To Our Health:

The Role of IT in Healthcare

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Abstract

Preventable medical complications are afflicting a growing number of Americans. Meanwhile, the field of healthcare has been slow to uptake information technology. This thesis reviews existing literature in order to produce recommendations on how to use information technology to reduce the cost and increase the quality of healthcare in the United States. Current findings and statistics from academic and governmental sources are cited in order to illustrate the present state of the healthcare system. Changes in the healthcare model are advocated on an individual, corporate, and government level. It is proposed that improvements can be made through the metrication of personal health statistics, the use of electronic medical records, and the conversion of American healthcare into a market-based system with widely accessible quality ratings. These recommendations are targeted to voters and policymakers interested in improving the American healthcare system.

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Introduction

Americans are dying. They are dying by incredible numbers, for incredibly stupid reasons. As this alarms me, I would like to highlight and propose means for improving the health of the American population. The health improvements that I will explore are produced through a combination of reductions in the cost of healthcare to individuals and society and increases in the quality of healthcare. Although many current efforts to improve health focus on conducting innovative research and finding new cures, this effort will not do that, but will instead focus on the low-hanging fruit. Instead of focusing on the dainty and irascible plums of medicine, I will focus on the big and hearty watermelons (see Figure 1). I hope to determine methods for reducing the number of people suffering from ailments that have both well-known and inexpensive cures. The desired outcome can only be achieved through the use of technology, as technology is a means through which labor can be replaced with capital, and efficiency can be most easily increased. Although there is much to be said about the importance of research and non-technical improvements, I am striving to seek ways to better use currently-available and inexpensive resources. Thus, my goal is to provide strategies for increasing the quality and reducing the cost of American healthcare, through the use of technology.

Pomelos Generic Procedures	**Watermelons** Self Care (General Knowledge)	
Plums Tailored Procedures	**Grapes** Self Care (Learned Knowledge)	

Size of Population Served (vertical axis)

Ease of Access (horizontal axis)
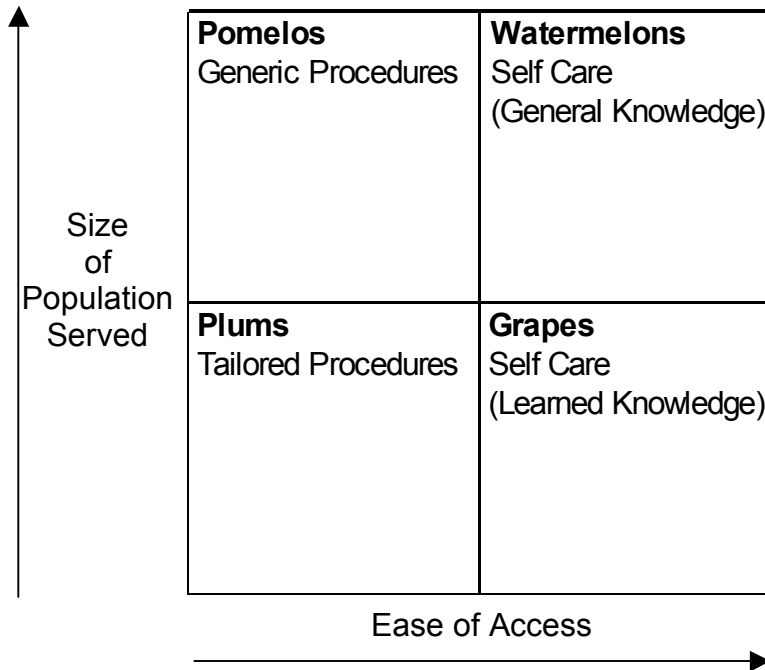
Figure 1: Ease and Value of Medicine Matrix

Before further broaching the subject, I would like to first explain how I became interested in this topic. In 1994, my father was diagnosed with diabetes. His sister had died of diabetes two years earlier, which made the disease ever more real to him. He could have decided to mismanage his health, as his sister had, but instead decided to take decisive action. By modifying his diet and exercise routine, he managed to fend-off the progression of the disease. For ten years now, he has diligently monitored his own health, and has managed to avoid needing to take insulin. His diet is not magical, and it is not expensive, but it works for him. He doesn't buy organic foods, and often opts to buy the house brand. The magic of the diet is not in its raw ingredients, but in his strict compliance to it. Although I will not delve into the particulars of his culinary habits, I will explore how willpower, discipline, and reinforcing mechanisms can help others achieve the type of miracle that he has achieved for himself. As not everyone has the discipline to follow a strict regimen, people can benefit from using technology-based behavioral re-enforcements to augment internal discipline. Through increased medical monitoring and other means, it is

possible to increase the number of incentives and reinforcements available to help Americans improve their health.

If modern America followed the advice of Jeremy Bentham's utilitarianism, and sought to provide the greatest good for the greatest multitude, perhaps there would be a far greater focus in society on solving the problems I am going to investigate, and far less focus on solving the problems that I am going to ignore. Schoolchildren are frequently warned of all sorts of potential dooms that may lead to their demise. Police officers tell elementary school children about the danger posed by strangers. High school students are told about the dangers of driving and Acquired Immune Deficiency Syndrome (AIDS). In 2002, 17,638 Americans of all ages died of assault, 106,742 died of accidents of all kinds, and 14,095 died of complications related to Human Immuno-Deficiency Virus (HIV).[1] While not trivial, all of these conditions should be considered a footnote in the scheme of things. The true danger is at lunchtime. In 2002, 2,443,387 Americans died of heart disease, 73,249 died of diabetes, and 27,257 died of cirrhosis of the liver (see Figure 2).[2] These three ailments, whose risk factors can be modified via diet and lifestyle, account for over eighteen times more deaths than the three maladies which are commonly used to scare schoolchildren. This statistic is particularly shocking, since malicious strangers, auto accidents, and AIDS strike suddenly and unexpectedly, but lifestyle ailments take decades to develop and often are accompanied by warning signs easily recognizable to family members.

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[1]"Table E. Deaths and percentage of total deaths for the 10 leading causes of death, by race: United States, 2002." National Vital Statistics Reports,Vol. 53, No. 17. 7 Mar. 2005. Centers for Disease Control and Prevention. 15 July 2005. <http://www.cdc.gov/nchs/data/dvs/nvsr53_17tableE2002.pdf >

[2]"Table E. Deaths and percentage of total deaths for the 10 leading causes of death, by race: United States, 2002." National Vital Statistics Reports,Vol. 53, No. 17. 7 Mar. 2005. Centers for Disease Control and Prevention. 15 July 2005. <http://www.cdc.gov/nchs/data/dvs/nvsr53_17tableE2002.pdf >

Figure 2: Death Rates for Leading Causes of Death for All Ages[3]

Judging by the title of this work, "To Our Health: The Role of IT in Healthcare," you may not be sure whether this document is of interest to you. Although my primary target audience consists of people in the information technology and healthcare industries, regardless of your occupation, this document discusses topics that will directly affect your life. While the information given may be industry specific, the document has been written from a layman's perspective.

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[3] "Data table for figure 25. Death rates for leading causes of death for all ages: United States, 1950-2002" <u>Health, United States, 2004</u>. Centers for Disease Control and Prevention.

Defining Information Technology

What is Information Technology (often abbreviated as "IT")? Before pontificating about the importance of IT, it is important to understand what IT is and what it is not. According to the American Heritage Dictionary, Information Technology is "the development, installation, and implementation of computer systems and applications." [4] As the definition shows, IT encompasses many things. For the purpose of this document, healthcare IT will be defined as:

Electronic applications, services, and systems that create value by enabling people within the healthcare industry to complete their jobs more effectively or by enabling people outside of the healthcare industry to better maintain their health.

Thus, systems that handle electronic medical records, assist in the creation of bills, or allow patients to better monitor their own health will all be classified as healthcare IT.

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[4] "Information technology." <u>The American Heritage® Dictionary of the English Language, Fourth Edition.</u> 2000.

Understanding the Problem

Why are Americans dying by incredible numbers, for incredibly stupid reasons? This is a problem for a variety of disciplines that will require a multidisciplinary solution. The specific disciplines that come to mind are:

- Behavioral science

- Information technology

- Nutritional research

- Organizational management

- Public policy

- Quality management

Deliberately omitted from this list is the field of medical science. Most of the medical knowledge necessary to combat the underlying causes of heart disease, diabetes, and cirrhosis of the liver already exists. Thus, *behavioral science* must be used to ask, "Why do people maintain unhealthy habits if they know that those habits are bad for them? Likewise, *information technology* must be used to ask, "How can people be assisted in making better choices?" Meanwhile, *nutritional research* must be employed to ask, "How can common foods be used to improve the health of the masses?" *Organizational management* must be used to ask, "How can healthcare companies be built that incentivize healthy behavior?" *Public policy* must be used to ask, "How can the government create systems that promote increasing the health of citizens?" Last, but perhaps most importantly, *quality management* must be employed to ponder, "How can we make what we are doing now work better?" Thus, the answer to solving most present day medical problems does not lie with the field of medical science. As the problems are largely solved, it is instead

imperative to use other disciplines to ask the right questions and seek the right answers. The future of healthcare rests in the hands of doctors and non-doctors alike. Medicine is no longer about white coats, cold, sterile hands, and candy stripers. It is about all of us.

Behavioral Science & Healthcare

It was recently reported by the Department of Health and Human Services that "six of ten men and seven out of ten women are not sufficiently active to benefit their health."[5] As activity can be defined as performing vigorous labor, walking, playing tennis, gardening, and other recreational activities, this figure may seem surprising. Although some physical activities, such as playing squash, may only be accessible to those with expensive health club memberships, many physical activities are accessible to all. In many of the poorest nations, it is easy to find people engaged in athletic pursuits.

Thus, this is clearly not a problem of wealth, but instead a problem of time and priorities. The argument that Americans, on average, lack the time to exercise can also be invalided. "Television watching represents a major sedentary behavior in the United States; on average, a male adult spends approximately 29 hours per week watching TV, and a female adult, 34 hours per week." The government's definition of being "sufficiently active" consists of exercising vigorously for twenty to sixty minutes per day, three to five times per week.[6] As this recommendation takes only one to five hours per week to complete, it is clear that if people replaced only a small fraction of their TV viewing with exercising, it would be possible for them to improve their health.

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[5] "Exercising for health. " Health and Hygiene 24.1 (2003): 10. Health Module. ProQuest.

[6] Klingensmith, Dawn. "Exercise Alert." Windy City Sports Magazine. 30 July 2005.
<http://www.windycitysports.com/story.cfm?story_id=9864&pageID=4824>

Therefore, it can also be said that America's inactivity cannot be blamed on a lack of time. If Americans are neglecting their health for reasons other than a lack of time or money, the issue must be behavioral.

Information Technology and Healthcare

Imagine if whenever someone transferred a bank account, the teller requested a photocopy of their bank statement from their last bank, keyed the statement into the system, and then sent a letter to the previous bank telling them to close the file. In this society, it would be hard to feel confident that one's financial assets were being handled properly.

The problem is that something similar routinely happens to pharmaceutical records. As no uniform method for transferring the records electronically currently exists, pharmacists must call each other when transferring prescriptions to pharmacies run by other companies. While pharmaceutical prescription data does not convey financial "value," as did the bank statement in the previous example, few would argue that it lacks a great amount of intrinsic value.

Robert Seliger, President and CEO of Sentillion, a company specializing in managing access and identity in healthcare systems, scornfully described the sorry state of the management of medical information as follows:

Filling out the same information on myriad forms does not engender confidence. Being asked the same questions by many different caregivers does not engender confidence. Having the same tests performed repeatedly does not engender confidence.

In the relatively new age of computerized records, seeing sensitive patient information on computer monitors in hallways and at central stations and patient bedsides also does not engender confidence. If I can see Mrs. Jones'

data on an unattended personal computer in the hallway, then who can see my data? Worse yet, who can enter data about me?[7]

If in the common vernacular, health is considered to be the greatest wealth, it is inexplicable that medical records are treated in such a slipshod fashion in comparison to financial records. While the creation of an electronic standard for medical records will require a standards body of some sort to convene, the result will be positive and long-overdue. The absence of solutions in this industry underscores the difficulty in creating them. Standards for electronic banking have existed for decades, yet no one has doubted their prudence. If the application of medicine is truly to become modern, it must employ information technology in a manner similar to other modern fields.

Nutritional Research & Healthcare

Children are often told, "You are what you eat." Although this may stir visions of transforming into pizza-slices in the imaginations of children, it is somewhat reflective of the truth. When a child eats a slice of pizza, he absorbs the fat-laden cheese and carbohydrate-laden crust into his body. The pizza becomes part of him.

Since diet has a powerful influence on health, great benefits can result from ensuring that Americans are eating properly. After all, it would be a shame for us to become a nation of pudgy, fat-dripping burgers. Unfortunately, less care is often given to monitoring diet than to monitoring other aspects of daily life. While many people use software applications such as Quicken to monitor their financial accounting, few people use similar applications to monitor their dietary accounting.

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[7] Seliger, Robert. "It's More Than a Matter of Trust." Health Management Technology. 1 Oct. 2004: 82. ABI/INFORM Global. ProQuest.

One of the problems with nutritional accounting today may stem from the general lack of national agreement on what constitutes a nutritious diet. While the U.S. Department of Agriculture suggests a food pyramid based upon grains, the supporters of Dr. Robert Atkins suggest a food pyramid based upon protein. There is not a great degree of national agreement on what constitutes a healthy meal, which makes it difficult for individuals to use technology determine if their meals were healthy. Thus, balancing a diet is not as easy as balancing a checkbook. Further research and agreement on what constitutes an optimal diet will be necessary before effort can be placed in widespread enforcement of diets.

Organizational Mgt. & Healthcare

Whenever a client of a health insurance company requires medical care, it costs the company money. Therefore, the company running the policy has the incentive of doing whatever best increases profits through reducing these expenditures. Classically, this has been viewed as a problem, as it has been thought that health insurers and health insurance customers have opposite objectives; the insurers to pay for as little care as possible, and the consumer to receive as much care as possible. This view, although possibly realistic, shows little creativity. It was recently mentioned in the Milbank Quarterly that The Rand Health Insurance Experiment had found that "copayments led to underuse of preventive care services and to a lower proportion of patients whose hypertension was adequately controlled."[8] While capitation-based payment decreased the level of care received, the opposite effect was observed for fee-for-service treatment, which promoted over utilization.

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[8] Chassin, Mark A. "Is Health Care Ready for Six Sigma Quality?." Milbank Quarterly, 1998, Vol. 76 Issue 4, p565, 27p

As the Rand study observed, policies that encourage the underuse of preventative services by a population can result in a greater incidence of costly conditions, such as hypertension. Although anti-hypertension drugs are costly, the complications caused by hypertension-related diseases, such as diabetes, are even more costly. As they saying goes, "a stitch in time saves nine."

Although insurance companies could attempt to reduce their costs through providing low-quality service, a more intelligent way to reduce costs would be to work to increase the health of the insured population. If insurers and policyholders worked together to increase health, a great cost savings could occur. Thus, there is a lot of value in insurers helping policyholders reduce the number of ailments they have. One such way to do this is to offer lower rates to people who are in better health. While this is currently done on the basis of smoking, it could be extended to other criteria, such as body mass index, cholesterol level, and blood pressure.

Public Policy & Healthcare

For better or for worse, the American government is inextricably linked with the American healthcare system. The government provides health insurance to those on Medicaid and Medicare, and is responsible for regulating medical records through the Health Information Privacy and Accountability Act (HIPAA).

In 2004, 54.6 million Americans were beneficiaries of Medicaid[9] and 41.7 million Americans were enrolled in Medicare[10]. Through Medicaid and Medicare, the government serves as one of

[9]"Medicaid Enrollment and Beneficiaries – Selected Years."
<http://www.cms.hhs.gov/researchers/pubs/datacompendium/2003/03pg34.pdf>

[10] "Medicare Enrollees – Selected Years."
<http://www.cms.hhs.gov/researchers/pubs/datacompendium/2003/03pg30.pdf>

the largest purchasers of health services. These programs, like private health insurance plans, are able to negotiate with hospitals to receive discounted rates for treatment.

As the government clearly plays a large role in the medical industry, the industry is somewhat outside the domain of the laws of economics. While talking about health savings accounts, President George W. Bush himself said, "There are no market forces involved with healthcare."[11] Although what Bush said can be viewed as a bit of an overstatement, as supply and demand for healthcare do somewhat exist, it serves to highlight an important issue. In most American industries, the supplier and the consumer are firmly linked.

For instance, when a man wants a haircut, he goes to a barber. The man determines how much he is willing to pay to receive a haircut, and the barber determines how much he must receive to give a haircut. If the price that the barber demands is less than the maximum the man is willing to pay, a transaction occurs.

If haircuts were performed by surgeons instead of by barbers, a very different transaction would occur. The resulting transaction would be rather similar to what happens when children wants a haircut. When a boy wants a haircut, he first asks a parent (i.e. the Primary Care Physician) whether they agree that he needs a haircut. If the parent agrees that the boy needs a haircut, the parent will suggest a few barbershops (specialists) at which the boy may receive the haircut. Once at the barbershop, the parent may limit the styles of haircut that the boy can receive, and may be unwilling to pay for elective treatments, like highlighting or coloration. While the boy has earned general "haircutting coverage" by paying his dues via chores, he does not receive money from the parent. Instead, the parent pays the barber for the directly. If the parent had given the boy cash, he could have gone to any barbershop of his choosing and received a haircut of any

[11] Keefe, John. "Health? Wealth? " <u>Institutional Investor.</u> 1 Mar. 2005: 1. <u>ABI/INFORM Global</u>. ProQuest.

style. If the boy received cash and wanted highlights, he could have used a bit of his own savings to supplement the money that he received from the parent.

In this example, it can be seen that in American healthcare, the buyer of healthcare is often not the end user. Just as a lack of a direct market interaction prevents children from receiving the haircut of their choosing, a lack of consumer driven healthcare prevents people from receiving the medical treatments of their choosing. For a market to be formed, the consumer and supplier must be able to express their desires to each other. If a proxy makes purchases for the consumer, the consumer is inhibited, and a market does not form.

Quality Mgt. & Healthcare

Neither a politician nor a plebian would protest the importance of having quality healthcare. Likewise, few citizens would say that it is important for the country to have a higher level of quality in cell phone manufacturing than in healthcare. One current strategy for increasing quality has been to strive for "Six Sigma" quality; that is to have 3.4 or less defective "products" per million. According to Ronald D. Snee, "Six Sigma is a statistically based, process-focused approach to business improvement that companies such as Motorola, Allied-Signal, and General Electric have used to produce millions of dollars in bottom-line improvements. Six Sigma is a strategic approach that works across all processes, products, and industries including health care."[12] Motorola's "Six Sigma" efforts have been successful, as its goal of improved quality has been reached. Although having fewer than 3.4 mistakes per million patients treated may be difficult to achieve in the healthcare industry, it is clear that the present state of healthcare

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[12] Snee, Ronald D. "Using six sigma in improving health care systems." Quality Congress. ASQ's ... Annual Quality Congress Proceedings (2000): 571. ABI/INFORM Global. ProQuest.

quality is no where close to that level. Mark R. Chassin, Chairman of the Department of Health

Policy at Mount Sinai School of Medicine, recently commented:

If the performance of certain high-reliability industries, whose standards of excellence we take for granted, suddenly deteriorated to the level of most health care services, some astounding results would occur. At a defect rate of 20 percent, which occurs in the use of antibiotics for colds, the credit card industry would make daily mistakes on nine million transactions; banks would deposit 36 million checks in the wrong accounts every day; and deaths from airplane crashes would increase one thousand-fold.[13]

Thus, it is clear that although people value having quality healthcare, the quality of healthcare is

leagues away from the quality of products in other industries. The problem that must be solved

is how to best extend practices such as "Six Sigma" and "Total Quality Management" to the

field of healthcare, which has historically been resistant to change.

The need for improvements in American healthcare is remarkably clear. The powers of IT are by

now well-known to industry, and the benefits of IT to healthcare have been well-articulated.

President Bush himself recently remarked,

It's estimated that they spend $8,000 per worker on information technology in most industries in America, and $1,000 per worker in the health care industry. And there's a lot of talk about productivity gains in our society, and that's because companies and industries have properly used information technology. If properly used, it is an industry-changer for the good. It enables there to be a better cost structure and better quality care delivered, in this case in the health field.[14]

As it is essential to address problems within the political framework surrounding them, this

document will seek to uncover means for implementing President Bush's vision. The tools

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[13] Chassin, Mark R. "Is Health Care Ready for Six Sigma Quality?." Milbank Quarterly, 1998, Vol. 76 Issue 4, p565, 27p

[14] Bush, George W. "President Bush Touts Benefits of Health Care Information Technology." 27 Apr. 2004. White House Press Releases. 23 June 2005. <http://www.whitehouse.gov/news/releases/2004/04/20040427-5.html>

necessary to see this vision through exist today. It is up to us to make sure that they are put to

good use.

Part 1 - Reducing Cost

Whenever a process innovation is made, there are typically two foci, which are sometimes, but not always, contradictory. These foci are reducing cost and increasing quality. Reducing cost involves examining the present for inefficiencies, while increasing quality involves creating better processes for the future.

There is a common adage that goes, "cost, quality, speed—pick two." Thus, some people may feel that the consequence of reducing cost and increasing the quality of medical care will be decreasing the speed in which medical services can be delivered. Following this train of thought, it is possible for visions to coalesce of America developing a health care system as slow as that of Canada or England. Although the Canadian and English healthcare systems both offer healthcare at a lower cost, there is evidence that superior medical care is available in the United States—at least for those who can afford it.

The above paragraph may cause doctors reading this document to gasp in fear. Many initiatives in other countries aimed at reducing the cost of medical care have done so by reducing the salaries of doctors. However, this document does not aim to accomplish these improvements through reducing the salaries of doctors, as substantial reduction in the salary of doctors may result in a reduction in the quality of people who pursue the field of medicine.

