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# NBR

# ANALYSIS

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## **THE NATIONAL BUREAU *of* ASIAN RESEARCH**

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For further information about NBR, contact:

THE NATIONAL BUREAU OF ASIAN RESEARCH  
4518 UNIVERSITY WAY NE, SUITE 300  
SEATTLE, WASHINGTON 98105-4530  
206-632-7370 PHONE  
206-632-7487 FAX  
nbr@nbr.org E-MAIL  
<http://www.nbr.org>

## Foreword

This *NBR Analysis* traces its origin back to a presentation by Craig Mundie at the inaugural Pacific Health Summit in June 2005 in Seattle. The Summit gathers top leaders in science, policy, public health, medicine, and industry from around the Asia-Pacific region to discuss how emerging science and technology can be connected to global health policy in order to realize the dream of a healthier future. His presentation on how emerging information technology could advance the cause of global health was perceptive, forward-looking, and passionate.

We at NBR were pleased when Craig Mundie agreed to shape his ideas into an *NBR Analysis*. He provides us with an elegant but powerful architecture to show how we can use information technology to address the major challenges facing global health care, whether it be an under-served village in China or an urban hospital in a developed country facing the strain of an aging population. Above all, Mundie shows us how information technology can shift our focus from costly late-stage disease management to a proactive investment in keeping people healthy. Inspired by an Asian model of early health, he shows us the path to a healthier world and offers to be our guide.

As Mundie acknowledges, however, such a transformational change is never easy. He notes that, in order to ensure that information technology yields its full promise, we must also lay the foundation for a transformation of global health policy. This realization requires both a broad program of cooperation among stakeholders and a fundamental reshaping of the health infrastructure. Mundie concludes with a series of broad and forward-looking policy challenges for us to consider. This brings us back full circle to the Pacific Health Summit and its vision of connecting science, innovation, and policy for a healthier world.

Mundie writes from a unique vantage point. As a senior vice president and CTO of Microsoft, he has an intimate understanding of technology. As a peripatetic traveler, he also has an intimate and first-hand understanding of the need around the globe for better and lower-cost health care and how information technology can make a difference. Moreover, as evidenced both in his long-time role as trustee of the Fred Hutchinson Cancer Research Center and in his support for the center's research on

the prevention and early detection of disease, we know that he brings to his work a personal passion.

We are grateful to The Henry M. Jackson Foundation for its support of the *NBR Analysis* series. As with all issues of the *NBR Analysis*, the author is solely responsible for the content and recommendations of this paper.

Michael P. Birt  
Director, Center for Health and Aging  
Executive Director, Pacific Health Summit

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## Information Technology: Advancing Global Health\*

*Craig Mundie*

**Craig Mundie** is Chief Technical Officer, Advanced Strategies and Policy, Microsoft Corporation. Prior to joining Microsoft, he co-founded and served as CEO of Alliant Computer Systems. He is a trustee of the Fred Hutchinson Cancer Research Center, advisor to the College of Computing at the Georgia Institute of Technology, and since 2002 has served on the Council on Foreign Relations.

\* The author would like to thank Claire Topal and Michael Birt for their support and contribution to this work.

## Executive Summary

This essay explores how we can use information technology to address major stressors on health care around the globe.

### *Main Argument:*

This essay makes the following main arguments:

- three major stressors on global health care can, and must, be addressed:
  - health care systems in general are too focused on acute care and late-stage disease
  - health care is prohibitively expensive and difficult to obtain in most emerging economies
  - the world's population is aging significantly, which is already putting mounting economic strain on governments, insurers, taxpayers, and caregivers
- information technology (IT) can help scale health care appropriately to each economy and reduce the burden of health care delivery on medical practitioners, caregivers, and economies encumbered by aging populations
- information technology can also enable a transformation from disease management to a focus on proactive wellness, also known as “early health”

### *Policy Implications:*

To ensure that technology is used to help promote safe and effective early-health systems, policymakers should be aware of the following:

- transforming health care through IT will result in significant cost savings to governments, insurers, and individuals over the long term as well as reduce stress on economies and workforces
- using the speed and accuracy of IT to detect and track disease increases policymakers' opportunities to intervene early and spread knowledge about effective treatment
- policymakers can easily create more websites that post reliable data, facilitating the spread of correct, up-to-date health information for their populations at a low cost to governments and citizens
- by taking criticism that is posted on the Internet seriously and responding on-line and through improved products and services, companies and policymakers can communicate directly with concerned constituents through positive feedback mechanisms
- electronic health records and other on-line medical information must be introduced in tandem with legislative and technological measures that prevent public access and give patients ownership of their private information
- a successful transformation in health care through IT will require the cooperation of many parties, ultimately requiring modified communication mechanisms and eventually more widespread, scaled health infrastructure

