only 15 percent of the 560,000 doctors in America use digital technology to order medication for their patients. 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.”

A Brookings Institution analysis undertaken by economist Robert Litan found that remote monitoring technologies could save as much as \$197 billion over the next 25 years. Cost savings are especially prevalent in the chronic disease areas of congestive heart failure, pulmonary disease, diabetes, and skin ulcers. With around the clock monitoring and electronic data transition to care-givers, remote

devices could speed up the treatment of patients requiring medical intervention. Rather than having to wait for a patient to discover there is a problem, monitors could identify deteriorating conditions in real time.

A 2009 PriceWaterhouseCoopers Health Research Institute study meanwhile found that \$210 billion is wasted through “defensive medicine – doctors ordering tests or procedures not based on need but concern over liability or increasing their income.” Other examples of wasteful spending include inefficient claims processing (\$210 billion), ignoring doctor’s orders (\$100 billion), ineffective use of technology (\$88 billion), hospital readmissions (\$25 billion), medical errors (\$17 billion), unnecessary emergency room visits (\$14 billion), and hospital acquired infections (\$3 billion).

Better use of digital and mobile technology could help on each of these fronts. Electronic medical records would reduce duplicate tests because various physicians would have easy access to the results of past procedures. Automated processing of medical reimbursements would save time and money. Not taking medicine at prescribing times and levels could be improved through remote monitoring and digital tracking. Unnecessary emergency room visits, hospital infections, and medical errors could be reduced through personalized medicine that employs video conferencing and non-hospital treatment facilities.

Some observers worry that 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. Rather than advancing the quality of patient care, she feels that digital medicine has harmed the intimacy of clinician-patient relations and undermined the personal touch within health care.

In a review of telemedicine research, though, Edward Alan Miller finds that 80 percent of medical studies showed a favorable impact of digitally-mediated contact on provider-patient relations. These kinds of technologies facilitate access for some individuals and expand the network of health-care providers that are available to patients.

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