Furthermore, any sort of medical reform cannot occur without the support of both the government and the health insurance industry. The healthcare market, in its present form, does not promote efficiency as much as it potentially could. Government and corporate change are essential for progress. Any changes that are made should be made in a manner that promotes a

free market. Thus, document's goal is not to socialize medicine, nor to reduce the earnings of those in the medical profession, but to instead reduce the cost, in terms of time and capital, of treating patients, so that more patients can be treated for more conditions. This can best be achieved alongside a parallel effort to reduce illness in patients via prevention. The increased volume that will be created by these efficiencies will hopefully both increase the health of Americans while maintaining the livelihood of those in the medical community.

Assessing the Present:

Before charging off into the future, it is crucial to sit in the present for a few minutes, and assess the milieu. The field of assessing the present is so important that practitioners of this craft have formed a discipline—sociological statistics. It will be through these statistics that the quality of America's healthcare will be explored in this section, as statistics provide the most scientifically general assessment.

In order to understand American healthcare in a broader context, it is important to have an understanding of the medical spending patterns of other nations. Learning about other nations will help place the structure and cost of American healthcare in context. A recent article in Health Affairs summarized healthcare in several English-speaking concluded that "U.S. hospitals stand out for high costs (three times the OECD[15] median cost per day and twice the OECD cost per capita), low rates of hospital admissions, and short lengths-of-stay."[16] In Table 1, the poor efficiency of the American healthcare system is illustrated. Despite having the highest level of per-capita healthcare spending, the United States has a lower life expectancy than Australia,

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[15] Organisation for Economic Co-operation and Development (sic; British spelling)

[16] Blendon, Robert et al. "Confronting Competing Demands To Improve Quality: A Five-Country Hospital Survey." Health Affairs Chevy Chase:May/Jun 2004. Vol. 23, Iss. 3, p. 119-135 (16 pp.)

Canada, France, Japan, and the United Kingdom. In this table, it is clear that America spends more than many of its peers on healthcare. However, it is unclear that Americans are getting proportionately more return. Total per capita healthcare expenses in the United States are double what they are in Japan. Are Americans twice as healthy as the Japanese? This is clearly unlikely, as the average Japanese can expect to live almost half a decade longer than the average American. The only conclusion that can be made is that for some reason, Americans are getting a bad deal.

Table 1: Core Health Indicators from the WHO (2002)[17]

Indicator	Australia	Canada	China	France	India	Japan	Mexico	UK	US
Life expectancy at birth (years) total population	80.4	79.8	71.1	79.7	61	*81.9*	74.4	78.2	**77.3**
Total expenditure on health as % of GDP	9.5	9.6	5.8	9.7	6.1	7.9	6.1	7.7	*14.6*
General Government expenditure on health as % of total expenditure on health	67.9	69.9	33.7	76	21.3	81.7	44.9	*83.4*	**44.9**
Private expenditure on health as % of total expenditure on health	32.1	30.1	66.3	24	*78.7*	18.3	55.1	16.6	**55.1**
General Government expenditure on health as % of total general government expenditure	17.1	15.9	10	13.8	4.4	17	16.6	15.8	*23.1*
Social security expenditure on health as % of general government expenditure on health	0	2.1	50.8	*96.8*	4.6	80.5	66	0	**30.8**
Out-of-pocket expenditure on health as % of private expenditure on health	61.4	50.3	96.3	40.9	*98.5*	89.8	94.6	55.9	**25.4**
Prepaid plans as % of private expenditure on health	22.7	42.1	0.4	54.9	0.7	1.5	5.4	18.6	*65.7*
Per capita total expenditure on health at average exchange rate (US$)	1,995	2,222	63	2,348	30	2,476	379	2,031	*5,274*
Per capita government expenditure on health at average exchange rate (US$)	1,354	1,552	21	1,786	6	2,022	170	1,693	*2,368*

[17]"Core Health Indicators from the World Health Report." World Health Organization. 2 Nov. 2005. <http://www3.who.int/whosis/core/core_select_process.cfm>

In the U.S., the rate of per capita healthcare spending is three times the OECD cost per day and twice the OECD cost per capita, while the amount of time people are spending in hospitals is less than in other countries. This can mean one of two things; either that expensive American medical care is so good that people do not need to spend long in the hospital, or that American medical care is so expensive that people do not want to spend long in the hospital. If the first scenario is the case, it would imply that the adage "cost, quality, speed—pick two" is correct, and that Americans have picked both quality and speed. If the second scenario is the case, a far worse situation is implied. Having inadequate and expensive medical care cannot possibly be an optimal situation. In the event of either scenario, it is clear that there is great room for reducing healthcare costs in America.

The Present State of Healthcare Costs

While exploring public policy and healthcare at the beginning of this document, it was presented that over 50 million Americans are on Medicaid, and that over 40 million Americans are on Medicare. Many other Americans are either insured by their companies or are self-insured. However, if a person possesses health insurance, it does not mean that they necessarily have substantial medical expenses. The run-of-the-mill elementary school child needs healthcare, but not that much. Perhaps there will be the occasional cast on the broken arm, the annual checkup, or the infrequent immunization, but beyond that there is unlikely to be any major expense.

Although some policyholders use little coverage, overall, subsidized healthcare is costing Americans an "arm and a leg." During Fiscal Year 2004, Medicare benefits cost a total of $294.3 billion and Medicaid cost a total of $177.1 billion. If the State Children's Health Insurance

Program is included in the total, total healthcare-related Federal Entitlement Spending reached $476.6 billion in 2004.[18]

If annual healthcare costs are in the billions, who is racking up the bills? Are expenses widely distributed throughout society, or are they concentrated amongst small groups of people. After noting that Medicaid spending increased at 28 percent per year between 1990 and 1992, Stuart & Weinrich attributed the increase to "multiple factors that extend beyond the health care system, including the expansion of Medicaid eligibility and the epidemic of AIDS."[19] Thus, one of the reasons why subsidized health care is costing more is because health care is being subsidized for more people.
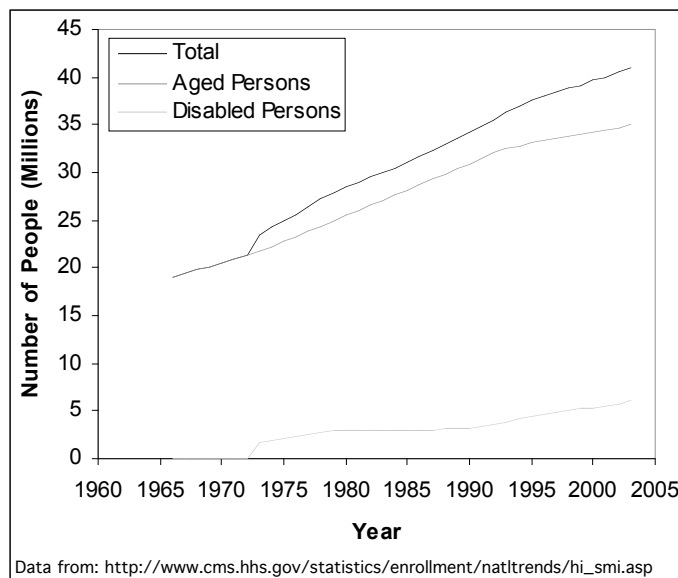

Figure 3: Number of People Receiving Hospital and/or Supplementary Medical Insurance (Medicare)

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[18] "CMS Financial Data." Centers for Medicare and Social Services. 21 June 2005.
<http://www.cms.hhs.gov/researchers/walletcard/04cmsfinancialdata.pdf>

[19] Stuart, Mary E., and Michael Weinrich. "Beyond managing Medicaid costs: Restructuring care." Milbank Quarterly; 1998, Vol. 76 Issue 2, p251, 30p, 9 graphs

As is shown in Figure 3, the number of people enrolled in Medicare has more than doubled between 1966 and 2005, while the population of the United States has only increased by about 50%.[20] Thus, the ratio of Medicare recipients to Americans has increased over the past forty years. If the real average cost of providing care to a person on Medicare remained constant over this span of time (an assumption which is false), the amount that the average person would have had to pay towards supporting Medicare would have increased by a third during that timeframe. Given that the number of medical treatments available and that the cost of those treatments has increased, it is likely that the cost of Medicare to the average American has increased by more than a third over the past four decades.
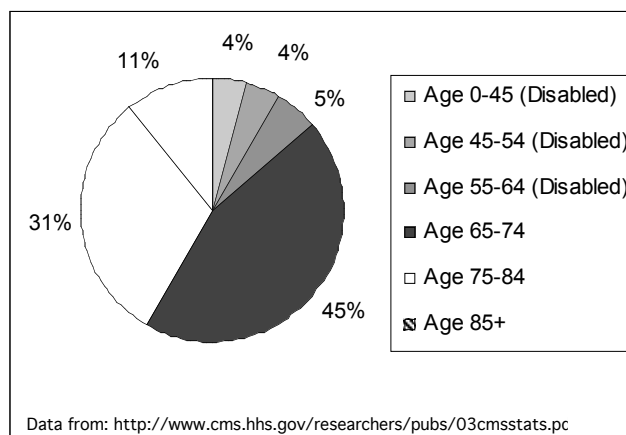

Figure 4: Age Distribution of 2003 Nationwide Medicare Enrollment

The cost of care is most certainly not evenly distributed amongst cohorts of patients (see Figure 4). In Maryland, "eighty-eight percent of high-cost patients are in Medicaid eligibility categories for the aged or disabled. Although the majority of Medicaid enrollees are in the Aid for Families with Dependent Children (AFDC) category, this group constitutes only 12 percent of the high-cost patients." Within this Maryland cohort, "forty-two percent of high-cost patients are age 65

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[20] "Historical National Population Estimates: July 1, 1900 to July 1, 1999." U.S. Census. 3 July 2005.
<http://www.census.gov/popest/archives/1990s/popclockest.txt>

or over" and "forty-three percent of high-cost patients are between the ages of 21 and 64." From this it can be reasoned that high cost patients are usually either aged or disabled—both conditions that often result in non-participation in the workforce. It can also be deduced that fifty-eight percent of high-cost patients are younger than 65! It was also found that the vast majority of high-cost adults outside of nursing homes had major medical problems. Stuart & Weinrich stated that "approximately 15 percent of these patients have both mental illness and chronic medical conditions, 10 percent have mental illness and problems with substance abuse, and 8 percent have substance abuse problems and chronic medical conditions."[21] Therefore, any treatment plan must address their conditions on multiple fronts.

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[21] Stuart, Mary E. and Weinrich, Michael. "Beyond managing Medicaid costs: Restructuring care." Milbank Quarterly; 1998, Vol. 76 Issue 2, p251, 30p, 9 graphs

The Cost of Using IT in Healthcare

It should by now be clear that American healthcare is expensive. In this section, the causes of the cost of healthcare will be explored. In any situation involving IT, there are typically two factors that determine cost. The first factor is the cost of *systems*—the cost of purchasing the computers and networks that get the work done. The second, and perhaps largest cost, is that of *labor*. Money must be spent to train new and old employees, and people must be paid to operate the systems that they have been trained to use.

Systems

When people think of IT, one of the first things that comes to mind is systems—the hardware and software that get work done. Systems usually need to be purchased, and have a reputation for rapid obsolescence. Surprisingly, the greatest cost in system deployments is often not the hardware and software itself, but is instead the continuous cost of maintenance. Nevertheless, there are many brave organizations that have forged ahead in the relatively unstandardized world of medical IT.

Oftentimes, substantial effort is required before a system can even be put into place. Mark Vernon of <u>Financial Times</u> wrote that Dublin's Beaumont Hospital "had to compile an integrated database for its patient health records" before it could get its Customer Relationship Management (CRM) system running.[22] Beaumont Hospital wanted a CRM system for two reasons: "first, to automate business processes and drive out costs; and second, to offer

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[22] Vernon, Mark. "Health service with a smile Customer relationship management software is proving a useful tool to help automate processes and bring better service to patients :[SURVEYS EDITION]. " <u>Financial Times.</u> 24 June 2005 <u>ProQuest European Business</u>. ProQuest.

personalization, thereby raising the bar when it comes to customer service." Thus, Beaumont Hospital had to complete a lot of legwork before it was able to reap the benefits that it had desired.

While a CRM system was in the works in Dublin, Radio Frequency Identification (RFID) technologies were put to use in Minnesota. Mercy Hospital, of Coon Rapids, Minnesota, needed to reduce the cost and intrusiveness of monitoring "at risk" patients' activities, in order to prevent them from leaving the Emergency Department (ED) prematurely. In order to do this, the hospital employed the RFID-based Safe Place ED patient monitoring system, from RF Technologies Inc. According to an article in Healthcare Purchasing News, Mercy Hospital reduced its one-to-one patient watches by 64 percent through using Safe Place ED, resulting in a savings of over $80,000. The technology was so promising that the hospital projected it could eventually save $110,000 annually through using it.[23]

On a similar note, in a 1999 study published in the American Heart Journal, the medical expenses of elderly patients with heart failure in a control group were compared with those of similar patients in a group receiving community-based monitoring. The goal of the study was to determine whether remote monitoring would reduce medical costs. It did! "The study found that, from 1995 to 1996, average medical claims for the monitored group declined almost 12 percent, from $8,500 to $7,500, while they more than doubled, from $9,200 to $18,800, for the control group"[24] This study demonstrates that monitoring is one means through which IT can be used to reduce the cost of healthcare.

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[23] "RFID produces a cost effective patient/staff safety model." Healthcare Purchasing News. 1 June 2005. 77. ABI/INFORM Trade & Industry. ProQuest.

[24] Averwater, Nancy Wilson, and David C. Burchfield. "No Place Like Home: Telemonitoring Can Improve Home Care. " Healthcare Financial Management 1 Apr. 2005. 46-52. ABI/INFORM Global. ProQuest.

In general, investments in improving healthcare have yielded a high rate of return. A 2005 study found that "every additional dollar invested in health care generates health gains valued at $2.40 to $3"[25] Investments in information technology have the potential to yield spectacular returns due to the inefficiency with which medical data is handled. As computers are designed to perform consistently, and thus can reduce costly processing errors. In 2005, the Journal of Quality and Safety in Health Care claimed that "more than 86% of mistakes are caused from administrative or processing errors."[26] Thus, it is clear that there are many errors to strive to eliminate. The U.S. Center for Information Technology Leadership (CITL) agrees that the healthcare industry could reduce its costs through IT, and estimates that the annual potential for "savings through standardized health information exchange is more than $87 billion." [27] Therefore, there is a large potential market for health IT systems, and large financial rewards to be received by those who implement them successfully.

Labor

Unless IT is inconspicuously integrated into existing systems and processes, people must be trained to use it. Otherwise, the technical investment will stagnate, and no benefits will be realized. Often, getting people to use technology will require organizational changes consisting of modification of both of business processes and organizational structure.

John Glaser, Vice President and CIO of Partners HealthCare, is a man who is particularly aware of these issues. Glaser once said, "The big changes that IT brings to health care are

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[25] Snowbeck, Christopher. "Health care costs reflect benefits, innovation, advocate says. " Knight Ridder Tribune Business News 8 Apr. 2005 1. ABI/INFORM Dateline. ProQuest.

[26] Schmitz, Jeff. "Remote monitoring reduces costs. " Communications News 1 Apr. 2005 45. ABI/INFORM Global. ProQuest

[27] "Vesalius Ventures; Communication network provider raises $3 million in financing. " Telemedicine Business Week 18 May 2005 8. Health Module. ProQuest.

organizational. That means you have to understand the politics and the social aspects to those changes."[28] When following Glaser's wisdom, one must examine the cultural as well as technological issues surrounding IT deployments.

One common cultural issue presented by technology is the fear that it will reduce the need for labor. Members of the healthcare industry sometimes worry that more efficient computers will result in less need for the services of people like themselves. While technology does not always lead to downsizing, their fears are somewhat justified.

There is a great incentive to downsize, as labor is expensive. In today's (2006) environment, there is a lot of momentum along enacting policies that reduce the amount of labor required for medical care. Thus, technological innovations are likely to garner more support if they reduce the cost of labor rather than increase it. A 2004 study by the Substance Abuse and Mental Health Services Administration decreed that managed care worked "to reduce the use of inpatient services, through prior approval for inpatient admission, utilization review to shorten inpatient stays and payments limited to a fixed number of days of care," resulting in the average length of stay being reduced to "10.4 days in 1994 from 19.8 days in 1992."[29] While none of these reductions in the use of services occurred through the utilization of technology, these reductions demonstrate managed care's general interest in reducing the need for labor. Therefore, a good technology is one that keeps hospital beds empty. A snide doctor might remark that the best way to achieve the goal of empty beds is to kill patients quickly with poor

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[28] McGee, Marianne Kolbasuk, and Charles Babcock "CIOs On Call. " InformationWeek 31 Jan. 2004: 28-30,34-36. ABI/INFORM Global. ProQuest.

[29] Mantone, Joseph. "Reversal of fortune. " Modern Healthcare 4 Apr. 2005 6-7. ABI/INFORM Global. ProQuest.

care. A more pragmatic one might argue that the best way to maintain empty beds is to prevent illness.

When creating systemic change, it is important to first consider which part of the system is most in need of change. According to Russell Morgan, President of the Information Technology Solution Providers Alliance (ITSPA), a greater number of people are affected by care received from family doctors than from hospitals. While most information technology initiatives have focused on hospitals, Morgan stated that "according to a California Healthcare Foundations report, 80% of all outpatient visits take place in practices with 10 or fewer doctors."[30]

As a result of this finding, there may be more public benefit from increasing the quality of primary care than from increasing the quality of hospital care. While primary care is often pivotal in instigating prevention, it often takes a backseat in medical situations where life hangs in the balance. Although long-term mistakes by family doctors are likely to make a substantial impact on health, the impact of short-term mistakes is not as great as with surgeons and other providers of hospital care. Therefore, the hospital-based quality initiatives that have recently been created make sense, as the impact of an occasional lapse of quality can have a far more drastic result in this environment than in a family doctor's office. However, long-term errors by primary care physicians are less excusable. While it is understandable that a hurried doctor might make an error, it is inexcusable for a doctor providing non-urgent services to do so. If all medical information is shared among doctors via electronic records, it will be more feasible for doctors to audit each other for long-term oversights.

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[30] "Information Technology; Physicians urged to consider electronic medical records. " <u>Obesity, Fitness & Wellness Week</u> 18 Jun 2005: 957. <u>Health Module</u>. ProQuest.

Current Usage of IT in Healthcare

What sort of IT do American hospitals want? In order to assess the American healthcare system's perceived technological needs, IDC Research   conducted a survey of 200 U.S. healthcare providers.[31] The 2005 survey found that:

- Provisioning (real-time allocation of IT resources across a network)

    o 18% of healthcare providers use provisioning technology

    o 45% of healthcare providers are evaluating the use of provisioning technology

- Single Sign-On

    o 35.5% of healthcare providers use single sign-on technology

    o 21.7% of healthcare providers have no plans to implement single sign-on technology

- Security

    o 53% of respondents use biometrics

    o 44.3% of respondents own tokens

    o 29.1% of respondents own smartcards

    o 22.8% of respondents own proximity cards

How much IT is used in American healthcare? The short answer is "not enough." America may spend a lot but it is clearly not getting a lot in return. Ambrose, Wykoff, & Lurie recently argued

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[31] "Sentillion; Technology helps health organizations with security and privacy. " <u>Medicine & Law Weekly</u> 17 June 2005 381. <u>Law Module</u>. ProQuest.

that the United States has the highest healthcare expenditures but ranks 37th in healthcare system performance because there is a "lack of emphasis on prevention."[32]

There are two varieties of problems with prevention in the United States; problems with preventing people from getting ill in the first place, and problems with treating people once they seek medical assistance. The free school lunch program is a prime example of the government not utilizing opportunities to prevent illnesses, while the lack of ubiquity of medical records serve to illustrate the lack of prevention that exists once people begin receiving medical care.

While the government could potentially use the school lunch program as a vehicle for reducing obesity, it currently does an inadequate job of doing so. This is illustrated by the minimum serving standards, some of which are rather alarming. All subsidized school lunches must contain a source of protein. Unfortunately, when peanut butter is served as a source of protein, the minimum that may be served to children aged twelve and older is six tablespoons.[33] After seeing this recommendation, I consulted a jar of Reduced Fat Jif® Creamy peanut butter. The serving size on the jar was two tablespoons; one third of the school lunch program's minimum. In this two tablespoon, reduced-fat serving, there were 12g fat and 190 calories. If Regular Jif® Creamy has been consulted; each serving would have contained 16g of fat.[34] If it is generously assumed that schools are serving students reduced-fat peanut butter, it is still possible to assert that by following guidelines, a lunch containing peanut butter contains 36g of fat and 570 calories! However, this sum does not include the milk, fruit, and grain that must also be served

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[32] Paul Ambrose, MD, MPH, Randolph F. Wykoff, MD, MPH, TM, and Nicole Lurie, MD, MSPH. "The case for an ancient cause Healthy People 2010. " <u>Postgraduate Medicine</u> 109.3 (2001): 9. <u>Sciences Module</u>. ProQuest.

[33] "Food Buying Guide for Child Nutrition Programs: Introduction" Chart 1A. USDA. <http://schoolmeals.nal.usda.gov/FBG/Introduction.pdf>

[34] "Peanut Butter Products: Flavors and Varieties from Jif." <http://jif.com/products/default.asp>

with the lunch. Generously assuming that the students are served a carton of <u>skim</u> milk, it is possible to estimate that another 80 calories are consumed. After adding some calories to account for the bread and the fruit, it is easy for the sum to reach 800 calories. Meanwhile, if the school had instead served the students <u>three</u> McDonald's hamburgers, at 9g of fat and 270 calories a piece, the students would only have been subjected to 27g of fat and 810 calories.[35] Thus, fourteen-year-olds eating an excessive amount of hamburgers at school would in fact be consuming less fat, and practically the same amount of calories, as students consuming a peanut butter-based school lunch. While the peanut butter sandwiches mentioned previously are but one example, they are representative of what the school lunch program allows. It is no wonder that the nation is facing an obesity epidemic.