There are three major stressors on global health care that can, and must, be addressed. First, health care systems in general are too focused on acute care and late-stage disease. This focus means that by the time symptoms emerge and illness is detected, diseases have advanced to the point where treatment is extremely costly and often ineffective, burdening health care workers and causing patients unnecessary suffering. Second, traditional approaches to medicine do not meet the needs of emerging markets. For the majority of the population in these economies, health care is prohibitively expensive and difficult to obtain. Finally, the world's population is aging significantly, a trend that is already putting mounting economic strain on governments, insurers, taxpayers, and caregivers. The current strain on the world's economy, people, and systems is fast approaching a crisis point; ignoring these three stressors will exacerbate their negative consequences beyond repair.

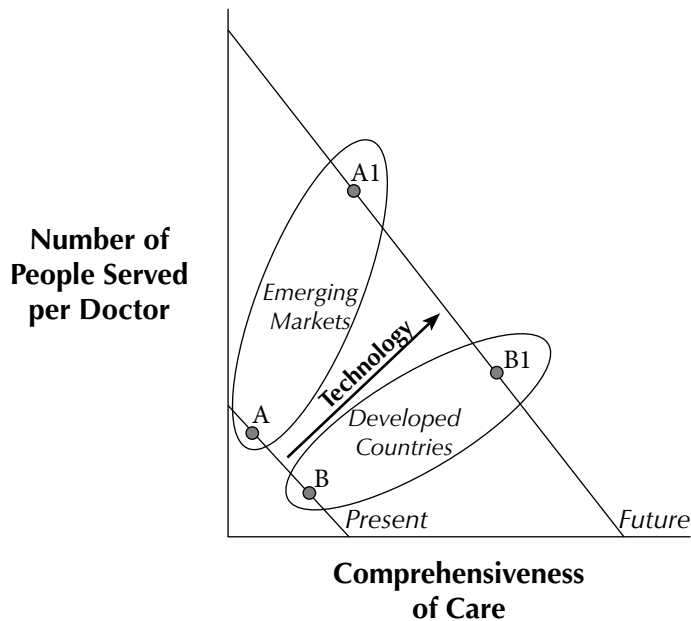
Our ultimate objective is a drastic improvement in global health worldwide, with a focus on wellness instead of disease management. This type of approach will reduce the negative impact of aging populations, decrease pressure on health systems, and improve health in emerging markets. To reach that end, populations, policymakers, industry executives, and all systems—political, health, technical, financial—must change the way they conduct business, interact, set and prioritize goals and how they approach health and health care in general. Individuals must gain greater access to tools that enable them to be proactive about their health. Additionally, health systems, tools, and techniques must be scaled to the unique needs of each economy and community.

The means to this transformation of health is information technology (IT). In addition to enabling individuals to monitor and maintain their own health, IT can take a great deal of the burden of health care delivery off the shoulders of medical practitioners, allowing them to focus on more valuable and complex care. IT will also remove a significant burden from caregivers and economies encumbered by aging populations. IT can also help scale health care appropriately to each economy, from facilitating drive-thru clinics in cities in the United States to connecting populations in remote areas with medical hotlines and automated health care kiosks in, for example, rural India and China.

**Graph 1** illustrates this concept of health care scalability. Points A and B show where health care is today with regard to comprehensiveness of care and the number of people served per doctor. Points A1 and B1 show where, with technology's help, health care could be in the future. "Comprehensiveness of care" refers to how much care and follow-up is possible with today's modern medicine via preventive measures, early detection, and early treatment: the more comprehensive the care, the more extensive

and personalized the services to each patient.<sup>1</sup> Point A represents the current situation in emerging economies, in which the number of people served per doctor is very large, reflecting the sheer size of the population in these regions and the overwhelming burden on physicians. In developed countries, by contrast, more doctors—helped in part by the migration of trained physicians from emerging markets—serve fewer people with more comprehensive care, as illustrated by point B on the graph.

**Graph 1: Scalability of Health Care**



This graph represents today’s reality: most doctors wish they could serve more people with better care, but that comprehensiveness is limited by (1) the resources (financial and otherwise) currently available for practitioners, (2) growing and aging populations, and (3) the current number of people trained to provide services.