While the school lunch program regulates the nutritional quality of lunches, its requirements are so lax that they are ineffective. The majority of Americans would agree that children should not be fed McDonald's Happy Meals™ on a daily basis. Unfortunately, the nutritional regulations on school lunches are so lenient that elementary school students could be served a Happy Meal™ consisting of 1% milk, a hamburger, and a small french-fries, in addition to a reduced fat ice cream cone and an apple dippers (see Figure 5). Although this meal would contain far more food than a standard Happy Meal™, it would be in compliance! The problem is that the government has set nutrient <u>minimums</u>, not nutrient <u>maximums</u>. The "McMeal" that has been mentioned would be perfectly suitable for students in kindergarten through 6th grade, but would be unsuitable for older students, as it does not contain enough calories (35 calories short) or protein (.5 grams short). Thus, the government has recommended that students be served meals that are even more caloric. This may result in the government exacerbating America's obesity epidemic, rather than preventing it.

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[35] "McDonald's USA – Nutrition Facts for Your McMeal." McDonald's. <http://www.mcdonalds.com>

McMeal:			McMeal[36]	K-6	7-12[37]
1% Low Fat Milk Jug	Calories		780	664	825
Hamburger	Cal. from Fat		230	n/a*	n/a*
Small French Fries	Total Fat (g)		26	n/a*	n/a*
Apple Dippers	Sat. Fat (g)		9	n/a*	n/a*
Red. Fat Ice Cream Cone	Sodium (mg)		860	n/a**	n/a**
	Carbs (g)		108	n/a**	n/a**
	Protein (g)		27	10	16
	Vitamin A (IU)		840	224	300
	Vitamin C (mg)		195	15	18
	Calcium (mg)		620	286	400
	Iron (mg)		4	3.5	4.5
*Calories from fat may not exceed 30% of total calories and					
calories from sat. fat may not exceed 10% of total calories.					
**School lunch program regulations do not restrict the intake of					
carbohydrates, cholesterol, sodium, sugar, and many other					
potentially harmful nutrients					

Figure 5: Comparison of a McDonald's Meal to National School Meal Program Minimum Requirements

Likewise, there is evidence that America is inadequately focusing on the prevention of errors during the treatment of illness. One source of this shortfall is low data visibility. A person is a complex collection of interoperating systems. An otolaryngologist maintains the entrance to the digestive system, while a gastroenterologist and a urologist maintain its exits. Only the family doctor, a generalist without extensive training in individual systems, has the job of looking at the

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[36] McDonald's USA – Nutrition Facts for Your McMeal." McDonald's. <http://www.mcdonalds.com>

[37] "Nutrient-Based Menu Planning: NSMP and Assisted NSMP." USDA.
<http://schoolmeals.nal.usda.gov/Recipes/menuplan/03CHAP3.pdf>

body as a whole. Although the esophagus, colon, and urethra are firmly linked, the links connecting otolaryngologists, gastroenterologists, and urologists are rather weak. Usually, they are bound together by a file in a manila envelope that is either carried by the patient or mailed. Clearly, this is not an efficient system.

As a result of the poor interconnectedness amongst specialists, the findings made by one specialist are unlikely to be fully relayed to all of the other specialists dealing with the patient. When a psychologist diagnoses a patient as bulimic, it is unlikely that the diagnosis will be relayed to the patient's dentist. As bulimia causes deterioration of the teeth, this lack of communication will reduce the chance that preventative dental actions will be taken. This will eventually cost Americans money, as it is far more expensive to repair a person's teeth than it is to issue them a rubber mouthguard, which would have prevented the dental damage in the first place.

Luckily, there is hope for improvement in the field of inter-specialty communications. According to Stacey Amig, "although used currently by only 13% of providers, electronic record utilization is expected to rise to 45% over the next two years."[38] Even so, the value of electronic medical records is severely reduced if their usage falls far short of universal. This reduction in value occurs because there is a network effect created by electronic medical records. The value of a doctor maintaining electronic records is proportional to the number of other doctors able to interchange information with the doctor.

Imagine if only 45% of doctors had telephones. If you were a doctor, getting a telephone would not be very beneficial as 55% of the time; you would have to communicate with your colleagues

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[38] Amig, Stacey. "Internet dilemmas. " Behavioral Health Management 1 May 2001: 48-51. Health Module. ProQuest.

through other means. If you usually had to communicate with your colleagues through mail or telegram, you would receive little value in your investment in a telephone. It is for this reason that there has been slow progress in creating electronic medical records.

Without wide preexisting usage of electronic medical records, there is little advantage in implementing a system that uses them. Proliferating electronic medical records is a problem like that of "the chicken and the egg." Luckily, there are three possible approaches to this problem.

The first approach, which in some ways is the least American, is to have a federal mandate that all doctors utilize a common medical record format by a certain date. It is likely that bureaucrats would dispute the record format for years, and that the eventual standard would be created by a combination of the needs of the industry and the needs of politicians.

The second approach, which is perhaps the slowest, is to wait for the technology to be gradually adopted. As America is clearly moving towards digitization, and the advantage of digitizing records grows with the number of records that have been digitized, it is possible to wait for the electronic snowball to pick up speed as it rolls down the hill of time.

The third approach, which may be optimal, is to explore ways in which both hospitals and the private sector can receive instant benefits from digitization. Software companies could create cost-saving systems with the ability to create electronic internal records. Those same systems could then potentially be enabled to exchange records between medical facilities. The software companies could generate short-term revenue through the sale of the systems and long-term revenue through selling security services for the transmission of medical records. As medical information is valuable and must be kept confidentially by federal mandate, medical facilities may be willing to pay for "digital security postage" when sending records. If this "digital security

postage" was both less costly than conventional postage and enabled cost savings on data entry, there would be a market for it. The medical facility could reduce costs through its usage, and the software company could increase revenues by selling the postage. Thus, the free market could be used to solve the problem of electronic medical records.

How should standards for electronic medical records be devised? The answer is to use the same approach that has been used by much of the rest of the software industry—open standards. Companies seeking to create programs to handle electronic medical records are simultaneously in two industries; the health industry and the software industry. By leaning on their heritage in the software industry, companies seeking to create a standard format for electronic medical records can use the committee-based approach that has worked so well for the rest of the software industry.

For example, although there are many ways in which data can be stored on compact discs, the International Organization for Standardization (ISO) created the ISO 9660 standard, which defined the way that files are stored on CD-ROMs. Similarly, the standard for storing music on CDs, Red Book, was originally created by a consortium between Sony and Philips. After Sony and Philips worked the kinks out of Red Book, they brought it to the International Electrotechnical Commission (IEC), which ratified it as the standard IEC 908. Industry consortiums have been proven to be effective in the software industry, and will continue to be effective in the case of electronic medical records.

Although discussion of electronic medical records occupies a substantial portion of today's conversations about health IT, there are many other innovations through which IT can be leveraged to improve healthcare. One such innovation is the LifeDrive, a high-capacity personal

digital assistant (PDA) manufactured by palmOne, Inc. Using this device, doctors can carry large amounts of patient records and references with them. Another company, PDA Verticals, has partnered with palmOne, Inc. to create custom-tailored software packages for the LifeDrive. According to Medical Devices & Surgical Technology Week, "PDA Verticals has relationships with 23 healthcare associations, including the American College of Physicians, the American Academy of Family Physicians, the American Association of Critical Care Nursing and the American Association of Physician Assistants. Each association works with PDA Verticals to determine what mobile software applications are most relevant to their members. The healthcare applications included in the custom bundles differ by specialty but always consist of up to 7 healthcare applications that can be remotely managed and updated by PDA Verticals. Among the most popular software included are applications for drug reference, clinical reference and clinical tools such as medical calculators. PDA Verticals also offers the option to add any of 1,000 other healthcare applications to their palmOne device."[39]

Although IT currently may be seen as a panacea for high healthcare costs, it is not without flaw. Often, installing new IT systems can be prohibitively expensive. When IT is implemented improperly, it does not always provide the cost savings that is expected and sometimes causes unanticipated difficulties.

A major fault of numerous IT systems is their lack of integration. Science Letter reported that although "e-prescribing has been shown to significantly reduce healthcare costs by decreasing errors and problems with drug interactions, integrated systems remain key to successful e-prescribing adoption in physician practices." E-prescribing systems that interface poorly with electronic medical record systems and other systems in the office often "result in a disruption to

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[39] "Information Technology; Software developer to bundle medical applications for mobile manager device use. " Medical Devices & Surgical Technology Week 26 Jun 2005: 288. Health Module. ProQuest.

physician workflow". Commissioning custom software to be written to facilitate this interface "can be difficult, time-consuming, and prohibitively expensive."[40]

Furthermore, IT investments are sometimes islands. Although the national pharmacy chain Walgreen's has invested extensively in producing a computerized system for handling prescriptions, the system is not interconnected with other chains of pharmacies. While Walgreen's pharmacists are aware of the prescriptions customers have at all Walgreen's locations, they are not aware of the prescriptions that customers have with other pharmacy chains.[41] Until a common system is developed that gives pharmacists complete information on their customers, some pharmacists may miss potentially dangerous drug interactions caused by prescriptions filled at unaffiliated pharmacies. Pharmacies like Walgreen's have already made the investment necessary to implement this. The system can only deliver its full value to customers after other pharmacies have formed similar systems and unified their systems with the Walgreen's system.

Perhaps, one of the problems with the Walgreen's system is that it is modeled after the old process for storing and looking up prescriptions. Prescriptions used to be only on file at one pharmacy, and a phone call would be required to transfer them. A phone call is still required at Walgreen's to fill a prescription whose script is at another pharmacy. Walgreen's system assumes that the pharmacy must be responsible for storing prescriptions.

In general, using IT to replace systems without rethinking them is not a good idea. According to Michael Hammer, president of the IT consulting firm Hammer and Company, "The usual

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[40] "Information Technology; Companion Technologies and InstantDx release integrated e-prescribing module. "Science Letter 14 Jun 2005: 1043. Health Module. ProQuest.

[41] Q&A Interview; Adam Powell & Jennifer, Walgreen's Pharmacy Technician, Aug. 22nd, 2005, 11 p.m., Online.

methods for boosting performance-process rationalization and automation--haven't yielded the dramatic improvements companies need. In particular, heavy investments in information technology have delivered disappointing results--largely because companies tend to use technology to mechanize old ways of doing business. They leave the existing processes intact and use computers simply to speed them up."[42]

Thus, according to the wisdom of Dr. Hammer, it is valuable for people to consider new approaches to solving the healthcare crisis. Rather than simply patching old tools, entirely new health management tools are needed. Following the spirit of Dr. Hammer's advice, the "Recommendations" section proposes two new types of health insurance that use IT. In one case, IT is used to lower rates and increase health awareness, and in the other case it is used to empower consumers.

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[42] Hammer, Michael (1990): Reengineering Work: Don't Automate, Obliterate, <u>Harvard Business Review</u>, July-Aug. 1990, pp. 104-112

Planning for the Future:

The future of cost reduction in healthcare will be influenced by IT. This is a certainty that can be stated with conviction. However, the road to the future will be littered with obstacles. Before proceeding, it is necessary to assess these barriers, and to contemplate some fundamental properties of the healthcare system. One such fundamental property is the demographics of the American people. After assessing both the barriers in the present, and the needs of the current population, it is possible to dream for the future while being firmly mounted in the rocks of realism instead of in the clouds of conjecture.

Barriers to Using IT in Healthcare

If IT was easy to implement and the panacea of healthcare, it would already be maximally in use. Clearly, if IT has not reached its full potential in this arena, there must be some barriers to its deployment. Perhaps the largest current barrier is a lack of standards. Hospitals are afraid to commit to investing in specific technologies; for fear that they may someday grow obsolete and not be interoperable with what is in use by the majority of hospitals. Privacy concerns are another major barrier to the further deployment of technology. Americans are bombarded with frequent reports of electronic institutions being hacked. For instance, on June 17th, 2005, CardSystems Solutions was hacked, exposing more than 40 million credit cards to potential fraud.[43] As the exposure of confidential medical records could ruin people's lives, hospitals do not want to implement any system that might put their patients at risk. The third barrier to the implementation of IT is the network effect. As was mentioned a few pages earlier, the return on

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[43] "News Release." MasterCard International. <http://www.mastercardinternational.com/cgi-bin/newsroom.cgi?id=1038>

investment of creating interoperable, electronic recordkeeping systems is far reduced if peer hospitals do not utilize the systems.

 At the Latter Day Saints (LDS) Hospital, the barriers of implementation were overcome. Although the wheel did not need to be reinvented to transfer the system to another hospital, transferring it still appeared difficult due to non-technical factors. The problem of technological transferability was described by Richard A. Garibaldi as follows:

 What would it take to transfer LDS Hospital's decision-support system into other hospitals? In many hospitals the installation of the computer components of the system would be relatively easy; a capital investment in computers has already been made, and the expertise in information technology already exists. However, the human components of the system are much more difficult to transfer from hospital to hospital. What is missing at most hospitals is the commitment and cooperation that must be developed over time. At LDS Hospital, years were required for the technology, the institutional commitment, the clinical leadership, and acceptance by the medical staff to come together. The successful operation of a system similar to that at LDS Hospital requires a level of staff involvement and financial support that few other hospitals or health care systems can provide.[44]

From the example of LDS Hospital, it can be seen that even when all of the ideas are in place, commoditizing technical upgrades is still difficult, as there are both human and technological barriers to the installation of IT.

A barrier to the usage of the Internet in delivering medical care in some fields of medicine is the anonymity of the Internet. In cases when doctors do not know the identities of their online patients, they are less able to intervene in crisis situations. Additionally, when doctors are not able to see their patients' bodies, the amount of information that can be used to diagnose conditions is reduced.[45] In the event of severe psychiatric emergencies, the usage of Internet-based care could potentially cost lives, as doctors would lose the ability to instantly hospitalize

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[44] Garibaldi, Richard A. "Computers and the Quality of Care -- A Clinician's Perspective." N Engl J Med 1998 338: 259-260

[45] Amig, Stacey. "Internet dilemmas. " Behavioral Health Management 1 May 2001: 48-51. Health Module. ProQuest.

their patients. However, anonymous care could also save lives, as it could enable people to seek care they otherwise would not.

The barriers to the usage of IT in healthcare are social, technological, and financial, but they can be overcome. LDS Hospital serves as an example to demonstrate that when strong leadership and institutional commitment are combined, IT can be implemented on a large scale.

Changes in the Demographics of the American People

One of the biggest changes in the dynamic of American healthcare will be the change in the size of America's population of senior citizens. This trend is supported by recent observations of American demographics. J. Michael McGinnis attested that "in 2000, the proportion of people over age sixty-five grew to 12.6 percent, up from 11.3 percent in 1980, and is expected to reach 20 percent by 2030." He also observed that the elderly were becoming increasingly able in their retirement, resulting in disability rates declining at about two percent per year. As a result of this decline, "the proportion of older people living in institutions declined to 4.2 percent in 1999 from 6.8 percent in 1982."[46] Americans are remaining independent longer, which will result in new challenges in geriatric care. When the elderly are institutionally housed, it is possible to provide medical resources to them in a centralized fashion. As more and more elderly remain at home, it will be essential to be able to provide high quality medical care in a decentralized fashion.

The absolute size of the demographic shift will be gigantic. It was stated in <u>Older Americans</u> that "over the next five decades, members of the population age sixty-five and older are expected to

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[46] McGinnis, J. Michael. "Toward improved quality of life. " Issues in Science and Technology 19.4 (2003): 29. Research Library Core. ProQuest

double from nearly thirty-five million individuals to over eighty million, representing more than one-fifth of the total U.S. population."[47] According to the 2000 U.S. Census, the age of the U.S. population follows a bimodal distribution. In 2000, the modal average age of the population was forty years of age (at the time of writing in 2006, presumably forty-five). The children of this cohort account for the second mode, which peaks at ten years of age (now presumably 15). Thus, unless a substantial portion of these forty-five year olds either die or emigrate in the near future, in 2030, there is going to be a substantially higher number of seventy year olds than there are today. As it is projected that the life expectancy for sixty-five year olds in 2020 will exceed fifteen years for males, and will be approximately twenty years for females, it is very likely that the majority of this cohort will live well past the age of sixty-five. Therefore, there will soon be great demand for geriatric care.
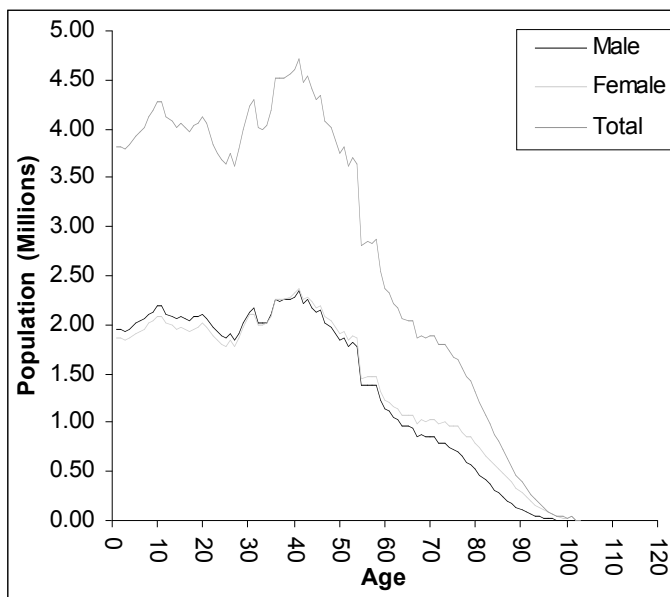
Figure 6: Age Distribution of the American Population[48]

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[47] Fed. Interagency Forum on Aging-Related Stat. <u>Older Americans 2000</u>; Key Indicators of Well-Being 56 (2000).

As a whole, the life expectancy of Americans is increasing substantially (see Figure 6). The result of this will be a larger population of seniors with geriatric health problems, and a large contingent of seniors at the polls. Senior citizens are known to have excellent voter turnout, and thus are likely to shape the direction of the future of healthcare.

Data from: http://www.cms.hhs.gov/researchers/pubs/03cmsstats.pd
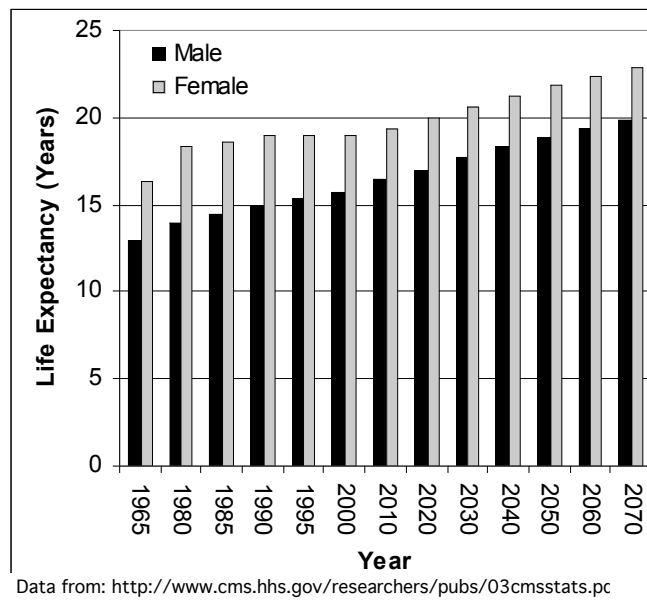
Figure 7: Life Expectancy at Age 65 (2003 Estimates)

The implication of this change is that there will be an increased demand for systems that enable self-sufficiency of the aged, and assist with geriatric conditions. Placing the aged in nursing homes is expensive, as nursing homes are rather labor intensive. As America's population of elderly increases, it will soon become essential to determine ways to reduce the cost of their care. Continuous electronic health monitoring devices are one means through which the health of seniors can be maintained while utilizing a minimum of labor and maximizing the mobility of the seniors.

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[48] "Sex by Single Years of Age," Apr. 2000 U.S. Census.
<http://factfinder.census.gov/servlet/SAFFPeople?_sse=on>

Using IT to Reduce the Cost of Healthcare

As of 2006, increasing the usage of electronic health records (EHRs) is the most widely discussed IT-based cost reduction initiative. The motivation for lavishing such attention on something as simple as medical records stems from multiple sources. First and foremost, the concept of EHRs has been around for over a decade. Although there has been a lack of standardization, EHRs have been created none the less. Secondly, the EHRs that have been created have had measurable financial return. Thus, EHRs are being touted because they have demonstrated their ability to save money.

Finally, the push for EHRs in 2006 may be a result of a maturing technological landscape. For a long period of time, there was no natural means for storing data and then converting it from one storage format to another. In 1998, the World Wide Web Consortium (W3C), the group responsible for creating the standards that govern the Web, created its first "recommendation" for the Extensible Markup Language (XML). Unlike many other data formats, XML can easily be read by both humans and computers. Human-readable content is augmented with "tags," which help computers understand the hierarchy and categorization of the data. As a result of these tags, it is possible for computers to understand the structure of the information. This understanding enables computers to shuffle data into new formats if it is necessary for them to be able to provide meaningful information to other computers which demand data in a different format.

Here is an example. When creating a recipe for making chocolate milk, XML could be used to make the recipe machine readable.

Here is the recipe in a format only readable by humans:

Recipe for Chocolate Milk:

- Pour 8 oz. of skim milk into a glass.

- Add 1 tablespoon chocolate syrup.

- Stir with a spoon for 15 seconds.

Using XML tags, I could make the recipe machine-readable. Tags start with <tag> and end with </tag>, and may contain additional information useful to the computer. Here is the recipe in XML, a format readable by both humans and computers:

```
<recipe title="Recipe for Chocolate Milk">
<step>Pour <quantity unit="ounce">8</quantity> oz. of skim milk into a glass.</step>
<step> Add <quantity unit="tablespoon">1</quantity> tbsp chocolate syrup.</step>
<step> Stir with a spoon for <time unit="seconds">15</time> seconds.</step>
</recipe>
```

A computer could then read the list, and with a few simple rules, format it (using Extensible Stylesheet Layer Transformations [XSLT]) as something easy for people to read. The only rules that would be needed to transform the above recipe are:

1. Start a new line with a bullet point every time a <step> tag appears

2. Ignore all other tags.

Placing this information in machine-readable format adds value for the computer, as it enables it to count the number of steps, determine the title of the recipe, and determine the units associated with all of the numbers. Without the tags, the computer would not have any of the information necessary to interpret the recipe.

As mentioned earlier, the value that is generated by storing medical data electronically is both sizable and measurable. In Indianapolis, Indiana, three hospitals were linked in a pilot study whose objective was to determine the benefits of EHRs. According to Dr. Marc Overhage, the CEO of Indiana Health Information Exchange (IHIE), the nonprofit organization leading this initiative, the network has resulted in a savings of $26 per patient visit. He estimates that as the system expands, it could save central Indiana $562 million in annual healthcare costs.

The savings experienced in Indiana is small compared to the potential savings that could occur through using EHRs nationwide. Although there is no firm agreement on how much money could be saved, different magazines have created different estimates. According to Health Affairs, $78 billion could be saved nationally each year via instituting electronic medical records.[49] According to CIO, using EHRs in hospitals "could reduce U.S. hospitalization costs by $2 billion a year." Furthermore, "if similar systems were used in doctors' offices and clinics as well as hospitals, they could prevent thousands of deaths from medical errors and save the U.S. health-care system a whopping $44 billion each year--taking a significant bite out of the $1.4 trillion America annually spends on health care."[50] Although the various savings estimates differ

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[49] Patton, Susannah. "Sharing Data, Saving Lives ; Sharing medical data among doctors and hospitals in a particular region can save lives and money. But conflicting standards, financial support and privacy concerns are major hurdles. " CIO 1 Mar. 2005: 1. ABI/INFORM Global. ProQuest.

[50] Sarah D. Scalet "Part 1: Paperless Medicine Saving Money, Saving Lives ; Health-care CIOs face intense pressure to install electronic medical records and order-entry systems, in spite of physician resistance and large up-front costs. Here's how early adopters are overcoming the obstacles. " CIO 1 Aug. 2003: 1. ABI/INFORM Global. ProQuest.

somewhat, they share one thing in common. They are all big. Even with the most conservative of estimates, it is clear that there is strong financial value in using EHRs.

Politicians have promoted EHRs as a vehicle for healthcare savings. Department of Health and Human Services secretary Tommy Thompson touted that EHRs have "the potential to produce savings of 10 percent of our total spending on health care."[51] During the 2004 Presidential Race, comments were made on the benefits of EHRs. Bush said that EHRs could reduce healthcare spending by $140 billion a year, while Kerry lauded the Veterans Administration for using EHRs to reduce the cost of pulling a medical record from $9 to almost nothing.[52]

In 2004, the Department of Health and Human Services launched the Decade of Health Information Technology Initiative. The initiative is designed to complete four objectives: bring electronic health records (EHRs) into clinical practices, interconnect physicians, personalize care, and improve the health of the American population. The first goal, bringing EHRs into clinical practices, will be achieved through providing incentives for EHR adoption, reducing the risk of EHR investment, and promoting the usage of EHRs in rural and underserved areas. Clinicians will be interconnected by encouraging regional collaborations, developing a national health information network, and coordinating federal health information systems. Healthcare will be personalized through encouraging the usage of Personal Health Records (PHRs), enhancing consumer awareness of their choices in medical care, and providing telehealth systems that enable people in rural and underserved areas to electronically discuss their medical needs. Finally, the goal of improving the health of Americans will be achieved through unifying systems

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[51] "HHS Launches 'Decade of Health IT'. " HomeCare Magazine 1 Sep. 2004: 18. ABI/INFORM Trade & Industry. ProQuest.

[52] Bernard Wysocki Jr. "Electronic Health Records Get a Push. " Wall Street Journal [New York, N.Y.] 21 Jul 2004, Eastern edition: D.4. ABI/INFORM Global. ProQuest.

for public health surveillance, streamlining monitoring of healthcare quality and health status, and accelerating the research and dissemination of scientific discoveries.[53]

There is support on Capitol Hill for using IT to reduce the cost of healthcare. Senate Majority Leader (2006) Bill Frist, R-TN, stated that "America's health system has in many ways remained in the Stone Age, and we need it to be in the information age." In order to implement this, Frist proposed having the Federal government define standards for electronic medical records. He and other Senators advocated a system that would be as simple and ubiquitous as ATM machines. In order to encourage adoption, he proposed "tying some reimbursement or bonus to the use of information technology in some way."[54]

Elsewhere in the Federal government, the Department of Health and Human Services announced in March 2005 the availability of "nearly $140 million in grants to promote the use of information technology, develop statewide and regional networks, and encourage collaboration in advancing the adoption of electronic health records." The focus of the awards is on assisting "small and rural hospitals and communities." In order to implement this, "Colorado, Indiana, Rhode Island, Tennessee, and Utah will receive a total of $25 million over five years to develop secure statewide networks so private patient medical information can be accessed."[55] From this, it is clear that the government has already decided that the free market may need assistance in ensuring the availability of electronic medical records. One of the reasons these small states may have been chosen is that their size might have impeded the profitability of digitization due to the

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[53] "HHS Fact Sheet--HIT Report At-A-Glance." U.S. Department of Health and Human Services Fact Sheet. July 21st, 2004. Available at: <http://www.hhs.gov/news/press/2004pres/20040721.html>

[54] Brady, Matt. "Politicians Push For IT In Health Care. " National Underwriter. Life & Health 14 Mar. 2005: 33. ABI/INFORM Global. ProQuest.

[55] Swartz, Nikki. "U.S. Hands Out Technology Grants for Healthcare. " Information Management Journal 39.1 (2005): 14. ABI/INFORM Global. ProQuest

network effect. Although a standard has yet to be specified, and the future technological platform is not yet clear, the government is already willing to support electronic health records.

In order to help see this through, the University of Chicago's National Opinion Research Center was recently awarded a multi-year, multi-million dollar government contract to create the National Health Information Technology Resource Center (the National HITRC). "The National HITRC will support the work of over 100 planning, implementation, evaluation and demonstration projects," which "build on the President's initiative to improve the nation's health care system through broad adoption of [Health Information Technology] HIT and Secretary Thompson's July 2004 release of a Framework for Strategic Action for achieving improvements in health care delivery through HIT." According to the National HITRC, recipients of the award "will explore the potential of HIT to help reduce medication errors; increase sharing of health information between providers, laboratories, pharmacies and patients; ensure safer patient transitions between health care settings; and reduce duplicative and unnecessary testing." [56] The creation of HITRC is an indication of the government's endorsement of the objectives of this document.

Although it was reported in <u>Information Management Journal</u> that as of 2005, "only 13 percent of the nation's 4,000-plus hospitals use electronic [health] records, and 14 to 28 percent of the 853,000 U.S. physicians are wired,"[57] there is hope for future improvement. The government is investigating means for using information technology to reduce the cost of healthcare through initiatives such as the Decade of Health Information Technology Initiative and the National

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[56] "Oct. 21, 2004—NORC and Partners Awarded Federal Contract for HIT Resource Center." National Opinion Research Center Press Release. Available at: http://www.norc.uchicago.edu/about/press10212004.asp

[57] Swartz, Nikki. "U.S. Hands Out Technology Grants for Healthcare. " <u>Information Management Journal</u> 39.1 (2005): 14. <u>ABI/INFORM Global</u>. ProQuest.

Health Information Technology Resource Center. Thus, while there is currently rather weak

adoption of electronic medical records, there is hope that the situation will improve by 2015.

Part 2 - Increasing Quality

What is high quality? High quality is repeatedly producing the right outcome. It is setting a standard, and then measurably meeting it. The Institute of Medicine defines quality as "the extent to which health services for individuals and populations increase the likelihood of desired health outcomes and are consistent with current professional knowledge."[58] Quality has been important in health care for time immemorial. Roy L. Simpson, Vice President of Nursing Informatics at Cerner Corporation, offered the following perspective on quality:

As far back as 3000 B.C., the Code of Hammurabi dictated, 'If a doctor, in opening an abscess, shall kill the patient, his hands shall be cut off.' Suffice it to say, medical error was not taken lightly back then. Centuries later, in 400 B.C., Hippocrates offered a more humane approach to quality in his Epidemics when he advised, 'As to diseases, make a habit of two things-to help, or at least to do no harm.' While we're not cutting off caregivers' hands today, we're also not just leaving it up to them simply 'do no harm.' Indeed, in just about every constituency in health care-from patients and payers, to providers, employers, regulatory agencies and professional organizations-quality of care is a top-of-mind issue.[59]

Although talk of kaizen, Six Sigma and Total Quality Management (TQM) may currently be in fashion, quality medical care has always been highly valued. When reviewing The Institute of Medicine's definition of quality, it is important to remember that it contains the phrase, "consistent with current professional knowledge." Thus, quality is not about creating new medical knowledge as much as it is about using existing medical knowledge consistently. If humanity has created only one device that enables the consistent application of knowledge, that device is most clearly the computer. Computers operate on programmed rationality. Although

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[58] Chassin, Mark A. "Is Health Care Ready for Six Sigma Quality?." Milbank Quarterly, 1998, Vol. 76 Issue 4, p565, 27p

[59] Roy L Simpson "The role of IT in health care quality assessment. " Nursing Administration Quarterly 1 Oct. 2003: 355-359. Health Module. ProQuest.

they may not be creative, they are able to apply well-documented rules in a consistent and

dependable fashion.

Assessing the Present:

According to Dr. David Blumenthal, Director of the Institute for Health Policy, the technical quality of care has two dimensions: "the appropriateness of the services provided and the skill with which appropriate care is performed." In order for technically high-quality care to be achieved, physicians must both demonstrate "high-quality decision making" and "high-quality performance." For this to occur, the doctor must have a working relationship with the patient. "The quality of the interaction between physician and patient depends on several elements in their relationship: the quality of their communication, the physician's ability to maintain the patient's trust, and the physician's ability to treat the patient with concern, empathy, honesty, tact and sensitivity."[60]

How is IT being used to assist decision making and performance? Is IT being used to its fullest potential in increasing quality? These topics, and more, will be explored in this section.

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[60] Blumenthal, David. "Quality of Care -- What is It?- Part One of Six" N Engl J Med 1996 335: 891-894

The Present State of Healthcare Quality

It was stated in Obesity, Fitness & Wellness Week that employers seeking IT to improve their

health plan offerings tend to look for technology that empowers employees to have three types

of information:

- *Information to Choose - individual providers, hospitals or care networks, health plans, benefit programs, physicians, and systems of care;*

- *Information to Use - tools that allow interactive claims management, enable chronic disease and care management, educate them about best practices for chronic conditions and acute care needs, offer research and evidence-based treatment options, and caregiver options;*

- *Information to Evaluate - tools that measure outcomes, assess safety, quality, and cost; comparative customer service, and patient perception reporting.*[61]

Without such systems, employees cannot make informed decisions on their healthcare. It has

been found that the probability of a procedure being performed correctly at a given hospital is

correlated with the number of times that hospital has recently performed the procedure. If

employees are provided information that is valuable in evaluating medical facilities, they can

choose treatment for themselves that is likely to result in a better outcome. The employer

directly benefits from this better outcome, as the quicker the employee returns to his job, the

less sick days he will use.

One strong advocate of increasing consumer information about healthcare is Joe O'Connor,

CPA, president and CEO of Integrated Healthcare Information Services Inc. Mr. O'Connor

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[61] "Healthcare Coverage; Employers seeking better e-based tools to raise employee Health I-CUE. " Obesity, Fitness & Wellness Week 18 Jun 2005: 842. Health Module. ProQuest.

remarked, "Average consumers now know the MSRP on a new car, government-published safety ratings, resale value and all the options they can add. Ask the same consumers about the price of the healthcare they receive or how their physicians and hospitals compare, and they are often at a loss."[62] It is only through the creation of a "Consumer Reports" for hospitals that patients will truly be free to receive the best care. Without patient knowledge, it is impossible for the forces of a free market to fully take effect, as patients currently have far less information about the services that they are consuming than the hospitals selling those services.

Without information on the health care quality of various providers, the only factors that consumers can easily make their decisions on are price and location. According to Edwina Rogers, vice president of health policy for the ERISA (Employee Retirement Income Security Act of 1974) Industry Committee (ERIC), "As healthcare evolves and more consumer-centric plans come on the market, employees will need even better tools to evaluate healthcare providers and plans based on quality. If employees only know who offers the cheapest care, they may not always choose the best care."[63] Even in healthcare, the aphorism "knowledge is power" holds true.

The problem lies in the fact that unlike other industries, such as the automobile and electronics industries, which religiously use quality metrics like Six Sigma, the healthcare industry has no well-defined system for reducing defects in care. Poor quality care can cost lives and can cost taxpayers money. This is exemplified by the following facts reported by Allison and Clark:

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[62] "Healthcare Coverage; Employers seeking better e-based tools to raise employee Health I-CUE. " Obesity, Fitness & Wellness Week 18 Jun 2005: 842. Health Module. ProQuest.

[63] "Healthcare Coverage; Employers seeking better e-based tools to raise employee Health I-CUE. " Obesity, Fitness & Wellness Week 18 Jun 2005: 842. Health Module. ProQuest.

- *Between 44,000 and 98,000 patients die each year in U.S. hospitals as a result of medical errors (Kohn, Corrigan and Donaldson, 2000).*

- *Preventable medication errors occur in 7.3 percent of hospital admissions (Bates, Boyle, Vliet, et al., 1995).*

- *The average cost of an inpatient adverse drug event ranges from $1,900 to $5,900 (Raschke, Gollihare, Wunderlick, et al., 1998[64]*

In 1984, the Harvard Medical Practice Study concluded with results that were similarly dismal. An examination of a representative sample of 30,000 hospital admissions found that patient injuries due to negligent care could be attributed to the following causes with the frequency noted in the list below. [65]

- 22%: Errors in diagnosis

- 21%: Non-drug-related treatment errors

- 12%: Mistakes in medication use

- 8%: Technical complications in surgery

- 6%: Surgical wound infections

The Harvard Medical Study, like so many after it, confirmed that there are pervasive problems in the quality of contemporary medicine. Many of these errors are avoidable, and could be somewhat rectified by IT. For instance, errors in diagnosis could be reduced by encouraging doctors to use rule-based systems to confirm their diagnoses.

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[64] Allison, Tom L. and John H. Clark "Making correctional health care smarter. " Corrections Today 1 Aug. 2001: 64+. Research Library Core. ProQuest.

[65] Chassin, Mark A. "Is Health Care Ready for Six Sigma Quality?." Milbank Quarterly, 1998, Vol. 76 Issue 4, p565, 27p

Quality problems happen frequently because there are many ways in which they can occur. Mark A. Chassin stated that "quality problems may be classified into three categories: overuse, underuse, and misuse."[66] All of these problems are potentially avoidable if adequate precautions are taken. Unfortunately, they occur all too often.

Overuse is when patients receive unwarranted medical treatment. Overuse can occur for a variety of reasons. Some doctors are aggressive about giving treatments for fear of being sued for malpractice in the event that they did not give a treatment that should have been given. Other doctors believe strongly in the curative power of their treatments, and are overly enthusiastic about their use. Less ethical doctors may cause overuse due to their interest in receiving money in exchange for providing treatment. Thus, doctors can cause overuse with both the best and the worst of intentions.

Sometimes, overuse can result in the over-application of a debilitating surgical procedure. Chassin later stated that a "Rand study found that 16 percent of hysterectomies performed in a group of seven managed care plans were inappropriate, at a rate ranging from 10 percent to 27 percent among plans (Bernstein et al. 1993). This level of overuse occurred despite the financial incentive for the plans to reduce utilization. Changing payment incentives alone is not likely to dampen the kind of enthusiasm that leads to overuse." There is strong evidence that overuse can occur due to over-enthusiasm alone. In the case of the Rand study, the hysterectomies were performed with the best of intentions, but sometimes resulted in patients enduring unnecessary hardships.

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[66] Chassin, Mark A. "Is Health Care Ready for Six Sigma Quality?." Milbank Quarterly, 1998, Vol. 76 Issue 4, p565, 27p

The problem of underuse is perhaps more tragic than the problem of overuse. As Kahneman & Tversky's Prospect Theory has shown, people experience a large disutility from losing any amount of money. The disutility of losing fifty dollars once is far less than the disutility of losing ten dollars five times. Yet, most health insurance programs make heavy usage of co-payments and deductibles. As people experience a large disutility by paying in this manner, they may use the services less than they would if they paid the sum of all their co-payments and deductibles before the year began. By making patients pay regularly, health insurance companies can psychologically reduce their utilization of services. As a result, Americans may receive far less preventative care than they should.

According to an article in the <u>New England Journal of Medicine</u>, there is an inherent conflict of interest in for-profit health insurance companies:

The quality of health care is now seriously threatened by our rapid shift to managed care as the way to contain costs. Managed-care plans involve an inherent conflict of interest. On the one hand they pledge to take care of their enrollees, but on the other their financial success depends on doing as little for them as possible. This direct threat to the quality of health care is sharpened as the original staff-model health maintenance organizations (HMOs), in which the risk of high, unanticipated costs for individual patients is shared by a large organization, give way to looser networks, in which the risk is often passed along to small groups of doctors or even to individual doctors — thus increasing the economic incentives to curtail expensive services to sick patients. For-profit managed-care organizations (MCOs) have the additional conflict of interest that stems from their obligation to maximize returns to their investors.[67]

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[67] Angell, Marcia, Kassirer, Jerome P. "Quality and the Medical Marketplace -- Following Elephants." N Engl J Med 1996 335: 883-885

This conflict of interest may be producing measurably worse health in certain individuals. People on Medicare or Medicaid are more likely to suffer from a physical difficulty than people with private insurance. Although some of these problems may stem from socioeconomic differences between the two cohorts, the magnitude of the difference in outcome is frightening. Even uninsured people are less likely to experience physical difficulty than those on a government plan (see Figure 8).
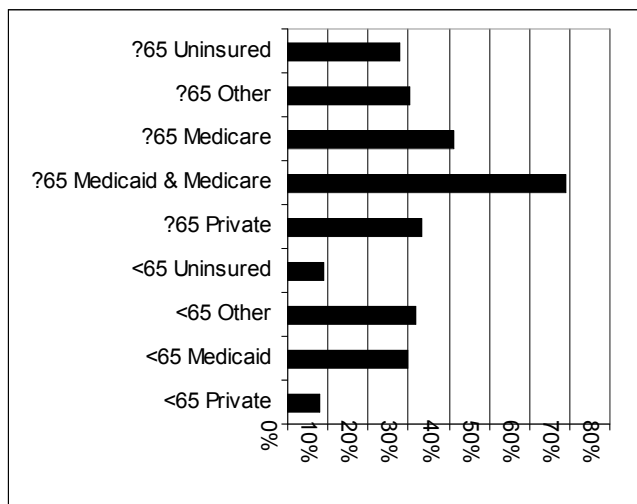
Figure 8: Percentage of Americans with Various Forms of Health Insurance with Any Physical Difficulty[68]

A possible reason for this difference in health outcomes is the lack of preventative care. Preventative care requires expenditures that have long-term, but not short-term rewards. Insurers who believe they will retain their policyholders for only a few years have no financial motivation to improve the long-term health of their enrollees. In the short-term, it is cheaper to treat the few people who suffer heart attacks than to work to prevent heart attacks from occurring in all of the policyholders. In <u>Health and Hygiene</u> it was stated that the National

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[68] "Table 30.Frequency distributions of body mass index among persons 18 years of age and over, by selected characteristics: United States, 2003." National Center for Health Statistics. <http://www.cdc.gov/nchs/data/series/sr_10/sr10_225.pdf>

Health Forum had estimated that "37% of deaths from Coronary Heart (CHD) Disease could be attributed to inactivity."[69] With more preventative care, this cohort could have avoided CHD all together. Nevertheless, an enormous percentage of Americans are in poor health for preventable reasons. J. Michael McGinnis highlighted this by reporting that "127 million adults in the United States are obese or overweight, 47 million still smoke, 17 million are diabetic, 14 million abuse alcohol, and 16 million use addictive drugs. Approximately 900,000 people are still infected with HIV, and last year some 900,000 teens became pregnant."[70]

Time and time again, preventative treatments are not given, and people are not assisted before it is too late for intervention. Poor usage of preventative medicine eventually results in large expenditures on surgical procedures and other quick fixes. Health is best achieved slowly and steadily, not by trying to save people as they are about to die from conditions that they have acquired over decades.

These sentiments are corroborated by the research of McGinnis, who expressed concern over the lack of prevention. He stated a frightening account of the lack of preventative services:

"Nearly one in five children remains inadequately immunized against the major childhood vaccine-preventable diseases. An estimated four out of five people with high blood pressure lack adequate treatment, as do as many as a quarter of those with elevated cholesterol levels. Approximately 30 percent of women do not receive mammograms, and 20 percent do not receive cervical screening. Fewer than 40 percent of adults who are 50 and older have been screened for colorectal cancer in the past two years. Fewer than 20 percent of smokers receive cessation counseling or treatment. With health care commanding 15 percent of the nation's gross domestic product, the medical care system misses very few opportunities to treat disease after it occurs, yet daily misses countless opportunities for prevention."[71]

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[69] "Exercising for health. " Health and Hygiene 24.1 (2003): 10. Health Module. ProQuest.

[70] McGinnis, J. Michael. "Toward improved quality of life. " Issues in Science and Technology 19.4 (2003): 29. Research Library Core. ProQuest

[71] McGinnis, J. Michael. "Toward improved quality of life. " Issues in Science and Technology 19.4 (2003): 29. Research Library Core. ProQuest

Although tragic, these problems highlighted by McGinnis are not limited to the United States. Quality medical care is less available to the poor even in countries with socialized healthcare, like Britain. It was reported by Michael G. Marmot that "in the Whitehall II Study of British Civil Servants, men and women at the bottom of the employment hierarchy had six times the rate of absence due to sickness as those at the top (North et al. 1993)."[72] The increased illness of the poor is eventually reflected in an increased mortality rate. Increasing the quality of medicine would prove beneficial to Americans from all walks of life.