This essay argues that, by increasing the use of health care focused IT by individuals, practitioners, institutions, and systems in general, health care worldwide would shift to the “future” curve on the graph above. Under such a scenario, more people are served with greater comprehensiveness of care, the burden on health care professionals is reduced, individuals are empowered to manage their own health proactively, and

<sup>1</sup> Examples of low comprehensiveness of care include a doctor seeing a patient only once, prescribing a shot or medication, running few or no tests to see if the prescribed medication was appropriate, or failing to carefully diagnose the condition for which medicine was prescribed.



physicians are empowered to care for patients more effectively. Moreover, health care advances can be scaled and spread to emerging markets with greater speed and with lower cost than ever before. Points A1 and B1 on the graph represent this vision.<sup>2</sup>

## Stressors on Global Health Care

### *Health Systems' Focus on Late-Stage Illness*

Modern medicine still has a long way to go despite the medical and scientific community's mind-boggling advances. The leading health threats in developed countries are non-communicable diseases such as diabetes, cancer, and heart disease—many of which can be prevented and respond well to early intervention. As developing countries begin to more broadly adopt Western lifestyles and all the health risks those lifestyles imply, non-communicable diseases will continue to become more prevalent.<sup>3</sup> One of the reasons for these continuing problems is that health systems remain focused on late-stage disease treatment and eradication rather than on prevention or early detection of disease and the assessment and management of health.

This late-stage disease model disproportionately pours energy, money, and time into invasive, complex, and costly treatments to prevent disease from causing death or incapacitation. For example, prevention, early detection, and early treatment can drastically reduce illness and deaths caused by easy-to-predict and preventable cardiovascular diseases, which result from tobacco use, high blood pressure or cholesterol, or a combination of the three. Unfortunately, today not enough is being done.

Left unchecked, the problems associated with focusing on late-stage illness are only going to get worse. A large proportion of medical expenditures is associated with age-related conditions. As our global society ages, increased pressure is placed on physicians to diagnose and deal with complex, life-threatening medical problems. What

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<sup>2</sup> A1 represents one future possibility that IT could help emerging markets achieve. Depending on financial, infrastructural, and human resources in each locale, country, and region, the point A1 could shift in two directions on the “future” curve. First, A1 could move further toward the y-axis on the future curve, where each doctor—with the help of IT—could serve more people with the same comprehensiveness of care. A second possibility is a move further down towards the x-axis, where, thanks to IT, doctors could serve the same number of people with better care. B1 represents the situation in developed countries and could also shift up or down the future curve depending on resources and geography, either serving more people with the same level of care in some areas or serving comparable numbers of people in other areas with more comprehensive care.

<sup>3</sup> World Health Organization, “The World Health Report 1998: Life in the 21st Century: A Vision for All,” Geneva, 1998, 5, [http://www.who.int/whr/1998/en/whr98\\_dgmessage.pdf](http://www.who.int/whr/1998/en/whr98_dgmessage.pdf).

health systems lack today are active patient participation, personalized risk assessment, and adequate emphasis on prevention of illness. Identifying, measuring, and promoting health are just as important as treating disease.

If people could more easily track and understand information such as their blood pressure and cholesterol level—indeed, if that personal information was available at the press of a button—individuals might be more encouraged to take responsibility for their health before symptoms of illness appear. Wellness begins with the individual.

### *Emerging Markets*

A startling contradiction between burden of disease and global health spending persists in emerging markets: developing countries account for 84% of the world's population and 93% of the worldwide burden of disease; these same countries also account, however, for only 18% of global income and 11% of global health spending.<sup>4</sup> Every year, as a result of this disparity, conditions that could be prevented or cured account for millions of deaths worldwide. The problem is not simply lack of money but also about access to health care and health resources.

In China, about 70% of the population lives in the countryside, and about 90% of these people lack access to affordable medical care.<sup>5</sup> Though China has historically been strong in providing preventive and primary care in rural areas, concerns have risen that standards of health care in the country are declining as China shifts to a market economy. Indeed, China's central government has cut health spending by almost half over the past twenty years, leaving poor families vulnerable to financial ruin if any one member falls seriously ill or has an accident requiring surgery or expensive medications.<sup>6</sup> Small clinics with extremely limited supplies and personnel are located too far away to serve the rural population, and most urban hospitals are too expensive.

According to Vice Health Minister Gao Qiang, citing the result of a web survey about the country's health care services in a 2005 *China Daily* article, "48.9% of Chinese people cannot afford to see doctors when they fall ill and 29.6% are not hospitalized whenever they should be."<sup>7</sup> In China, as in many other emerging markets, doctors are

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<sup>4</sup> G. Schieber and A. Maeda, "Health Care Financing and Delivery in Developing Countries," *Health Affairs* 18, no. 3 (1999): 193–205.