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[72] Marmot, Michael G. "Contribution of psychosocial factors to socioeconomic differences in health." Milbank Quarterly, 1998, Vol. 76 Issue 3, p403, 46p, 9 charts; (*AN 1056455*)

IT & Healthcare Quality Today

The state of healthcare quality in 2006 is the result of a long chain of progress. Although medical licensing was developed during the 19th century in Europe, the quality assurance movement in the United States did not begin until 1917, when a set of standards for hospitals were created by the American College of Surgeons. These standards have evolved into the standards currently used by the Joint Commission on Accreditation of Healthcare Organizations.[73]

Currently, one of the biggest quality management standards initiatives is ISO 9000. ISO 9000 specifies the requirements for a generic quality management system. Thus, it is tailored to the healthcare industry. What was to become ISO 9000 was originally conceived by the British in 1957. In order to maintain its relevance, the standard has been periodically revised, with the last revision occurring in 2000 (referred to as ISO 9000:2000). The ISO 9000 quality management system is based on the following eight simple principles, which can be applied to any industry:

1. Customer focus

2. Leadership

3. Involvement of people

4. Process approach

5. System approach to management

6. Continual improvement

7. Factual approach to decision making

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[73] Simpson, Roy L. "The role of IT in health care quality assessment. " <u>Nursing Administration Quarterly</u> 1 Oct. 2003: 355-359. <u>Health Module</u>. ProQuest.

8.   Mutually beneficial supplier relationships[74]

The ISO 9000 standard is the latest in a long series of attempts at improving general quality. Hopefully, someday there will be specific standards for healthcare quality and for electronic medical records. While following ISO 9000 is a general trend within the healthcare industry, there are other less general trends worthy of mention. In 2003, Manhattan Research, a provider of healthcare and pharmaceutical industry research data, made four observations about current usage of health information technology.[75] Manhattan Research's observations were:

- Health plan portals have achieved viability as an option for customer service. The majority of health plans are now delivering online solutions to some providers in their physicians' networks. Early innovators are deploying e-care applications to enable electronic patient care.

- Although many consumers wish to interact with their physicians over the Internet, the availability of virtual care has not increased, as most physicians are waiting for financial incentives for participation. Some insurers are funding pilot programs that will enable physicians to better observe the impact of online care.

- Segments of physicians in information-intensive fields now rely on the Internet as a vital source for clinical news and pharmaceutical information.

- Mobile computing has come of age. Approximately 35% of practicing physicians actively use a Personal Digital Assistant (PDA), and two-thirds of physicians using PDAs utilize a prescription reference database on their PDA.

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[74] "Understanding the Basics: Quality Management Principles." International Organization for Standardization. Available at <http://www.iso.org/iso/en/iso9000-14000/understand/qmp.html>

[75] "Group identifies seven key trends related to physician and IT for 2003. " Health Care Strategic Management 1 Feb. 2003: 9. ABI/INFORM Global. ProQuest.

It should be noted that it is possible to argue that all of these changes can increase the quality of healthcare. Portals increase patients' perceived quality of service, as they enable them to receive medical information at all times of the day. Additionally, they potentially can provide a dashboard through which doctors can provide updates on the best practices for self-care. Likewise, once e-care becomes more prevalent, bed-bound patients will be better able to receive information from their doctors, as it will be less necessary for them to receive general information in person.

There are additional advantages to delivering information over the Internet. When information is delivered online, it is delivered in print. However, when information is delivered over the phone, it is delivered via audio. As patients can print and retain online information, there is less chance that they will misinterpret what their doctor has said to them. Older patients are also less likely to misinterpret what their doctor has said, as poor hearing can sometimes be a barrier to verbal communication. Patients with poor English-language ability can translate pages into their native language using online translation technologies, such as Babelfish. All of these benefits can result in higher quality treatment, and fewer errors in doctor-patient communication.

When physicians utilize electronic information resources, it improves the quality of their care. By reading the latest information online, they are able to learn vital facts before they hit the press in journals. Likewise, electronic prescription reference databases can be updated more quickly and easily than old paper classics, such as the <u>Physicians Desk Reference</u> (PDR). Nowadays, the notoriously weighty PDR is available online at PDR.net, and a PDA version exists, called mobilePDR. Thanks to IT, it is possible to take the <u>Physicians Desk Reference</u> off of the desk.

While PDAs can be used to store databases, their potential uses are far more extensive. In Nursing, Mimi Hasset summarized that "in clinical settings, you can use PDAs to keep track of patient/staff contact information and schedule information, house a drug reference database, and do medical calculations. You can load the devices with complete patient-management applications."[76] PDAs have proven to be versatile investments for doctors that can provide many types of benefits.

It can be shown that the trends observed by Manhattan Research have produced tangible benefits. Aetna, a health insurance provider, experienced a substantial increase in the usage of its website after it improved the site's design. This demonstrates that site design can influence the degree to which consumers benefit from online information. In Medical Devices & Surgical Technology Week the benefits of the Aetna redesign were reported in detail. It was stated that inquiries into claim details increased from 163,000 to 734,606 between September 2004 and March 2005. This was likely the result of usability studies and focus groups conducted by Aetna in order to determine how to optimize the site.[77]

One of the motivations for this change was a survey conducted by Aetna. According to Aetna's head of product development, Robin Downey, "people in consumer-directed health plans tend to want more knowledge and, therefore, use the technology more than do employees in the same company who are enrolled in other types of plans."[78]

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[76] Hassett, Mimi. "PDAs: Leading the information revolution. " Nursing 1 Feb. 2002: 66. Health Module. ProQuest.

[77] "Information Technology; Aetna's member website is redesigned. " Medical Devices & Surgical Technology Week 19 Jun 2005: 269. Health Module. ProQuest.

[78] Geisel, Roseanne White. "Advances in technology shaping health care system. " Business Insurance : IndustryFocus 1 May 2004: 14-17. ABI/INFORM Global. ProQuest.

Although the Manhattan Research survey showed some of the major trends in healthcare information technology, it was by no means exhaustive. In addition to the uses mentioned, IT is also being used to enable hospitals to determine the overall quality of their care and to assist medical personnel in recalling the billing codes for their treatments.

One company that has strived to assist with the management of billing codes is ProVation Medical, Inc., a maker of clinical productivity software, has taken some stabs at reducing the errors and inefficiencies that occur during medical transcription. According to <u>Obesity, Fitness & Wellness Week</u>, ProVation MD software assists doctors with procedure documentation and billing code compliance by replacing the current process of dictation and transcription that is used. An additional version, ProVation RN, is specifically tailored to the needs of nurses. It provides nurses with notes, and can be configured to the local needs of the medical facility.[79]

Using ProVation's software, medical facilities can reduce costs related to support staff, while increasing the overall accuracy of data. As ProVation's software allows doctors and nurses to document their procedures without the use of transcriptionists, there is less chance that information will be misinterpreted as it is recorded.

New York-Presbyterian Hospital has made a substantial effort to use IT to increase the quality of care. Marianne Kolbasuk McGee reports that the hospital "is working on a number of clinical systems developed by the hospital's services provider, First Consulting Group, to help doctors and caregivers make better decisions based on analysis of the most timely, comprehensive data available. Last year, New York-Presbyterian began rolling out a health-monitor system for cardiac-surgery patients recovering in the ICU. The system analyzes data from monitoring

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[79] Information Technology; Texas healthcare system selects coding software for gastroenterology procedure. " <u>Obesity, Fitness & Wellness Week</u> 18 Jun 2005: 962. <u>Health Module</u>. ProQuest.

equipment and compares a patient's progress with expected recovery milestones based on aggregate data from patients who underwent similar procedures at the hospital."[80] Through this type of analysis, it is possible to quickly determine which patients are progressing worse than expected. Using this information, additional interventions can be made where they are most needed and the cost of care increased as needed. This data can also be used to reduce the risk of the hospital being sued due to negligence.

In addition to the ways previously mentioned, there are a myriad of other ways that corporations can use information technology to improve healthcare quality. According to Roy L. Simpson's 2003 article, "It Take a Village," the following three efforts are currently underway[81]:

- **The Leapfrog Group**: In 2000, several large purchasers of healthcare sought to use their purchasing power to reduce the cost of medical errors by founding The Leapfrog Group. The organization provides the incentive of "preferential use and other intensified market reinforcements" to providers who work to improve safety, combined with the threat of lost business to providers who do not. Their number one initiative is promoting computerized physician order entry (CPOE), as order entry has been shown to be a source of many medical errors.

- **The National Coordinating Council for Medication Error Reporting and Prevention**: The council, which was formed in 1995, strives "to examine and evaluate the causes of medication errors; increase awareness of medication errors and methods of prevention throughout the healthcare system; recommend strategies relative to system

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[80] McGee, Marianne Kolbasuk, and Charles Babcock. "CIOs On Call. " InformationWeek 31 Jan. 2004: 28-30,34-36. ABI/INFORM Global. ProQuest.

[81] Roy L. Simpson "It Takes a Village. " Nursing Administration Quarterly 1 Apr. 2003: 180-183. Health Module. ProQuest.

modifications, practice standards and guidelines; stimulate development and use of medication error reporting and evaluation systems; and stimulate reporting to a national system for review, analysis, and development of recommendations to reduce and prevent medication errors." Additionally, the council has sought the implementation of uniform barcode standards for food and drugs. The council hopes that uniform barcodes will proliferate down to the "unit-of-dose" packaging.

- **The Patient Safety Institute (PSI)**: The PSI seeks to leverage existing technology to provide improved access to patient-centric information. The PSI believes that the five most important focal areas for quality improvement are "diagnoses, laboratory results, medications, allergies, and immunizations." As part of an open-standards initiative, the PSI hopes to create a system that will enable healthcare providers "to securely access clinical information" using the technology of their choosing.

Corporate action is occurring at the individual corporate level as well as at the consortium level. According to McGee & Murphy of InformationWeek, the health insurers Aetna and Cigna are both working to create solutions that will enable employers to better determine the nature of their healthcare spending.[82] Kinko's Inc. (now a part of FedEx) used a web-based data analysis tool from Aetna to examine "the type of claims, the cost, and drug-price trends." Kinko's utilized the information it gleaned from the tool to develop a wellness program and to determine if its healthcare services were meeting its employees' needs.

Cigna is providing a similar program to employers, enabling them to determine where money is being spent year-round. Cigna is additionally using their analysis tools to improve the health of

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[82] McGee, Marianne Kolbasuk, and Chris Murphy. "Cure for soaring costs. " InformationWeek 14 Oct. 2002: 47-54. ABI/INFORM Global. ProQuest.

individual subscribers. McGee & Murphy continued to state that "through a disease management program, Cigna will provide information directly to an individual employee when that person does something such as fill a prescription. If he or she fills a diabetes prescription for the first time, that can automatically trigger Cigna to send information regarding how diabetics can stay healthy and manage their disease." Through information technology, Aetna and Cigna have strengthened their link with employers, and increased the quality of the care they provide.

Insurers, software companies, and hospitals are all working together to increase the quality of healthcare through IT. Improving healthcare quality will require a multidisciplinary effort that is beneficial to all parties involved. The positive results experienced by today's pioneers can serve as an example to others which wish to follow the IT trail to quality excellence.

Planning for the Future:

If good health is to be in future of the American people, it is essential that they plan the path to achieving it. People spend large quantities of time and money planning their retirement, as they would like to have comfortable lives in their senior years. Regardless of wealth, ill people have trouble enjoying retirement. In order to ensure a bright future both for yourself and for others, it is essential to explore how the institutional management and self-management of health can be improved.

Institutionally Managing Health

According to Dr. Ed Chaplin, Medical Director at Continental Rehabilitation Hospital San Diego (CRHSD), focusing on quality is the key to improving healthcare. Dr. Chaplin believes that "the conceptual knowledge we need to know to accomplish what we want to accomplish already exists." However, the barrier to accessing and incorporating that knowledge into daily practice is both individual and social. Luckily, this barrier is not insurmountable. "Science as it applies to quality and technology are both tools for overcoming these barriers."[83]

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[83] "Keynote Speakers: Dr. Ed Chaplin, MD." The 10th World Congress for Total Quality Management. <http://www.world-congress.ae/dr_ed_chaplin.htm>

On a separate occasion, Dr. Chaplin provided a more detailed assessment of how the medical field could defend itself against errors. He advocated the following six-step approach:

1. *"Personal self-assessment and self-monitoring by each staff of capacity to meet the standard*
2. *Review by either a peer or supervisor*
3. *A department or section periodic audit*
4. *Independent audit by the quality department*
5. *Audit independent of the facility, i.e., by corporate*
6. *Outside independent review, i.e., JCAHO of State of California"*[84]

In a nutshell, Dr. Chaplin advocates increasing quality through increasing auditing. This approach is definitely a trendy one in other industries. The Sarbanes-Oxley Act of 2002 requires public companies issuing securities to conduct rigorous internal audits, in addition to being periodically audited externally. Likewise, the military frequently audits the readiness and training of its troops. Auditing is a time-tested method for increasing quality. A large portion of the quality increase resulting from auditing comes from the increased awareness of quality that auditing instills. Sarbanes-Oxley helps ensure quality by making CEOs and CFOs criminally accountable for the quality of their companies' financial statements. While doctors can be sued for malpractice when there has been a gross breach of quality standards, there is no board to prosecute poor quality doctors without patient involvement.

It is important for doctors to play an active role in developing quality initiatives, regardless of whether Chaplin's suggestions are followed. Dr. Mark A. Chassin stressed that "although health plans and insurers may emphasize lowering costs, physicians are in the best position to make the case for improving quality." Cost-cutting efforts need not work in opposition to quality improvement efforts. "By focusing cost-containment efforts on reducing the inappropriate use of health services and avoiding preventable adverse effects, physicians can cut costs and improve

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[84] Chaplin, Ed. "The Application of Six Sigma Strategies to Medication Administration. " <u>Quality Congress. ASQ's ... Annual Quality Congress Proceedings</u> 57.(2003): 1-38. <u>ABI/INFORM Global</u>. ProQuest.

quality at the same time."[85] Through increasing quality, doctors can prove that it is not necessary for them to endure the mediocrity of "cost, quality, speed—pick two."

Where will increases in quality have the most impact on healthcare? Some might argue that quality is most paramount in the operating room, where lives hang by a thread. Others might argue that quality is most important in primary care, as primary care physicians are the gateway to medical services. Which patients are most important to help? Which are most likely to be cured, and which are most likely to become ill again?

Stuart & Weinrich contributed to answering these questions by studying which diagnoses produced "relatively high volumes of admissions and frequent readmissions relative to admissions." Their findings are summarized in Table 2.

Diagnosis	Admissions	Readmissions
Respiratory Disease	30%	50%
Psychoses	15%	25%
Drug Dependence	11%	23%
Alcohol Dependence	9%	18%
Diabetes	8%	15%
Asthma	6%	12%

Table 2: Likelihood of Diagnoses Leading to Admissions & Readmissions[86]

It can be seen that diseases related to personal habits tend to cause high rates of admissions, which correlate with high rates of readmissions. Respiratory disease is often caused by smoking, and asthma is often caused by exposure to second-hand smoke. Drug and alcohol dependence are both self-inflicted conditions, and diabetes is often caused by a poor diet and a lack of

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[85] Chassin, Mark A. "Improving Quality of Care-Time to Act." Journal of the American Medical Association. 1991. 266:3472–3

[86] Stuart, Mary E. and Weinrich, Michael. "Beyond managing Medicaid costs: Restructuring care." Milbank Quarterly; 1998, Vol. 76 Issue 2, p251, 30p, 9 graphs

exercise. The only diagnosis on this table that is not at least somewhat influenced by personal habits is psychoses, although some psychoses can be produced through drug use. If the quality of the health of Americans is to be improved, it is essential to rein in deleterious personal habits.

The field of predictive modeling can be employed to help doctors determine which patients are most in need of vigorous preventative efforts. Although it would be ideal to be able to target everyone for additional preventative intervention, it is often most realistic to concentrate efforts on a subset of the population. According to Tracey Walker, Senior Editor of <u>Managed Healthcare Executive</u>, "The success of many disease management programs is dependent on the programs' ability to effectively predict risk among the disease patients, stratify the patients according to their predicted risks and match the intensity of available interventions with the patient-specific risks."[87] Walker views predictive modeling as an essential means of generating information that can be used to optimize the delivery of healthcare.

Predictive modeling can be used to help doctors determine which patients would benefit from simple interventions, such as lifestyle changes, and which would benefit from complex interventions, such as surgery. Before recommending a drastic procedure, a doctor must predict the risk of the patient prematurely dying with and without the procedure.

Michael Vizard, editor-in-chief of <u>CRN Magazine</u>, claims that there are currently three trends influencing the institutional management of health. He believes that changes in the healthcare industry are being driven by the government, the legal community, and the insurance industry. The government is forcing the creation of holistic, electronic medical histories through HIPAA. Meanwhile, the legal community is providing teeth to HIPAA. Although "the fines that will be

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[87] Walker, Tracey. "Eye-level data. " <u>Managed Healthcare Executive</u> 1 Sep. 2004: 26-31. <u>ABI/INFORM Global</u>. ProQuest.

applied by the Office of Civil Rights for violating HIPAA are nominal," violation can still cause major headaches, as "once a health-care organization is found to be in violation, it sets the stage for lawsuits that could easily cost health-care providers millions of dollars." Thus, private citizens, not the federal government, will play the primary role in enforcing HIPAA. Finally, the insurance industry is playing a leading role in changing healthcare. As medical errors causing accidental death often result in insurers paying damages, insurers have a strong incentive to reduce medical errors.

Vizard remarked that "today's health-care IT landscape is one of the most fragmented of the major vertical markets. At its core are backoffice applications, which function similarly to hotel booking applications that are tied into financial applications. Outside of the operating room, a hospital pretty much functions like a hotel for sick people."[88]

Although institutions can do much to improve healthcare by working to determine the causes of poor health, and then to fight them through predictive modeling, it remains to be seen how much improvement will occur over the next decade. Optimistically, Vizard's predictions will prove correct, and the push for HIPAA compliance will cause a cascade of changes in healthcare. Through applying quality controls used in other industries, such as auditing and predictive modeling, hospitals can increase the quality of care that they deliver.

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[88] Vizard, Michael. "Bridging the health-care gap. " CRN 24 Mar. 2003: 22A. ABI/INFORM Global. ProQuest.

Self-Managing Health

Television talk show host Jerry Springer often said, "Take care of yourself, and each other." Although it was not his original intent, his advice should be applied to healthcare. At this point in time, individuals are best able to monitor their own wellbeing. Luckily, technology will soon be able to augment people's ability to perform this task.

While Americans have gotten healthier over time, there is still a great deal of room for improvement. Ambrose, Lurie, & Wykoff remarked:

Consider that since the turn of the 20th century, the life expectancy of Americans has increased by 30 years, but only 5 of those years are credited to improvements in acute medical care; the remaining years are attributed to public health interventions. In an analysis of the major determinants of premature deaths in the United States in 1990, the Centers for Disease Control and Prevention found that 47% could be attributed to unsafe personal behavior and lifestyle practices, 16% to environmental factors, 27% to inherited and genetic factors, and 10% to lack of access to medical care.[89]

From these remarks, it is clear that public health initiatives have played a large role in extending the lives of Americans. However, with 47% of premature deaths still attributed to lifestyle, it is apparent that people can substantially improve their health by focusing on their own behavior. According to the previously mentioned study, a massive amount of people are dying from avoidable causes. These deaths consisted of:

- Tobacco use (400,000)

- Poor diet and activity patterns (300,000)

- Alcohol abuse (100,000)

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[89] Paul Ambrose, MD, MPH Randolph F. Wykoff, MD, MPH, TM Nicole Lurie, MD, MSPH, Paul Ambrose, MD, MPH, Randolph F. Wykoff, MD, MPH, TM, and Nicole Lurie, MD, MSPH. "The case for an ancient cause Healthy People 2010." Postgraduate Medicine 109.3 (2001): 9. Sciences Module. ProQuest.

- Microbial infection (90,000)

- Exposure to toxic agents (60,000)

- Firearm injuries (35,000)

- Unsafe sexual behavior (30,000)

- Motor vehicle accidents (25,000)

- Use of illicit drugs (20,000).[90]

These are all problems that could be somewhat reduced by people taking more personal responsibility for their health. Unfortunately, it is clear from these statistics that nearly a million premature deaths could be prevented each year through personal responsibility.

One component of taking personal responsibility for one's health is exercising (see Figure 10). The fact of the matter is that most Americans do not exercise. Those who do exercise do not exercise enough. In fact, the majority of Americans in all age brackets do not exercise… at all.
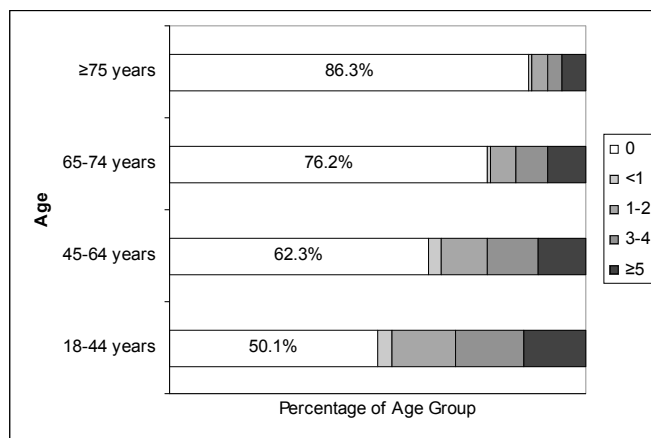
Figure 9: Frequency of Participation in Vigorous Physical Activity by Age Bracket[91]

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[90] Paul Ambrose, MD, MPH Randolph F. Wykoff, MD, MPH, TM Nicole Lurie, MD, MSPH, Paul Ambrose, MD, MPH, Randolph F. Wykoff, MD, MPH, TM, and Nicole Lurie, MD, MSPH. "The case for an ancient cause Healthy People 2010. " <u>Postgraduate Medicine</u> 109.3 (2001): 9. <u>Sciences Module</u>. ProQuest.

[91] "Table XVII. Crude percent distributions (with standard errors) of number of leisure-time periods per week of vigorous physical activity lasting 10 minutes or more among persons 18 years of age and over, by selected

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Some might argue that Americans do not exercise because they are too busy working, or because they cannot afford exercise equipment or access to exercise facilities. Those who argue this may have somewhat of a point, as inactivity tends to decrease with increased income (see Figure 11).
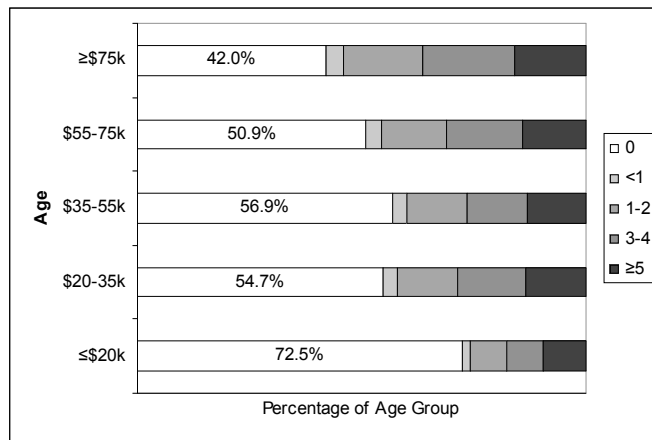
Figure 10: Frequency of Participation in Vigorous Physical Activity by Income Bracket[92]

However, 42% of people earning $75,000 a year or more do not exercise vigorously at all. (Subjects exercising occasionally, but on average less than once a week, fall in the <1 category in Figures 10 & 11.) It is clear that there is simply a culture of non-participation in exercise. The key to increasing participation in exercise is to change the culture surrounding it.

American exercise culture is associated with teams, sports, classes, Richard Simmons tapes, and spandex outfits. There is a large sporting goods industry that stresses the importance of exercising while utilizing the right equipment. Running no longer just requires a pair of legs. It requires cross-trainers or running shoes, a shirt with fibers that breathe, and a synthetic pair of

characteristics: United States, 2003." Centers for Disease Control and Prevention. <http://www.cdc.gov/nchs/data/series/sr_10/sr10_225.pdf>

[92] "Table XVII. Crude percent distributions of number of leisure-time periods per week of vigorous physical activity lasting 10 minutes or more among persons 18 years of age and over, by selected characteristics: United States, 2003." Centers for Disease Control and Prevention. <http://www.cdc.gov/nchs/data/series/sr_10/sr10_225.pdf>

shorts. Few runners consider themselves complete without a pair of headphones and an mp3 player or radio. Exercise has become a production instead of a way of life. This production is further exacerbated by the concept of health clubs, which make exercising require a journey outside of the home. Although home treadmills and stationary bicycles give the wealthy access to exercise within their home, they are outside of the budgets of many Americans.

How can exercise become an integral part of American culture? How can it be made ubiquitous, accessible, and affordable? The answer may be found by observing the approach of China. In Beijing, China, there are an abundance of outdoor recreational parks. These parks contained rust-proofed, multicolored equipment, like American parks. However, the nature of the equipment and the users of the equipment were decidedly different than in America. The users were not preschoolers, as they often are in the U.S., but instead were senior citizens.

The equipment did not consist of jungle gyms, designed for imaginary play, but instead consisted of ruggedized, unpowered exercise devices. The Chinese playground had monkey bars set two meters off of the ground (for adult strength training), instead of one meter off of the ground, as is typical in American playgrounds for children. In order to ensure ruggedness, the Chinese exercise equipment did not contain foam padding like its American equivalent. There were treadmills, ellipticals, leg-presses, and many other types of devices. There were even paths of textured stones that people could walk on sock-footed to massage and stimulate circulation to the feet. All of this was available outdoors to the public, rain or shine.

Through closely examining the picture of the Chinese woman on the elliptical (Figure 12), some critical realizations can be made. First, she has a tree next to her. She is outdoors, as the

ellipticals shown are in a public park. Second, the elliptical is unmotorized. There is little that can break, as it consists of a few pieces of metal that have been welded together. Third, it has no electronic control console. The resistance is set at one setting, and the only way for the woman to burn more calories is for her to move faster. It is equipment like this that can be cheaply deployed in America in order to fight obesity. There is no excuse for people not being able to exercise. Exercise should be as free and easy as visiting the neighborhood park. As it has been possible to fund children's equipment in American parks, there is no reason that it should not be possible to fund park equipment for adults.

Figure 11: Women Exercising on Outdoor Elliptical in Beijing, China[93]

Poor dietary habits are another major controllable factor in poor health. Although, as of 2006, people cannot change their genes, they can easily change what they eat. According to Dr

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[93] Powell, Adam. 1 June, 2005. Chaoyang District, Beijing, China.

Christopher Murray, Executive Director for Evidence and Information for Policy at the World Health Organization, it is simple to improve health through dietary change. "Blood pressure and cholesterol can be contained by limiting salt in processed foods and stepping up physical activity," said Murray. He continued, "Use of salt in processed foods can be reduced by government regulation or voluntary regulation. Such regulation can be effective, and its effectiveness can be tested by random sampling."[94]

Although it is un-American to force people to eat a certain diet, or to not eat certain foods, there are many ways in which the government could do a better job of improving the nation's nutrition. The easiest way for the government to improve health without limiting the freedoms of Americans is for the government to enact a policy of only providing and subsidizing nutritionally-sound meals. An unfortunate number of school cafeterias are serving America's youth daily doses of fries and pizza. Although there are already regulations on school lunches, the regulations could use some tightening.

Likewise, food stamps, WIC, and free breakfast programs could also be restricted to only providing nutritious food. Currently, WIC participants can purchase milk with any level of fat, including whole milk. The government could easily restrict the subsidized purchases of WIC participants from including extraordinarily fattening dairy products. As a result, WIC children could grow up accustomed to drinking skim milk instead of whole milk, and eating mozzarella instead of cheddar, leading them to a lifetime of lower caloric consumption. Through more strictly regulating food subsidies, the government could bring about positive change in the lives of Americans.

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[94] Suri, Sanjay. "Health: Add Five to Ten Years to Life at Little Cost. " <u>Global Information Network</u> 30 Oct.20021. <u>Multicultural Module</u>. ProQuest.

People can use IT to help them manage their health through the process of self-metrication. When creating personal goals, employees at Microsoft are required to place them in Paul J. Meyer's "S.M.A.R.T. Goals" framework.[95] Goals must be:

- **S**pecific

- **M**easurable

- **A**ttainable

- **R**ealistic

- **T**angible

Information technology can be used to help people make their health goals measurable and tangible. On most days, the average American measures little about their health besides their weight. Bathroom scales are the only body metrication device prevalent in most homes. While scales enable people to create S.M.A.R.T. goals centered on weight, such as "to lose five pounds by December 1st," they do not allow people to create S.M.A.R.T. goals centered on other variables, such as physical activity, dietary intake, blood pressure, and blood content. Pedometers, heart rate monitors, and glucose monitors enable people to track more variables about their health.

In 2004, McDonald's began selling pedometers with some of its meals. Promotions such as this are important, as they help reduce the cost of health metrication devices and disseminate metrication devices to common Americans. Hopefully, there will be future initiatives to distribute metrication devices to Americans, and new devices will be invented that will enable the measurement of even more variables. Optimistically, ten years from now, people will be able

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[95] Meyer, Paul. "Creating S.M.A.R.T. Goals." Top Achievement. Accessed 17 Oct. 2005. Available at: http://www.topachievement.com/smart.html

to continuously track dozens of variables about their health, using Bluetooth-enabled devices. Every night, the user could synch his devices with his computer in order to see his progress in meeting his health goals.

Through increasing the accessibility of exercise equipment, and increasing the nutritional content of subsidized meals, the government can increase the health of the American people. Meanwhile, personal metrication devices will play an important role in helping people set and achieve health-related goals. While people clearly need to do more to reduce their susceptibility to diseases with controllable risk factors, the government can do more to help people make wise decisions. Regardless of the degree of government intervention, individuals must monitor their health, and work to reduce their risk of obtaining preventable illnesses.

Part 3 - Recommendations

The first two parts of this document served to establish the problems with the cost and quality of American healthcare. While a few IT-based solutions to contemporary problems in healthcare have been proposed, until now, discussion of solutions has largely been skirted. In this section, healthcare problems will be addressed through specific advice for assessing and solving them.

Determining What to Do

Before proposing solutions for corporations, the government, and individuals, it is important to determine what needs to be done in order to reduce the cost of healthcare while increasing quality. This detour will provide ample ground on which to later build recommendations.

Cost Reduction

Healthcare costs can be reduced in three ways. First, risk factor research can be used to determine the relative risk that patients will contract costly conditions when determining treatment. Risk factor research can also be used to help patients minimize their susceptibility to diseases. Second, decision support software can be used to help doctors more scientifically assess the conditions of their patients, increasing the overall chance that the proper treatment will be applied. Finally, cost can be reduced by creating preventative programs and targeted at those most at risk. Insurance companies can encourage compliance with preventative programs by strengthening the connection between prevention and health insurance rates.

As was mentioned earlier in this document, there are certain behaviors and conditions that predispose people to becoming expensive patients. Stuart & Weinrich stated that "patients considered to be particularly likely to incur high costs have social risk factors like homelessness and poor social support systems in addition to their medical problems."[96] As was shown in the table containing data on hospital admissions and readmissions, the majority of conditions leading to premature death have behavior-based risk factors. As behaviors detrimental to health have been readily identified, there can be a great decrease in medical spending by working to decrease their prevalence. Although conquering these ills may lead to previously less important conditions gaining in importance, the reduction will decrease the cost of fighting today's most prevalent conditions.

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[96] Stuart, Mary E. and Weinrich, Michael. "Beyond managing Medicaid costs: Restructuring care." Milbank Quarterly; 1998, Vol. 76 Issue 2, p251, 30p, 9 graphs

In order to reduce the degree to which subscriber health is affected by preventable illness, insurers should increase the number of patient-related variables that they track in their databases and should attempt to use their information to increase the quality of their care-related decisions. Unifying database schema is essential if an accurate view of the health of the American people is to be produced. Without unified schema, different doctors and insurers will each have a postage-stamp-sized view of the condition of their patients. While insurers may be able to somewhat rely on diagnosis and procedure billing codes to determine the ailments of their patients, the picture produced by these codes is far grainier than desirable.

Secondly, decision support software can be used to assist hospitals in becoming more rational decision makers. The medical profession is currently rooted in the tradition of saving life at all costs. Inadequate regard is given to the financial ruin that "saving life" can bestow upon a family. While in an ideal world, it would be possible to provide unlimited medical care to all those who are ill, today's world has financial and human constraints.

There are a relatively static number of doctors who can perform cardiac surgery. As doctors become busier and busier, providing cardiac surgery to one patient often means denying it (through market forces) to another. If there were an excess of surgeons, surgery would cost less. However, in the event of a decrease in the price of surgery, fewer exemplary people would make the investment in learning complex procedures due to the decreased reward. Thus, it is difficult to substantially increase the supply of quality medical professionals, while maintaining a population of practitioners willing to undergo training.

As no one doctor would like to bear the grave moral burden of determining whether one patient's treatment should be prioritized over that of another, decision support systems enable

prioritizations to be made in a logical and less painful fashion. According to journal <u>Health Care</u> <u>Management Science</u>, the National Institute for Health (NIH) has recommended that hospitals behave rationally when allocating their intensive care unit (ICU) resources. When ICU resources are limited, only patients with a decent chance of recovering should be given access to the ICU. In order to objectively decide the probability of patient recovery, hospitals are utilizing decision support software packages, such as APACHE. APACHE estimates the likelihood of recovery through binary logit regression.[97]

Although it would be wonderful for it to be practical to treat all critically ill patients, the resources are not always available to do so. Software like APACHE enables hospitals to make decisions in a manner that best promotes their overall mission of extending life.

While improving treatment will be beneficial, perhaps the best way to reduce the cost of medical treatment is to improve the quality of prevention. Although there are many ways in which people can work to improve their health, it is by now clear that only a minority do so. Perhaps, the reason for this is that the rewards of a healthy lifestyle are not received through instant gratification and are by no means certain. Pessimists often use examples of people dying unexpectedly to argue for the importance of living for the moment and enjoying hedonistic pleasures.

How can people be made to value far-off medical benefits? The answer is to shift some of the increase in utility from good health to the present. Although improving one's health through exercising and eating properly has some benefits in the present, those benefits may be hard to conceive for people who have not recently experienced them. People who have been overweight

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[97] Goss, Ernest Preston, and George S. Vozikis. "Improving Health Care Organizational Management Through Neural Network Learning. " <u>Health Care Management Science</u> 5.3 (2002): 221-227. <u>ABI/INFORM</u> <u>Global</u>. ProQuest.

for the majority of their lives may not be able to conceptualize the added energy that fitness brings. Likewise, they may not be able to visualize the potential for improvement in physical appearance.

How can people be made to conceive of the short-term benefits of improved health? The answer is to create additional incentives. When a person improves his health, he increases the utility of insurers, tax-payers, and himself. While a person cannot pay himself for his perceived increased utility, tax-payers and insurers can. Tax-payers would save money if they gave people on Medicare and Medicaid tax rebates or other financial incentives for keeping their health within defined parameters, which are statistically known to reduce healthcare costs. As long as the tax rebates were less than the projected savings, the program would save tax-payers money. Another method for accomplishing this aim is for insurers to more rigorously monitor their subscribers, and to provide additional discounts to subscribers who have reduced their risk of having expensive medical problems. While treadmill-based stress testing is currently used to determine health, insurers could create more invasive means for enforcing prudent preventative practices.

Cellular telephones have a great potential for helping insurers and subscribers work together to improve health. For example, a great number of medical complications are caused by unmanaged diabetes. Insurers could issue diabetics Bluetooth-enabled glucose monitors, and give them a discount for transmitting their daily glucose readings to the insurer via cell phone. Insurers would increase the amount of information that they had on the health of their subscribers, and subscribers would feel more compelled to comply, as they would know that someone was watching them, and that their insurance would cost more if they did not comply. Likewise, those susceptible to heart disease could be given a discount for continuously wearing a

Bluetooth-enabled heart rate monitor.[98] The monitor could periodically transmit readings of the subscriber's heart rate to the insurer, which would enable the insurer to be better able to determine how much time the subscriber spent sleeping, sitting, and exercising.

Through reducing information asymmetry, health monitoring would make insurance accessible to people who had previously been priced out of the market. Many of America's uninsured are young workers without employer-provided health insurance. As adverse selection has caused the cost of individual health insurance policies to be prohibitively expensive to those in this demographic, it is essential to counteract the force of adverse selection. Through providing more information to insurers, people can reduce information asymmetry and receive insurance at a rate that is more proportional to their risk.

While doing this will have the undesirable side-effect of making health insurance more expensive for those either unwilling to consent to monitoring and those with a high risk for substantial claims, this side-effect is acceptable, as it makes health insurance more like indemnity insurance. If health insurance is truly to be a form of insurance instead of a means of social transfer, it should serve to reduce the variance in medical expenses, instead of reducing the expected amount that some people will pay while increasing the expected amount that others will pay.

If America were not a country focused on individual freedom, the best way to implement all of these means for monitoring health would be through federal mandate. Alas, any means of mandatory surveillance would be un-American. Thus, the best way to increase the medical surveillance of Americans is through the most American force of all; capitalism. If legislation permits insurers to gather more actuarial data about their policyholders, they will be able to offer

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[98] "IBM develops heart rate monitor that calls cell phone for help." IBM Press Release. Dec. 17th, 2002.
<http://www-03.ibm.com/technology/news/2002/121702monitor.shtml>

rates that are more precisely tuned due to reduced information asymmetry. This will in turn enable insurers to craft policies that are more profitable, and to create policies that are appealing to people who anticipate low utilization of medical services. In the end, federal tolerance towards health monitoring will result in people more actively taking preventative measures and receiving more appropriate premiums. Opening up insurance to the market of low-risk individuals will ultimately also increase the profitability of insurers. Through health metrication, everyone wins, as everyone pays premiums that are closer to their expected utilization.

Quality Improvement

As the second part of this document has shown, there are many ways in which the quality of healthcare can be improved. The quality of healthcare can be improved by both employing techniques that are less error-prone and by enabling consumers to discriminate between doctors on the basis of quality. Quality improvement must be driven by consumers, insurers, and the government. If any of these parties has its ability to drive quality abridged, the overall health of the American people will suffer.

First and foremost, quality management techniques must be more rigorously applied to the field of healthcare. As mentioned previously, there are major benefits to increasing auditing, using international standards, following Six Sigma, and generally striving for better care. Compared to many other industries, the quality of medical care is frighteningly low. Hospitals should create the goal of achieving Six Sigma quality when performing procedures or delivering medications. While the varying medical conditions of patients sometimes result in incorrect diagnoses, there is no excuse for a doctor accidentally replacing the left hip of a patient instead of the right. Likewise, there is no excuse for a patient diagnosed with a cold to ever be prescribed an antibiotic.

Electronic health records (EHRs) can assist doctors in increasing the quality of their treatments by increasing the transparency of the conditions of their patients. In order for EHRs to be able to provide value, it is vital for doctors to be able to easily obtain complete medical histories on their patients. A national central electronic health record repository should be created, so that doctors can quickly access extensive information on their patients.

As it is essential for patients to be able to defend the privacy of their medical records, all of the records in the central database should be stored in an encrypted format. A biometric password, such as the patient's fingerprint, should be used to control access to medical records. Patients should be required to grant access to doctors to view their medical records. An added advantage of this system is that a national database of fingerprints would enable doctors to obtain medical information on unidentified people found unconscious. Likewise, coroners could use the fingerprints to instantly identify the unknown deceased.

Once access privileges are granted, the doctor should retain them for a fixed period of time after the patient's last visit. As a result, the number of doctors with access to a patient's medical records would not explode out of control over the course of the lifetime of the patient. This would be better than today's system, in which patients have little control over how long doctors have access to their records.

Although some may argue that tying fingerprints to the delivery of healthcare is an invasion of privacy, a large portion of the American public has already submitted to fingerprinting. While I have never committed a crime, even my fingerprints are on national file. This is the case, as I have worked in the financial services industry, an industry which routinely requires the fingerprinting of its employees. Fingerprinting is not just limited to bankers and inmates. The Department of State's electronic passport system allows people to opt to place their fingerprints on file. All recipients of student visas must also have their fingerprints on national file. Fingerprinting is becoming a common part of American life, and can be used to increase the quality of healthcare.

In addition to improving the quality of medical care itself, it is essential to improve the ability of patients to judge the quality of available treatment options. Consumers selecting automobiles, restaurants, and theatrical performances can rely on reviews and reports of quality to assist them in their decisions. There are multiple independent bodies that provide ratings for all of these goods and services. Like doctors, both chefs and actors are members of the service industry. Although it is not possible to precisely determine the quality of the service that they will provide on any given evening, reviewers feel comfortable assessing them nonetheless. It is unfortunate that patients are not currently able to select doctors in the same manner. Instead, they must rely on word-of-mouth, which is often provided by people (such as friends and family) who lack an adequate basis for comparison and the training to make a professional evaluation.

Although licensing boards currently review the quality of doctors, they do not go far enough. Medical licensing boards essentially give doctors a "thumbs-up" or "thumbs-down" rating. There is a great deal of variation in quality among the doctors that are approved to practice. The creation of multiple external ratings systems (perhaps in the form of websites) would enable medical care to be more responsive to market forces. Although all rated doctors would be considered safe by licensing boards, the difference in quality could more directly translate into differential pricing. Patients could then better decide how much they are willing to spend on care, and seek a doctor of the appropriate quality.

However, when creating ratings of doctors and hospitals, it is important to not base them solely on patient satisfaction surveys. "Patient satisfaction surveys may be subject to nonresponse bias; that is, consumers who respond to health surveys may differ from those who do not. Recall bias—when consumers do not accurately recall information about their care—is also a potential problem. Administrative measures, although less prone to these forms of bias, may be a less

sensitive measure of health care process than consumer-derived indicators."[99] Thus, the best solution is for reviewers to rate doctors and hospitals on a combination of factors, such as the quality of the care as perceived by patients, according to audits, and according to the number of lawsuits filed against the doctor or hospital.

Through increasing the quality of the medical procedures performed, and increasing the ability of customers to measure past performance, the quality of care can be increased overall. While medicine is an inherently fuzzy field, there is strong evidence from other fields that it is possible to rigorously increase quality under such circumstances. The future of increasing medical quality begins with empowering consumers. IT can play a strong role in both gathering and storing data related to the quality of previous performance, and disseminating it to potential patients.

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[99] Druss, Benjamin G., Rosenheck, Robert A., Stolar, Marilyn. "Patient Satisfaction and Administrative Measures as Indicators of the Quality of Mental Health Care" Psychiatric Services. 1999 50: 1053-1058

Making it Happen

Now that the present situation has been explored, how can these changes be implemented? In America, there are usually three ways in which any change is enacted. Change is caused either by corporations, the government, or citizens. As healthcare problems are broad and complex, they will require remedies involving all three.

Corporate Approach

Corporations are naturally well-suited to improving the healthcare system. Both hospitals and insurers operate, at least to some degree, on a corporate level. Likewise, the vast majority of information technology is created by corporations. If information technology is to be a significant driver in improving the quality of healthcare, corporations will have to play a significant role.