<sup>5</sup> Fei Li, "Medical Sector in Dire Need of Changes," *China Daily*, March 10, 2005, [http://www.chinadaily.com.cn/english/doc/2005-03/10/content\\_423414.htm](http://www.chinadaily.com.cn/english/doc/2005-03/10/content_423414.htm).

<sup>6</sup> "China's Growing Pains," *Economist*, August 21, 2004.

<sup>7</sup> Li, "Medical Sector in Dire Need of Changes," *China Daily*.

overworked and underpaid, leaving a large number of people without comprehensive health care because doctors simply do not have enough hours in the day to treat all their patients effectively. Additionally, these populations are in even more dire straits as doctors either leave the profession or leave the country altogether to seek work in developed countries where they receive more support and higher pay.<sup>8</sup>

Similarly, Russia's health care system has been undermined by severe funding shortages and inefficient distribution of health resources in the wake of vast political shifts during the early 1990s. The 1998 economic crisis further compounded the health crisis, leaving Russia with drug shortages, higher health care costs, and poorer overall health. As in China, the majority of medical staff is underpaid. Poor families are left scrambling to find money for bribes—often the only available way to get the medicine or treatment they need.

India and Vietnam also suffer from poor access to health care and treatment for those who need it most. India's health system ranks 118th out of 191 World Health Organization (WHO) member countries in overall health performance, and the poor are still in need of access to essential medical services. Because medical staff are notorious for not keeping appointments, many conditions go untreated. As a result, people in India sometimes turn to unqualified amateur doctors or traditional healers, and preventable and curable illnesses often go untreated or mistreated, resulting in increased fatalities. For Vietnam, poverty is the main obstacle. Since hospital visits and recovery time are extremely expensive in terms of both cost and lost wages, people often wait until they are too ill to work before they seek medical advice or treatment. In keeping with the above trend, doctors and nurses are also underpaid and overworked.

### *Aging Populations*

Though the populations of most developed countries have been aging steadily for the past hundred years, Asian countries in particular have recently experienced a dramatic fall in fertility rates. In fact, of the six countries that account for 54% of the total number of citizens aged 80 years or over, China is number one, the United States is number two, and India and Japan rank third and fourth.<sup>9</sup> Additionally, in the Republic of Korea and Singapore, the population 80 years or older is projected to

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<sup>8</sup> There is an unprecedented exodus of African health care professionals and the situation is worsening by the day. Of the 600 Zambian doctors trained since independence, only 50 are said to have remained in the country. See Ian Couper and Paul Worley, "The Ethics of International Recruitment," *Rural and Remote Health* 2, no. 1 (January-December 2002): 196.

<sup>9</sup> United Nations, Department of Economic and Social Affairs, *World Population Ageing: 1950-2050* (New York: United Nations, 2001), <http://www.un.org/esa/population/publications/worldageing19502050/>.

increase tenfold from 2000 to 2050.<sup>10</sup> In Europe, 65-year-olds outnumber 15-year-olds in Italy,<sup>11</sup> while Germany's social net, which depends upon young workers taking over from older people and financing their retirement, is already facing a severe imbalance. Even France's population, which has the second highest fertility rate in Europe, faces a serious aging problem that threatens state spending on health and pensions. Like Japan, one third of French citizens will be over 60 years old by 2050.

The health of the elderly typically deteriorates with increasing age, inducing greater demand for health services and facilities over longer periods of time. Should this stressor continue to evolve without significant political and social intervention, the world will face severe economic and social consequences over the next 50 years. These consequences are likely to include serious labor shortages, reduced tax revenues, and financial pressure on governments to provide pensions and social security benefits as well as pay for the medical bills of a large population afflicted with acute illnesses. These financial demands will drive up the taxes of a decreasing working population with fewer savings, eventually slowing economic growth. A shortage of caregiving facilities and providers will place additional strain on families, with sons and daughters forced to choose between full-time work and caring for elderly parents. This problem is approaching a crisis point. Indeed, as a 2005 McKinsey report states:

...by 2024, more than a third of Japan's population will be over the age of 65, making it one of the oldest in the developed world. Retired households will outnumber households in their prime saving years, so savings rates will fall dramatically, and Japan's financial wealth will begin to decline. The continual improvement in living standards that the country has enjoyed over the past half century will come to an end.<sup>12</sup>

## Early Health—An Asian Model

*Toward an Early Health Model:*

*Merging Western Medicine with an Eastern Mindset*

Staying healthy is a much easier process for aging individuals to manage than is treating illness. But maintaining one's health requires sustained attention and

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<sup>10</sup> United Nations, *World Population Ageing*.

<sup>11</sup> Sylvia Poggioli, "Italy's Population Problem," National Public Radio, October 11, 2004, <http://www.npr.org/templates/story/story.php?storyId=4079779>.