The importance of corporations in healthcare is in great part due to the spirit of the American people. By and large, Americans do not like to have their government force them to do <u>anything</u> that is not written somewhere in the Constitution or in another widely-accepted legal document. If legislators passed a law that required people to submit to fingerprinting for their health records, there would be uproar, as it would be considered an invasion of privacy. As fingerprinting has for a long time been primarily associated with law enforcement, many innocent Americans would view having their fingerprints taken as an unlawful incursion into their privacy.

Unlike the government, corporations can much more readily get away with all sorts of invasions of privacy. Receptivity to invasive corporate policies is greatest when there is substantial initial reward for compliance. The reason for this is that if a person does not like the invasion that the corporation demands before rendering services, the person has the option of simply using a competing corporation, or not using the service at all. Meanwhile, if a person does not like a federal law, his only recourse is to leave the country. Thus, the public is much more receptive to draconian corporate policies than to draconian government policies.

As a result of this phenomenon, health insurance companies have a far greater ability to regularly monitor the health of the American people than the government. If Congress forced all Americans to wear pulse monitors, it would be un-Constitutional. If a health insurance company gave customers discounts for wearing pulse monitors, it would be American. Likewise, health care companies can ally themselves with their cohorts to create a win-win situation. The insurers want their cohorts to require minimal medical care to reduce expenses, while the members of the cohort would like to minimize their overall illness. By transferring some of the financial utility resulting from improved health to the cohort, insurers can help motivate people to better maintain their health. It is through this strategy that insurers will be able to introduce continuous health monitoring systems, which can be used to more precisely assess risk.

Phillip J. Longman wrote of the importance of creating this win-win situation. He advocated:

Instead of simply adding more benefits to a health-care system that is already financially unsustainable, or using new benefits to herd people into HMOs, why not offer a more sensible deal: Bribe people into taking better care of themselves. For instance, why not offer seniors who exercise bigger drug discounts than those who don't?[100]

Following the advice of Longman, it is possible for corporations to improve American healthcare. The key is to align the interests of individuals with those of corporations. When a corporation is focused on increasing the overall health of a group, and an individual is focused on increasing his overall health, there is a severe misalignment. Individuals have only minor concern for the health of the other people subscribed to their policy, as they should. The only way to get people to make decisions that are beneficial to the group of policyholders as a whole is to share with them the benefits of such decisions.

Bill Gates, Founder of Microsoft and the Bill and Melinda Gates Foundation, agrees with the assertion that a corporate approach should be taken with U.S. healthcare. When asked what should be done to improve health in the U.S., he responded "capitalism is working just fine." Mr. Gates has chosen to focus his efforts on other countries because "there is no market failure in rich world health." Instead, he spends his efforts on curing illnesses largely not found in the U.S. He remarked that "many of these diseases [the ones his foundation is fighting] only occur in the tropics," and that "when we [The Bill and Melinda Gates Foundation] put money into malaria, we were the only ones doing it." Thus, his goal is to solve health problems in places where the free market has not yet done so. As he believes in the American market, he has directed his efforts elsewhere.[101]

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[100] Longman, Phillip J. "The health of nations: instead of forcing seniors into HMOs, how about forcing them to exercise?" <u>Washington Monthly</u>. Apr., 2003.
<http://www.findarticles.com/p/articles/mi_m1316/is_4_35/ai_99988622>

Thus, there is strong evidence that the solution to today's healthcare problems must have a sizable corporate component. Healthcare is not charity, as it was once regarded, but is a commodity to be bought and sold. As evidence of this, the next few pages will describe several ways in which corporations have profited by improving healthcare.

There is a huge potential profit to be made by corporations entering the healthcare information technology space. Frost & Sullivan, a San Jose consulting firm, estimated that "the market for healthcare information technology could reach $56 billion by 2004." They additionally predicted that in 2004, "U.S. hospitals and clinics could spend $748 million for electronic medical record systems, a rise of more than 40 percent from 2000 expenditures."[102]

There is an equally large profit to be made by insurance corporations that wish to use technology to better assess the health of their cohorts. If insurers can use electronic monitoring to both better determine the health of their subscribers and to motivate their subscribers to improve their health, they will see large benefits. Increased monitoring will enable them to more precisely determine risk, and thus more accurately set premiums. Continuous assessment would enable insurers to set rates on a monthly or perhaps even continuous basis. No one currently says, "I should not eat that piece of fudge—my insurance premium will go up!" but if premiums were assessed daily, they might. Although the majority of the premium would be determined by a person's lifetime health history, days of healthful and unhealthful activity could work to gradually increase or decrease the rate a few pennies. Subscribers on "Adjustable Rate Health Insurance" plans would see more than financial benefits. The increased monitoring of health

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[101] Q&A Interview; Adam Powell & Bill Gates, July 13th, 2005, 7 p.m., The Gates Estate

[102] "Spending to rise on IT, medical records. " <u>Health Management Technology</u> 1 Nov. 2001: 56. <u>ABI/INFORM Global</u>. ProQuest.

central to the plan would motivate the cohort to be more conscientious of taking care of its health. Adjustable Rate Health Insurance would align the objectives of subscribers and insurers, as both would work to reduce the cost of care through increasing subscriber health.

This is important, as currently, health care plans have a rather group-centric approach that focuses on the health of the cohort, rather than the health of the individual. When "compared with physicians, health care plans and organizations tend to place greater emphasis on the health of enrolled populations and on attributes of care that reflect the functioning of organizational systems." As a result, "definitions of the quality of care must take into account the extent to which care meets the needs of a plan's enrollees as a group," often superseding measuring the quality of care on a per-individual basis. [103] Charging slightly different rates to members of a group based upon their individual health would enable insurers to give their subscribers an incentive to improve their health.

Some may worry that Adjustable Rate Health Insurance is a bad idea, as people would be charged more and more as they got sicker and sicker, eliminating the value of having insurance. Following the methodology used by Adjustable Rate Mortgages (ARMs), Adjustable Rate Health Insurance policies could have caps on the amount the premium could increase each day and each year. Thus, subscribers could be assured that in the event of illness, their rate would not skyrocket.

Continuous monitoring (see Figure 13) will produce a cycle that will be both beneficial to subscribers and insurers. Monitoring will produce awareness of health status, both on the part of the subscriber and the insurer. As the subscriber gains awareness of his health status, he can

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[103] Blumenthal, David. "Quality of Care -- What is It?- Part One of Six"
N Engl J Med 1996 335: 891-894

think of ways to improve his health, and his insurer can provide him with suggestions. After creating a plan, the subscriber can then work to prevent illness. While modifying behavior to prevent illness, the subscriber continues to monitor his health to ensure that new conditions do not develop as a result of the preventative efforts.
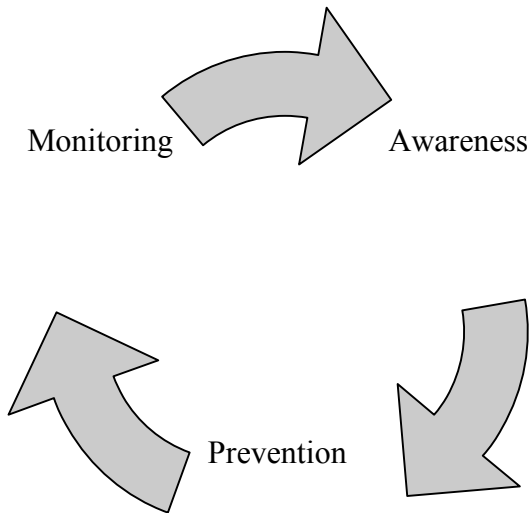
Figure 12: The Continuous Monitoring Cycle

Governmental Approach

While much can be done to improve healthcare on a corporate level, there are some improvements that are best left to the government. These improvements primarily deal with the fundamental structure of the healthcare system. There are certain changes that should be made that are "public goods"; they are of no benefit to any individual company, but benefit society as a whole. It is the government's responsibility to ensure that such improvements are made to the healthcare system.

Perhaps the largest problem with the U.S. healthcare system, which has in part caused the slow adoption of IT, is the manner in which healthcare is consumed. Milton Friedman, a Nobel Prize winner in Economics, expressed concern over the lack of connection between the consumers of healthcare and those whose who pay for it (the government and employers). As the consumers are not directly involved in the payment, market forces are less able to work. Thus, to paraphrase Jim Klein, when purchasing healthcare, consumers are unable to make the "money-versus-value" decisions that they would normally make when purchasing other commodities or services, such as food, appliances, or home repair.[104]

The government could help fix this problem by changing the economic dynamics of the healthcare system. Currently, health insurance is a near necessity for two reasons. The first reason is that medical expenses are costly, and the need for medical care is not equally

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[104] Klein, Jim. "HSAs Will Catalyze Adoption of EHRs. " Health
Management Technology 1 Nov. 2004: 58,57. ABI/INFORM
Global. ProQuest.

distributed amongst people. Spreading the cost of medical care amongst a group helps prevent any individual from paying an unbearable amount. The second, and perhaps more important reason that people need health insurance, is that hospitals charge different rates for procedures depending upon the payer. People without insurance pay a substantial premium for procedures over what insurers pay for procedures. The lawyer Bryan Vroon said in <u>The Wall Street Journal</u>, that the American system of pricing medical procedures consists of "a Persian rug market of negotiations," in which providers, suppliers and insurers cut deals, and only the uninsured are left unable to haggle. Later in the article, it was mentioned that the bill for one Virginia man's cardiac catheterization could be drastically different depending upon the payer (see Table 3). [105]

	Uninsured	Medicaid	Medicare
Ambulance ride	$1,000	$165	$247
Hospital stay	$29,500	$600	$1,500
Doctor charge	$6,800	$1,000	$875

Table 3: Cost of a Cardiac Catheterization in Virginia

The article explained that one of the chief reasons for this discrepancy is that health insurers are billed on a per-diagnosis basis for treatment, while uninsured patients are given line-item, ala carte bills. Thus, it is impossible for consumers to compare line-by-line the cost of their treatment with the cost billed to insurers. To make matters worse, insurers are able to negotiate lower rates for the treatments of various diagnoses, while uninsured individuals are not, as the latter do not have the same leverage. Thus, uninsured people are often billed far more than insurance companies would be billed for the same medical procedures.

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[105] Lagnado, Lucette. "Anatomy of a Hospital Bill; Uninsured Patients Often Face Big Markups on Small Items; 'Rules Are Completely Crazy'. " <u>Wall Street Journal</u> [New York, N.Y.] 21 Sep. 2004, Eastern edition: B.1. <u>ABI/INFORM Global</u>. ProQuest.

As a result, bankruptcy is too frequently the only option for uninsured people who have experienced catastrophic healthcare problems. It was stated in the <u>New England Journal of Medicine</u> that "medical problems contribute to about half of all bankruptcies."[106] Many bankruptcies also result from people with insurance who have contracted a debilitating illness that has prevented them from working, and thus caused them to lose their insurance. Realizing this problem, Himmelstein et. al suggested that, "as in Canada and most of western Europe, health insurance should be divorced from employment to avoid coverage disruptions at the time of illness."

While there are strong arguments for decoupling health insurance from employment, perhaps that the key to reducing medical bankruptcies, reducing the cost of care, and increasing the quality of care lies in enabling consumers to purchase their own treatments. If consumers paid for their own medical expenses and health insurance, their insurance status would not directly depend on their employment, as it so often does today. Furthermore, without plans dictating where medical treatment should be received, and what types of medicines should be prescribed, consumers would be free to pick treatments that they deemed to be an appropriate mixture of quality and cost. If there were an open market, prices would be reduced, as hospitals would have to compete with each other for customers.

This can never successfully happen if the government encourages employers to provide health insurance coverage through tax incentives. When the majority of Americans receive private health insurance through their employers, there is an effect of adverse selection on the pool of people who are self-insured. If everyone were self-insured, this problem of adverse selection would be reduced, and insurers could use differential pricing to control for its remnants.

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[106] Himmelstein, David U., et al. "MarketWatch: Illness And Injury As Contributors To Bankruptcy." <u>Health Affairs</u>. 2 Feb. 2005.

In order for these changes to occur, the federal government must act. Consumers will never be able to successfully pay for their own care unless it is legislated that doctors and hospitals must charge all patients uniformly. Every doctor and hospital should be free to charge as much as they wish for each of their procedures. However, once they pick a rate, they should be required to stick with it, regardless of whether they are providing care to an uninsured person, or a person with a group insurance policy.

If the federal government mandated that doctors charge all patients uniformly, it would by no means eliminate the need for health insurance, but would somewhat reduce its necessity. The original concept of health insurance was to spread the financial risk of unanticipated medical treatment. Like fire insurance, it was originally meant to help protect people who have suffered from an unforeseen turn of events. In its rawest form, insurance is not meant to be a discount program. Coverage of annual physicals and biannual dental cleanings is a bastardization of the concept of insurance. People do not need to mitigate the risk that they will require a perennial procedure required by everyone. Unfortunately, it is vital to have health insurance in these cases, as the rates charged to those without insurance are far higher than those charged to insurance companies. If the federal government put a stop to health insurance "discount programs," insurers would be able to provide the same value to consumers with health insurance that they provide with auto, fire, and flood insurance—restoration, no more and no less.

President Bush's Health Savings Accounts are a small step in the right direction. By encouraging people to purchase high-deductible health insurance, and to use a special savings account to cover all minor medical expenses, medical insurance once again is restored to its purpose of spreading risk, instead of providing discounts. When consumers spend their own money on medical expenses, they do so according to market forces. While this plan is a positive one, it can

only work successfully if the consumers that pay using their Health Savings Accounts are paying the same fees that insurers normally would. Without this protection, consumers may find themselves quickly paying their entire deductible each year, and not benefiting from the savings account.

If doctors were forced to charge only one fee per procedure, the cost of medical care would decrease. As patients would, in effect, be spending their own money on treatment, they would become price sensitive. There is currently a lack of price sensitivity in patients, as health insurance shields them from the actual cost of medical care. If patients were unshielded, a market would form in which there was more substantial competition amongst care providers.

In a nation in which each doctor charged a uniform price for each service he provided, it would be possible for technology to be used to enable consumers. People could "shop" for healthcare online and read reviews posted by other patients. Doctors could display their prices on websites, like restaurants displaying their menus. Third-parties could write reviews of doctors to help people determine their quality. Using the menu prices and the ratings, some people would choose more expensive doctors, while others would choose cheaper doctors. This would be similar to how some people choose to eat at expensive restaurants, while others choose cheaper restaurants. Insurance companies could clearly state the maximum they were willing to reimburse for each type of procedure, so that consumers could then personally augment their coverage if they desired higher quality care. Through this system, there would be a true market for healthcare. Insurers would still play an important role in spreading risk, while doctors could continue to charge as much as they saw fit. The true victor would be the consumer, who would have a larger range of treatment options than ever before.

This change would fix a substantial problem in American healthcare; the two-faced loyalty required of doctors. According to an article in the <u>New England Journal of Medicine</u> by Angell & Kaiser,

Most doctors are now double agents — working for their patients but also for their companies. And despite the lip service, the financial interests of those companies are not the same as the health interests of their enrollees, a truth underscored by the gag rules some MCOs [Managed Care Organizations] have imposed on their doctors. Therefore, to protect patients and the doctors who are committed to serving them, we need to set up an apparatus to curb the incentives of health plans to stint on care.[107]

If insurers imposed maximum reimbursements to be given to patients, instead of maximum reimbursements to be given to doctors, this problem would rectify itself. Doctors could recommend whatever treatment they believed to be most appropriate, and then patients could use their coverage, and if necessary, personal funds, to cover the expenses. Under this system, insurers would be able to control their expenses, while patients would be able to control the quality of their care.

In many ways, this system of health insurance would be similar to fire insurance. When a house burns down, the insurer attempts to restore the owner to his previous quality of life by providing a payment equal to the value of the house, minus the deductible. Once the insurance payment has been received, there is no obligation for the owner to spend it on reconstructing a replica of the lost house in the same location. The money could be spent on purchasing another house in another location, or could be spent on purchasing a more expensive house, if supplemented with personal funds. When health insurance forces patients to use a proscribed manner of treatment, it is like fire insurance forcing people to spend their settlement on producing a replica of their

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[107] Angell, Marcia, and Jerome P. Kassirer. "Quality and the Medical Marketplace -- Following Elephants." N Engl J Med 1996 335: 883-885

previous home. In both cases, organizational control of consumer spending is not in the consumer's interest.

Although government expenditures on health should be kept to a minimum, there are many important improvements that can be made in programs promoting public health. In healthcare, as in all other domains, the government's duty is to provide services that companies would be unwilling or unable to provide; no more and no less.

Furthermore, I believe that the government has the obligation to provide medical care for those who are physically incapable of obtaining insurance to provide it for themselves. Providing care for the impoverished, particularly children, must be done by the government, as the private sector has no financial motivation to do so. Additionally, the government should provide programs that benefit the general health of society in a manner that is unlikely to be funded by private industry. For instance, community-based youth health initiatives are justifiable, as no insurance company could easily directly capture the profits resulting from increasing the health of a population of youths, as their ultimate insurer is unknown. As these programs do not make financial sense to corporations, the government must see that they are provided. In all such situations, I believe the government has the obligation to determine whether a program will reduce the societal burden of care before widely implementing the program. If a program does not reduce the total cost of care of a condition, it should not be implemented.

In order for a government health initiative to work, there must be broad community support for the initiative. There is no point in offering lead-screenings to children if their parents are unwilling to remove the sources of lead from their homes if it is detected. At the Kaiser

Foundation, it was observed that "community activation as a health promotion strategy entails organized efforts to increase community awareness and to reach a consensus about health problems, coordinated planning of prevention and environmental change programs, interorganizational allocation of resources, and citizen involvement in these processes."[108] Without forming a cohesive network of individuals working together to improve health, no initiative can succeed. The community must be activated; it must be willing to be active and to spend resources in improving the health of its members.

What makes a community-based initiative successful? The researchers Steckler & Goodman found that the success of community health promotion programs was determined by several factors: "community competency; depth of community involvement; level of organizational support provided by the sponsoring agencies; and the degree to which the organizational goals and mission of the program 'fit' with those of the sponsoring agency."[109] Thus, it is imprudent to introduce certain types of health initiatives in communities that will not embrace them. Money on abstinence-based sex education is perhaps best spent in conservative communities, while money on contraceptive-based sex education is perhaps best spent in liberal communities. Delivering health messages that go against the grain is both ineffective and wasteful.

One avenue through which the government can easily improve the health of the American population is the free school lunch program. The program was originally created after it was discovered that some American boys were too malnourished to serve in World War II. This national nourishment program has gone too far, and may now be one of the causes of obesity.

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[108] Wickizer, Thomas M. "Implementation of Henry J. Kaiser Family Foundation's Community." Milbank Quarterly; Mar98, Vol. 76 Issue 1, p121, 27p, 6 charts

[109] Wickizer, Thomas M. "Implementation of Henry J. Kaiser Family Foundation's Community." Milbank Quarterly; Mar98, Vol. 76 Issue 1, p121, 27p, 6 charts

Although the time has long since passed since Ronald Reagan declared ketchup a vegetable for the school lunch program (it no longer qualifies), there are many "vegetables" still served that are equally dubious. Curly fries, refried beans, and tomato-based spaghetti sauce are all considered to be valid fruits and vegetables.[110] When determining servings of canned fruit, the syrup is included in the measurement. Although the list of acceptable foods contains many nutritious and legitimate offerings, a surprising number of unhealthy foods are present.

What should the government do, and how does this involve IT? The answer is that the government must alter the school lunch program so that it improves the health of young Americans, rather than destroys it. Many poor parents assume that school lunches are the most nutritious meals that their children eat each day. As a result, children are lead to believe that the meals can serve as a model of nutrition. In order to make the meals more nutritious, the government should regulate them by setting a maximum instead of a minimum requirement for the number of calories in a meal. By the same token, maximums should also be set for the amount of carbohydrates, cholesterol, fat, sodium, and sugar allowable in a meal.

The government should also use school meal programs as an opportunity for health education. In April 2005, the U.S. Department of Agriculture launched MyPyramidTracker.gov, a website that allows people to interactively track their nutritional intake over an extended period of time. In exchange for free lunches, older students might be required to log their nutritional intake on the site daily. In schools where computers are not readily available, older students might be required to fill out a daily dietary log during mealtime. Requiring students to observe their nutritional intake will result in their becoming more aware of the relative nutritional value of

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[110] "Food Buying Guide for Child Nutrition Programs: Vegetables/Fruits" USDA.
<http://schoolmeals.nal.usda.gov/FBG/2003FBG/%20Section%202.pdf>

foods. This "food intuition" will remain with them for a lifetime, and cause them to select foods more conscientiously. As a result, they will be less likely to incur medical expenses due to diet-related ailments, saving tax-payers money.

The beauty of requiring dietary logging is that it will educate students without requiring significant expenditures. If dietary logs were collected, even if they excluded personally identifying information, they could be analyzed and used to determine both what students were eating both within school and outside of school. Schools could then analyze this data, and gear their lunches to fill the nutritional gap in the lives of their students.

Although this information most likely exists on a national basis, it is important to collect it locally, as students living in different areas who are from different cultural groups have vastly different diets. For instance, African-American cuisine is stereotypically associated with the consumption of collard greens and kale; vegetables containing large amounts of calcium, iron and protein. As a result, students in non-African-American communities may need to be served larger quantities of these vegetables in order to ensure that they receive these nutrients in their diets.

Thus, once again, the role of IT in healthcare can be one of metrication. Just as the "No Child Left Behind Act" currently penalizes schools for not meeting "Adequate Yearly Performance" on standardized tests, another act should be created that penalizes schools for not meeting "Adequate Yearly Performance" in student health. In addition to taking standardized tests, students could be measured and weighed on an annual basis. Schools could then be assessed on the percentage of their students who are of a healthy weight. Although some may argue this as

unfair, as not all eating occurs at school, this argument does not hold, as students are assessed on learning, and not all learning occurs at school either. The school's role is to develop students into educated and healthy citizens. When many students are overweight, the school has failed in this area of health education, and all of society will have to bear the resulting financial burden.