<sup>12</sup> Diana Farrell and Ezra Greenberg, "The Economic Impact of an Aging Japan," *McKinsey Quarterly*, May 2005, [http://www.mckinseyquarterly.com/article\\_page.aspx?ar=1614&L2=7&L3=10](http://www.mckinseyquarterly.com/article_page.aspx?ar=1614&L2=7&L3=10).

proactiveness with regard to personal health beginning from childhood as well as effective detection and treatment of illness early enough to prevent or cure disease. Moreover, focusing on wellness early is much easier for individuals' families, friends, and communities. In many regions, however, current health care systems are primarily centered on treating acute and chronic medical problems. As populations age, this type of system, which is found in both developed countries and emerging markets, is fast approaching a crisis point.

For the health care ecosystem to continue to be viable, there must be a radical shift to relieve pressure on strained and expensive human and infrastructural resources. This change will require a focus on personal prevention and wellness, a shift that will in large part be enabled by those technologies available at low cost to the mass market. In this regard, the Asian world is far ahead of the West and has been so for millennia. According to traditional Chinese medicine, the physician's responsibilities emphasize prevention, recommendations about lifestyle, and emotional support, all of which combine to promote health rather than respond to sickness.<sup>13</sup> The patient is also responsible for monitoring his or her lifestyle and maintaining a healthy mental and physical balance.

What this shift entails is a move away from the existing primary focus in Western health systems on treating late-stage illnesses toward a more holistic view of health maintenance, a view that Asian populations have traditionally held for thousands of years and that is increasingly becoming known as "early health" in Western societies. The building blocks of early health include: (1) maintaining wellness, (2) prevention and prediction of illness and disease by understanding not only risks and benefits of personal behavior but also environment and genetic predisposition to certain conditions, (3) early detection of disease, and (4) early treatment of disease. In the context of this essay, the term "disease" encompasses both non-communicable and infectious diseases as well as chronic disorders and pain, high cholesterol, obesity, and other less severe conditions.

For many Western countries, the term "health" essentially means "the absence of disease." Western societies demand that hospitals have the most advanced medical technology readily available to treat illnesses, regardless of cost. While this demand is not going to diminish, we could reduce the need to access expensive, complex, last-resort technologies and procedures if people were to focus more attention on preventing

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<sup>13</sup> David Eisenberg, *Encounters with Qi: Exploring Chinese Medicine* (New York: W.W. Norton & Company, 1985).

illness early—and invest in simpler, more accessible technology that aids prevention, early detection, and prompt treatment.

A transformation in health care will not be easy or quick—but such a change is possible, and in fact already in progress. For example, a recent *New York Times* article reported that, after 70 years of rising steadily, the number of deaths from cancer in the United States declined for the first time ever from 2002 to 2003. The source of this decline was not stronger drugs but rather an apparent reflection of “...a change in personal smoking habits and early detection and treatment in prostate, colorectal and breast cancer.”<sup>14</sup>

The goal is not to forgo Western medical advancement in favor of alternative traditional Eastern healing approaches but instead to incorporate the modern advances of the West with the added focus on prevention and prediction of disease as seen in traditional Eastern medical thought.

Although this approach is intuitive to most people, a shift toward early health requires major behavioral and systemic changes for most countries. Even if individuals were to embrace this concept wholeheartedly, there are not enough doctors or medical facilities available either to help everyone understand the risks that their behavior and genetic history pose or to provide the necessary resources for people to manage and monitor their health effectively. By scaling health care to the individual needs and conditions in each system, economy, and culture, information technology can not only help address the three stressors outlined at the beginning of this essay but can also bring about a systemic shift toward early health.

## **How Information Technology Addresses the Three Stressors on Global Health**

### *Health Systems' Focus on Late-Stage Illness*

Technologies ranging from personal instrumentation and monitoring to nanotechnology and advanced robotics represent a huge opportunity to create an increasingly self-managed health care environment that facilitates early health in a scalable way. In the future, as technology becomes less expensive and more sophisticated, homes could be equipped with sophisticated but easy-to-use monitoring, diagnostic, and communications infrastructures to help individuals manage the health

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<sup>14</sup> Denise Grady, “Dip in Cancer Deaths Is Reported, First Decline in U.S. in 70 Years,” *New York Times*, February 9, 2006, [http://www.nytimes.com/2006/02/09/national/09cancer.html?\\_r=1&oref=slogin](http://www.nytimes.com/2006/02/09/national/09cancer.html?_r=1&oref=slogin).

maintenance process. Diagnosing and treating many everyday conditions can be a completely automated process—just feed a drop of blood into a machine, and a few minutes later your computer produces a diagnosis, recommends treatment, and helps you arrange a visit with an appropriate health care professional if necessary.

In this wellness ecosystem, the result of a personally managed “check up” could be as simple as an alteration in wellness behaviors or, if there is a more complex problem, the scheduling of a visit to a doctor who would receive the patient’s computerized health work-up in advance. With early diagnosis, monitoring, and care, it may become possible to mitigate or even eliminate entire categories of medical issues. Information technology will also empower people to take control of their health and live healthier lives longer, making visits to doctor’s offices and hospitals the exception rather than the rule—something associated more with acute rather than chronic care. Eventually, personal health-monitoring and diagnostic tools—similar to the personal glucometers used for diabetes testing today—will be integrated into the personal profile. For more complicated tests, low-cost “drive-thru” clinics will become commonplace for indicators such as blood protein. Such clinics will provide computer-assisted diagnostics for a quick reading on the current internal functions of the body—along with preliminary computer-aided recommendations for next steps.

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**In the near future, a portfolio of personalized wellness services—connected to increasingly sophisticated and IT-enabled diagnostic and monitoring services—will give people the tools needed to manage their own non-acute care.**

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Today, without leaving their living rooms, people are able to become sufficiently knowledgeable to participate intelligently in their own wellness and health treatments through personal monitors and research on the Internet. It is only a matter of time before these tools become even more affordable and accessible and sensors are commonly used in the home to monitor health and wellness. Do-it-yourself health will become the norm, and individual-directed health maintenance will become commonplace. In the near future, a portfolio of personalized wellness services—connected to increasingly sophisticated and IT-enabled diagnostic and monitoring services—will give people the tools needed to manage their own non-acute care. This notion of a portfolio will ultimately redefine the shape of health care systems in both developed and emerging markets. Over time, there will also be a shift in the economics of health care provision, with more responsibility shifting to the ultimate recipients of health care services, who will have an economic incentive to be proactive about their health care. In developed

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countries, health care systems as we know them—whether supported by government or third-party insurance carriers—will be changed beyond recognition over the next 30 years.

Despite this sea change, the personal physician will not become obsolete—in fact, the general practitioner will become more important than ever. The difference is that the physician's roles will change, moving away from the treatment of late-stage illness and toward assessing options for preventive actions. Current medical practice will be augmented by IT, robotics, and expert systems that help physicians understand and treat more conditions and perform more complicated procedures more effectively.

Doctors will also increasingly rely upon highly personalized treatments, such as new drugs targeted specifically to an individual's family history or even nano-machines that eradicate bad cholesterol or find and eliminate tumors that are too small to detect today. Specialists will be freed to focus on complex procedures and push the frontiers of health care. Other health care providers can also benefit enormously from the incorporation of advanced technology into their work. For example, emergency paramedics could use camera phones to send pictures of incoming injuries ahead to hospitals or remotely gather information and provide diagnoses from secluded locations without either the patient or the physician having to travel.

Thanks to sophisticated information systems and the intelligent interrelation of information produced by search technology and other forms of artificial intelligence, doctors will also have at their command a more integrated, holistic set of images and diagnostic information concerning their patients. Doctors will have access to advanced medical records that will over time be more accurately collected and saved. Additionally, doctors and nurses will use expert diagnostic systems that employ computer imaging and pattern recognition to deal with the highly complex interconnectivity of the human system. This development will result in more personalized, holistic, and ultimately better care.

### *Emerging Markets*

While many outstanding problems persist in emerging markets with regard to health, including physicians' salaries and a lack of facilities, there is light at the end of the tunnel.

Health information technology will go a long way in decreasing the burden on medical staff, reducing frustration and financial hardship on patients, cutting the cost of medical services and resources, and increasing communication among qualified



professionals and the general public. Furthermore, the communication and technology infrastructure for drastically increasing access to effective care is already starting to be put in place in emerging markets. That infrastructure is IT—via the Internet and cellular phones—which is available in areas where hospitals and physicians are not.

While only a very small percentage of the population in rural areas in Asia have access to the Internet in their homes, many of the most remote villages across Asia can boast at least some access to the Internet. In China, India, Russia, and Vietnam, Internet kiosks—used for communication and news—are becoming more and more prevalent. For a fee, Internet operators perform a variety of tasks for their neighbors. Increasingly, those operators are being called upon to look up health information, communicate data about symptoms and outbreaks of disease, and transfer digital photos of injuries to urban facilities—all from one small, remote village stand. Using that skeletal but sustainable infrastructure to provide diagnoses and treatment (either automatically or with a trained medical staff in the loop) and creating networks to connect these infrastructures could drastically improve the quality of health care in these markets.

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**In the interconnected health care world of the future, general practitioners will have more expert system tools at their command; as a result of the ubiquity of information systems, those tools can be made available even in the most underserved areas.**

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In the interconnected health care world of the future, general practitioners will have more expert system tools at their command; as a result of the ubiquity of information systems, those tools can be made available even in the most underserved areas. Inexpensive, scalable technologies that can help rural and disadvantaged populations take steps to detect and treat disease early—and even avoid many of today’s preventable disease—will see rapid, widespread adoption in emerging markets. Over time, more sophisticated practices and treatments will continue to become available at lower costs to a much larger percentage of the population. While many of these technologies will reach the developed world first, some may first be deployed in emerging markets as a result of greater need and fewer policy and infrastructure barriers.

Recalling the graph in this essay’s introduction, the scaling of health solutions in emerging markets through IT will also enable doctors in those economies to shift their energy and attention either to more people (moving up the “future” curve in the graph) or to more comprehensive care for the patients they already serve (moving down the curve).

*Aging Populations*

IT can provide the aging with a significant improvement in the quality of life at considerably less expense and at the same time ease the impact of aging on the health care infrastructure. Relatively small advancements in the technology and support infrastructure could even keep people out of expensive nursing home environments for

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**“Relatively small advancements in the technology and support infrastructure could even keep people out of expensive nursing home environments for a much longer period of time than is possible today—perhaps almost their entire lives...”**

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a much longer period of time than is possible today—perhaps almost their entire lives—as technologies enable more people to do for themselves what currently takes a staff of full-time caregivers. For example, diagnosis and treatment of many common conditions can be an increasingly automated process, while robotics, sensors, and communications technologies will help aging populations live healthier, longer, and more independent lives. Additionally, robotics may be applied in a cost-effective manner to routine house chores (as we are already seeing with vacuum

cleaners today) as well as meal-preparation, drug dispensing, and even as robotic companions. Increasingly sophisticated robots could help older people move around and stay safe, while remote sensing and communications technologies can keep them in touch with loved ones and monitor their condition.

Introducing simple assistance and monitoring devices while adults are still self-sufficient can help elderly individuals remain independent by preventing dangerous falls as well as by providing simple reminders for appointments and diet and medicine regimens. Through e-mail, instant messaging, and cellular phones, elderly individuals can stay in touch with friends, family, and doctors without a large physical or financial cost. Such technology not only physically empowers aging individuals to monitor their own health but also empowers them emotionally by creating mechanisms and processes that reduce their dependence on relatives or doctors.

Using technology to enable elderly individuals to care for themselves will, in turn, also help those individuals preserve their dignity. The adoption of technology will be much easier for the next generation of elderly individuals as the baby boomers of today grow older. Indeed, the vast majority of people approaching retirement in the next 10–30 years will be well versed with IT through experience throughout their adult lives with fax machines, cellular phones, e-mail, and the Internet.

## Policy Implications of Information Technology in Health Care

Search technologies enable people to find almost anything they want, any time they want, regardless of their location, race, language, or socioeconomic background. Additionally, on-line chat rooms, bulletin boards, and publications have created a new form of Web activism, one that enables people from around the globe to share information immediately and dynamically. These technologies create a new climate of information availability, which is already exerting influence on many governments and industries. The influence of this “community at large” offers enormous opportunities for policymakers to improve global health. Technical empowerment and connectivity will also create many challenges for the policy world. Some policy implications of evolving information technologies are given below.

### *Cost Savings*

Transforming health care through IT will over the long term result in significant cost savings to governments, insurers, and individuals. In the United States alone, experts project that effective implementation and networking of electronic medical records, for example, could save almost \$628 billion in health care efficiency and patient safety over the next fifteen years.<sup>15</sup> Additionally, centralized IT platforms for outpatient records, X-rays, and laboratory tests will save individuals and medical institutions enormous sums by eliminating the need for multiple record databases and facilitating information exchanges. Finally, IT can help reduce the financial burden of caring for the elderly, postponing and sometimes eliminating the need for institutionalized caregiving.

### *Faster, More Efficient Global Response to Disease Outbreaks*

Trade and travel have created a world in which infectious disease knows no borders, and technology is already facilitating international networks to advance disease detection, tracking, and reporting systems worldwide. Using the speed and accuracy of IT in this way increases policymakers’ opportunities to intervene early and spread knowledge about effective treatment. Technology will enable the international community to be much more proactive about containing HIV/AIDS, seek fresh resolutions to new outbreaks of polio and tuberculosis, and even help slow the spread of pandemic viruses such as SARS and avian flu. In addition to facilitating detection

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<sup>15</sup> Clifford Goodman, “Savings in Electronic Medical Record Systems? Do It For The Quality,” *Health Affairs* 24, no. 5 (September-October 2005): 1124–26.

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and treatment, greater technological connectivity makes possible the quick, efficient sharing of more basic medical information across borders.

### *Proliferation of Accurate Health Data*

Technology already empowers individuals and their caregivers by increasing access to valuable information through the Internet, providing opportunities to ask questions to licensed medical professionals, helping them conduct research on symptoms and diseases, and enabling them to share personal experiences and information with others. There has been a proliferation of individually managed websites that provide health information, on-line chat rooms, and publicly compiled on-line information clearinghouses where health information and experiences can be exchanged. Given these developments, people are clearly hungry for information and are willing to spend a great deal of time seeking answers to their questions. On the other hand, the Internet also gives individuals a greater opportunity to spread misinformation about procedures and treatments (whether intentionally or unintentionally) because there are few checks and balances. Though a challenge, such misinformation also presents opportunities for policymakers and technologists alike. Creating more websites that post reliable data, noting and publicizing sites that are exploitative or wrong, and establishing more chat rooms with licensed professionals standing by to answer questions are easy and inexpensive steps. Formal reputation and rating systems will also play an important role in promoting accurate information and in ensuring that health information on the Web is reliable and accountable.

### *Greater Opportunity for Coordinated, Global Public Scrutiny of Health Systems and Providers*

The Internet now enables citizens around the globe to communicate how well their health care provider, physician, or government is performing in terms of delivering this critical piece of the public infrastructure. The increasingly public nature of this dialogue has already created a level of focus that was not previously commonplace in the health industry. This scrutiny can benefit governments and insurers if policymakers harness the technical feedback mechanisms and welcome critiques and suggestions about change. In fact, policymakers could use public comments, frustrations, and experiences with health systems expressed on-line as market research to help governments enact more effective health policies and inform more popular institutional changes. By taking criticism posted on the Internet seriously and responding on-line and through improved products and services, companies and policymakers can communicate directly with concerned constituents, ultimately benefiting all parties.

### *Privacy and Security Debates*

IT companies understand concerns about privacy and are meticulously incorporating extensive security and privacy measures into emerging technologies. Policymakers also value privacy and security enormously and are working with IT companies to ensure they meet appropriate standards at every stage of development. For example, new mechanisms—such as Information Rights Management and role- and policy-based access—have been important software tools in rigorous validation of identification and access rights and can also be brought to bear on problems in the health care arena.

Fundamentally, the same privacy and security issues that exist with paper medical records will transfer to concerns surrounding electronic health records (EHRs). The goal of EHRs is to streamline information for patients to manage in tandem with their health care providers, and for that information to be available for practitioners to prevent, detect, and treat diseases more effectively. Most people lack detailed records of allergies, immunizations, chronic conditions, past events, and operations. While a patient's medical history is important, streamlining that history is very threatening to individuals concerned that their private health information could be accessed and misused by outside parties. EHRs can already be configured to ensure that only the right eyes view sensitive sections, such as positive disease status and psychiatric history. Ultimately, however, EHRs must be introduced in tandem with legislative and technological measures that prevent public access and give patients ownership of their private information.

### *New Collaboration Among Policymakers, Hospital Administrators, Physicians, Insurers, and the Public*

A successful transformation in health care through IT will, in the long run, require the cooperation of policymakers, hospital administrators, physicians, insurers, and consumers. This will mean significant adjustments in the way that all of these parties conduct business and interact with each other and will require the creation of new measurement and reimbursement systems, modified communication mechanisms, and eventually more widespread, scaled infrastructure. This transformation will not be easy. But the benefits to all will be enormous.

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Representative Joseph Pitts (R-PA)  
Representative Earl Pomeroy (D-ND)  
Representative David Reichert (R-WA)  
Senator John Rockefeller IV (D-WV)  
Representative Loretta Sanchez (D-CA)  
Senator Charles Schumer (D-NY)  
Representative Rob Simmons (R-CT)  
Representative Adam Smith (D-WA)  
Senator Gordon Smith (R-OR)  
Senator Ted Stevens (R-AK)  
Representative Ellen Tauscher (D-CA)  
Senator Craig Thomas (R-WY)  
Representative Mac Thornberry (R-TX)  
Senator John Warner (R-VA)  
Representative Diane Watson (D-CA)  
Representative Curt Weldon (R-PA)  
Representative Robert Wexler (D-FL)