Although no single governmental approach is optimal in solving the American healthcare crisis, it is vital that the government intervene. While individuals can monitor their own behavior, and companies can create services that empower individuals, only the government can fundamentally change the structure of the American healthcare system. Regardless of whether the government has a Constitutional obligation to provide healthcare, the government has clearly been in the business of healthcare for a long time. Although some of the policies that have been mentioned may be deemed heavy-handed, they are no more so than policies that currently exist. The Bush Administration has created a series of policies that will help transform the healthcare system into a market-based one. It is crucial that the government continue its current policies, and to carry them further in order to transform its vision of healthcare into a reality.

Individual Approach

Although this document was probably not found in the self-help section of the local bookstore, its readers may still wonder what they can do to use technology to improve their health and healthcare nonetheless. Some of its readers may view its suggestions as a bit radical, and may

wonder if anyone would be willing to adopt them. According to a 2003 survey of Americans conducted by Harris Interactive[111]:

- 52% believed that they would benefit from cost savings resulting from the usage of IT

- 53% felt "that new information technology will end up being more trouble than doing things the old way"

- 56% felt that personalized health reminders, sent via e-mail and over the telephone, would improve healthcare

- 58% felt that Internet-enabled remote monitoring could improve healthcare

- 59% "agreed that information technology will give them a sense of control and empowerment in managing their health"

- 60% felt that the usage of technology would reduce in-person care, "driving doctors even further from their patients."

- 61% believed that IT will increase the cost of healthcare

- 63% believed that IT would reduce unnecessary visits to the doctor

- 77% believed "that doctors will miss subtle clues in online interactions that they would normally pick up in a face-to-face visit"

- 89% believed that patients would absorb increases in the cost of healthcare resulting from the use of IT

Thus, Americans currently have conflicting views about the role of IT in healthcare. Although monitoring may increase health management, it may also reduce privacy. While the increased use of IT may reduce unnecessary visits to the doctor, the patient may have to absorb the cost of implementing the system, mitigating the benefit.

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[111] "Survey: Consumers conflicted about impact of IT when it comes to health care. " Health Care Strategic Management 1 Feb. 2003: 8. ABI/INFORM Global. ProQuest.

Regardless of individual opinions on these issues, there are many ways that IT can be used to improve personal health today; resulting in reduced medical expenses and an increased quality of life. The most practical ways of improving one's health are to improve diet, increase exercise, and improve quality of healthcare. It is possible to make improvements in all of these areas without corporate or government intervention.

Fundamentally, the only way for people to improve their diet is to change what they eat and how much they eat. Although IT cannot be used to directly modify the nutritional properties of food, it can be used to help determine trends in eating habits and to provide advice on how to improve them. Luckily, the U.S. Department of Agriculture created a website, entitled MyPyramidTracker.gov, to assist people in tracking the foods that they eat. This free service allows Americans to enter the types and quantities of foods that they have eaten each day and to receive detailed information on their overall nutritional intake. It additionally enables its users to determine how their daily intake stacks up against the federal dietary guidelines. As nutritional maintenance is as much about calories out as calories in, the site also provides the ability to track physical activity.

As it may be impractical for people to monitor their nutritional intake via the Internet, there are also a series of applications available that run on cell phones and PDAs. Wimos Diet Tiny Assist is a cellphone application that serves essentially the same purpose as MyPyramidTracker.gov. Several downloadable Windows applications also serve this purpose.

Hopefully, some day it will not be necessary for people to manually monitor their intake at all. This may be enabled by technologies such as RFID, which can potentially be put to use to enable refrigerators to track the contents that are removed from them. These smart refrigerators

could then assist Americans in performing culinary audits. Unfortunately, it will most likely be many years until RFID tags become inexpensive enough that they are attached to individual units of food. Likewise, as refrigerators are a costly durable good with a long lifespan, it is unlikely that standard refrigerators will soon be replaced by their smarter brethren.

Like diet, exercise can also be enhanced by metrication. As a result, many of the same systems that have been developed to monitor nutritional intake can also be used to monitor physical activity. However, within the domain of exercise there are additional measurements that can be made which are not available within the domain of food. For example, people can assess their fitness by measuring their active and resting heart rates, heart rate recovery time, lung capacity, and blood pressure. Technology will play an exciting role in these forms of measurement, as it will enable more frequent measurements and improved measurement storage. For example, new heart rate monitors have been developed that allow continuous measurement. Their results can be recorded and then analyzed at a later date. Additionally, most modern exercise machines are equipped to determine the user's current and optimal heart rate. This enables people to have a continuous gauge on how close their performance is to its optimum. Likewise, pedometers enable people to track the number of steps that they take, and thus determine how many calories have been burned through walking. Gadgets such as these will play an increasingly important role in helping Americans determine how many calories they expend during their daily routines, so that they adjust their nutritional intake appropriately.

While people are unable to fully utilize the benefits of a free market for healthcare today, there are still some actions they can take to improve the quality of their healthcare. Patients should routinely scour the Internet for information on their physicians. Fee-based websites, like

HealthGrades.com serve to provide consumers with information on their doctors. Blogs may someday become a common means of conveying medical experiences.[112] Through entering the names of physicians into search engines, it is possible to learn information about doctors that is not otherwise readily available.

As always, referrals will continue to be a source of information on the quality of medical care. Social networks, such as Orkut, Friendster, and Facebook enable people to keep in touch with geographically-diverse acquaintances. After relocating, it may be possible for people to leverage social networks in order to obtain reliable referrals for medical care.

However, it is difficult for patients in rigid healthcare plans to take advantage of any of this information. In order to have the flexibility needed to choose quality care, it is vital to be enrolled in an insurance plan that provides numerous options. Referrals from social networks are useless if one cannot afford to use them.

All in all, there is currently a wide array of technologies available to assist people in improving their health. Ultimately, it is up to us to utilize what is available to us in order to maximize our health. Healthy individuals who are most concerned with maintenance may not need to perform metrics as frequently as those who are attempting to adjust themselves to new, more health-conscious routines. In either case, there are many technologies available today that can play a vital role in decreasing the cost of maintaining one's health, while increasing the quality of one's health.

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[112] However, the risk associated with posting medical information on blogs is that blogs are individually-identifiable, and that such posting could potentially be viewed as libel.

Epilogue

As you have hopefully already deduced, we are at an exciting juncture in the history of health-related information technology. For the first time in ever, a wide-range of largely unused tools are available that potentially could improve healthcare. Tommy Thompson's Decade of Health Information Technology initiative demarcates an exhilarating era in which both the necessary corporate and government support for health information technology exists.

In 2006, there are many opportunities to improve healthcare that involving picking low-hanging fruits. It is up to us to make sure that the fruits are picked. With this in mind, I would like to propose that the American medical community launch itself on what I have dubbed "The Watermelon Initiative."

Watermelons, unlike many fruits, grow on the ground. A ladder is not necessary to pick them, and once they have been picked, they yield a lot of fruit that can be shared with a lot of people. Although large, watermelons are cheap. As watermelons have a thick rind, the fruit inside them is of a relatively uniform quality. Thus, the defect rate on watermelons is rather low compared to other fruits, such as the plum.

Unlike the watermelon, the plum grows on a tree, and may require the use of a ladder to be picked. Although perhaps tastier, a plum will only feed one person, and is costly to serve. It is necessary to pick more plums than watermelons to feed an equally sized group. Plums are also

very prone to defect. Due to their thin skin, a small knick will result in the fruit having to be discarded.

Medical researchers should work on ways of providing Americans with more watermelons—more easily achievable, labor un-intensive, reliable, and economical treatments. All too often, research is focused on solving glitzy, unsolved problems that afflict a minority of the population. It is considered less notable to develop a means for reducing the rate of alcoholism than it is for developing a cure for an obscure type of pancreatic cancer. Hopefully, this change in attitude will occur, and the medical community will adopt a back-to-the-basics mentality. After all, America's life expectancy can only be increased if the health of a substantial number of Americans is increased.

In closing, I would like to urge you to join with me in improving healthcare. Look for readily-accessible means for increasing the quality of the care delivered while reducing its cost. Only after the watermelon patch has been picked bare should the plum trees be pursued with ladders in hand.

Appendix A: Wages & Workforce

Americans often consider doctors to be extraordinarily wealthy. How wealthy are they? Also, how many people practice medicine? As America's population ages, it is clear that there will be need for a large supply of medical professionals. In this appendix, I hope to provide basic information about the size of the medical and regular workforce, and about the wages of medical professionals and Americans as a whole.

In Figure 15, one can examine the income distribution of Americans. While most doctors earn over $100,000 per year, only twelve percent of Americans earn that salary. Meanwhile, twenty-three percent of American earn under $20,000 per year, placing them to some degree in a state of poverty.
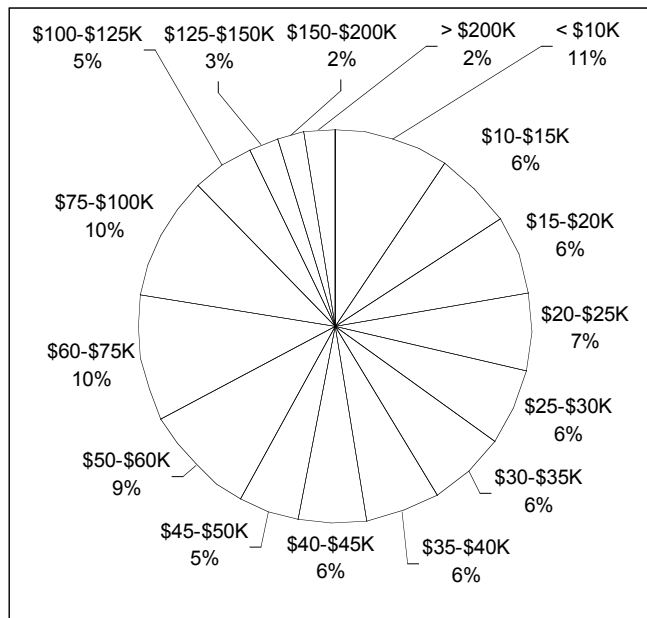
Figure 13: Distribution of U.S. Household Income[113]

[113] "Income Distribution in 1999 of U.S. Households and Families," Apr. 2000 U.S. Census. <http://factfinder.census.gov/servlet/SAFFPeople?_sse=on>

In order to determine how much doctors make and how many doctors there are, it is necessary to read data from the Bureau of Labor Statistics. In Table 4, population and salary data for various medical specialties are shown. Medical technicians, aids, and specialists have also been included in the table, as they play a vital role in the delivery of medical care.

Table 4: Occupational Employment and Wages[114]

Occupation	Population	Mean Salary
Healthcare practitioner and technical occupations		
Chiropractors	21,830	$87,390
Dentists, general	84,240	$132,850
Oral and maxillofacial surgeons	4,950	$165,750
Orthodontists	6,190	$150,700
Prosthodontists	730	$145,670
Dentists, all other specialists	2,710	$130,300
Dietitians and nutritionists	46,530	$44,640
Optometrists	22,780	$96,780
Pharmacists	222,960	$84,370
Anesthesiologists	25,130	$174,250
Family and general practitioners	106,750	$138,490
Internists, general	51,180	$158,200
Obstetricians and gynecologists	20,850	$176,270
Pediatricians, general	26,520	$141,520
Psychiatrists	22,440	$150,110
Surgeons	55,800	$181,610
Physicians and surgeons, all other	162,720	$137,610

Occupation	Population	Mean Salary
Physician assistants	59,470	$68,780
Podiatrists	7,550	$108,400
Registered nurses	2,311,970	$54,210
Audiologists	9,810	$55,050
Occupational therapists	83,560	$56,550
Physical therapists	142,940	$62,390
Radiation therapists	14,470	$60,420
Recreational therapists	23,050	$34,280
Respiratory therapists	91,350	$44,180
Speech-language pathologists	89,260	$55,550
Therapists, all other	8,090	$44,620
Veterinarians	46,090	$75,030
Health diagnosing and treating practitioners, all other	56,920	$92,300
Medical and clinical laboratory technologists	151,240	$46,600

[114] From "Occupational Employment and Wages, May 2004," Bureau of Labor Statistics, <ftp://ftp.bls.gov/pub/news.release/ocwage.txt>

Occupation	Population	Mean Salary
Medical and clinical laboratory technicians	141,720	$32,120
Dental hygienists	155,810	$59,440
Cardiovascular technologists and technicians	43,540	$39,710
Diagnostic medical sonographers	41,280	$53,620
Nuclear medicine technologists	17,520	$61,210
Radiologic technologists and technicians	177,220	$44,530
Emergency medical technicians and paramedics	187,900	$27,650
Dietetic technicians	24,630	$24,730
Pharmacy technicians	255,290	$24,700
Psychiatric technicians	59,010	$27,940
Respiratory therapy technicians	24,190	$37,440
Surgical technologists	82,280	$34,770
Veterinary technologists and technicians	58,570	$25,990
Licensed practical and licensed vocational nurses	702,740	$34,840
Medical records and health information technicians	155,030	$27,660
Opticians, dispensing	62,350	$29,880
Occupation	**Population**	**Mean Salary**
Orthotists and prosthetists	4,930	$57,130
Health technologists and technicians, all other	72,390	$37,650
Occupational health and safety specialists	36,360	$53,110
Occupational health and safety technicians	11,190	$44,320
Athletic trainers	13,100	$36,350
Healthcare practitioners and technical workers, all other	52,240	$37,860
Healthcare support occupations		
Home health aides	596,330	$18,980
Nursing aides, orderlies, and attendants	1,384,120	$21,610
Psychiatric aides	54,520	$24,340
Occupational therapist assistants	20,880	$38,460
Occupational therapist aides	5,240	$26,030
Physical therapist assistants	57,420	$37,730
Physical therapist aides	41,910	$23,160
Massage therapists	32,200	$36,670
Dental assistants	264,820	$29,060
Medical assistants	380,340	$25,400
Medical equipment preparers	40,380	$25,240
Medical transcriptionists	92,740	$29,150
Pharmacy aides	47,720	$19,810
Veterinary assistants and laboratory animal caretakers	70,200	$19,640
Healthcare support workers, all other	182,550	$26,250
Community and social services occupations		
Substance abuse and behavioral disorder counselors	68,880	$34,310
Educational, vocational, and school counselors	220,690	$47,590
Marriage and family therapists	20,710	$42,040
Mental health counselors	89,300	$36,000

Rehabilitation counselors	115,150	$30,710
Counselors, all other	21,970	$37,880
Child, family, and school social workers	250,790	$37,830
Medical and public health social workers	103,180	$41,440
Mental health and substance abuse social workers	108,950	$36,060
Social workers, all other	60,120	$41,180
Health educators	46,490	$42,120
Probation officers and correctional treatment specialists	89,170	$42,690
Social and human service assistants	331,860	$25,890
Community and social service specialists, all other	89,250	$34,470
Clergy	35,790	$40,000
Directors, religious activities and education	12,620	$33,560
Religious workers, all other	8,810	$23,730

When viewing the income distribution in Figure 15, some readers may wonder whether a substantial number of the people in the lowest income brackets are young people without families. In order to shed light on the answer to this question, Table 5 provides information on the family status of households in various income brackets.

Table 5: Number of U.S. Households in Income Brackets[115]

	Households	Families Total	Married couple families	Female householder, no husband	Nonfamily
Total	**105,539,122**	**72,261,780**	**55,458,451**	**12,500,761**	**33,277,342**
< $10K	10,067,027	4,155,386	1,452,444	2,307,019	6,339,164
$10-$15K	6,657,228	3,115,586	1,489,634	1,334,456	3,760,242
$15-$20K	6,601,020	3,640,373	2,020,718	1,287,159	3,148,297
$20-$25K	6,935,945	4,117,024	2,523,544	1,212,278	2,968,703
$25-$30K	6,801,010	4,287,407	2,826,607	1,080,857	2,606,312
$30-$35K	6,718,232	4,397,022	3,106,490	930,770	2,359,039
$35-$40K	6,236,192	4,267,228	3,164,292	780,173	1,953,797
$40-$45K	5,965,869	4,223,392	3,280,833	654,713	1,693,436
$45-$50K	5,244,211	3,886,488	3,130,358	525,247	1,276,972
$50-$60K	9,537,175	7,299,543	6,129,602	787,065	2,071,246
$60-$75K	11,003,429	8,830,557	7,756,145	702,750	1,940,436
$75-$100K	10,799,245	9,009,327	8,205,331	509,431	1,524,679
$100-$125K	5,491,526	4,662,368	4,344,283	191,351	690,700
$125-$150K	2,656,300	2,273,842	2,145,258	75,947	311,029
$150-$200K	2,322,038	1,983,673	1,883,025	56,767	281,264
> $200K	2,502,675	2,112,564	1,999,887	64,778	352,026
Median Inc.	41,994	50,046	57,345	25,458	25,705
Mean Inc.	56,644	64,663	73,253	33,369	36,609

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[115] "Income Distribution in 1999 of U.S. Households and Families," Apr. 2000 U.S. Census.
<http://factfinder.census.gov/servlet/SAFFPeople?_sse=on>

Appendix B: America's Healthcare

The following diagrams were too interesting to omit, but could not be placed within the context of this document. They help illustrate correlations between age, income, insurance, and obesity. As each of these concepts is central to this document, these diagrams provide support to the notions of this document.
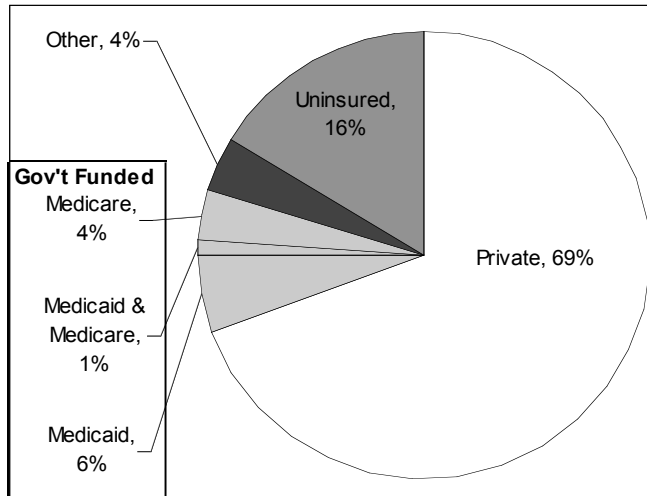
Figure 14: Insurance Coverage of 18+ Americans[116]
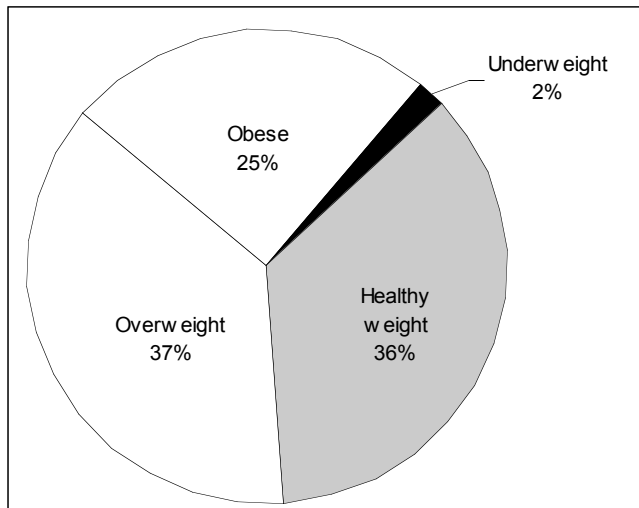
Figure 15: Distribution of BMIs of 18+ Americans[117]

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[116] "Table 30.Frequency distributions of body mass index among persons 18 years of age and over, by selected characteristics: United States, 2003." National Center for Health Statistics. <http://www.cdc.gov/nchs/data/series/sr_10/sr10_225.pdf>

[117] "Table 30.Frequency distributions of body mass index among persons 18 years of age and over, by selected characteristics: United States, 2003." National Center for Health Statistics. <http://www.cdc.gov/nchs/data/series/sr_10/sr10_225.pdf>

% of Income Category at BMI
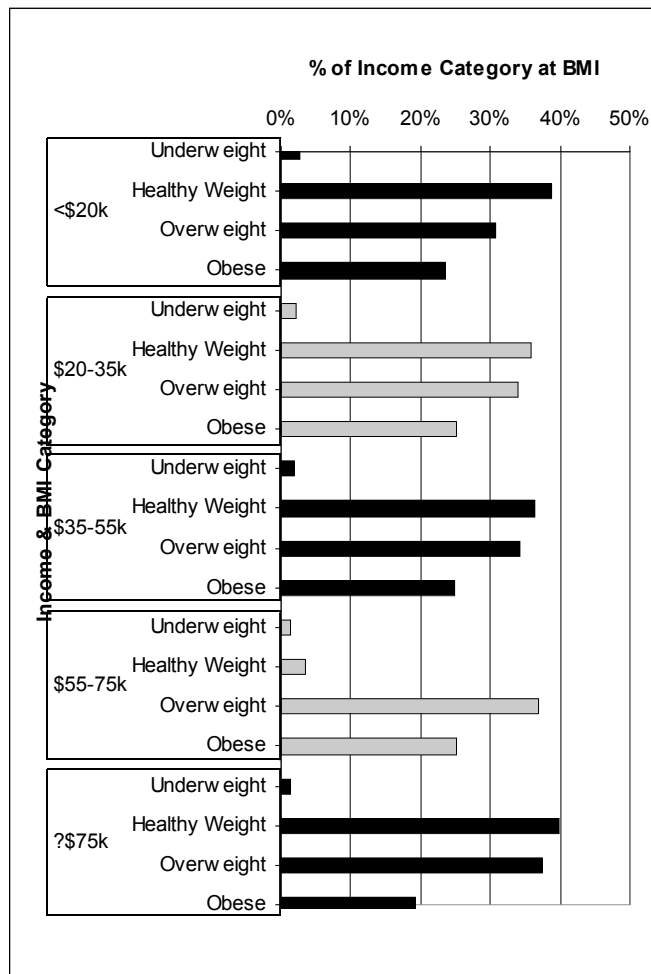
Figure 16: BMI Distribution by Income Bracket[118]
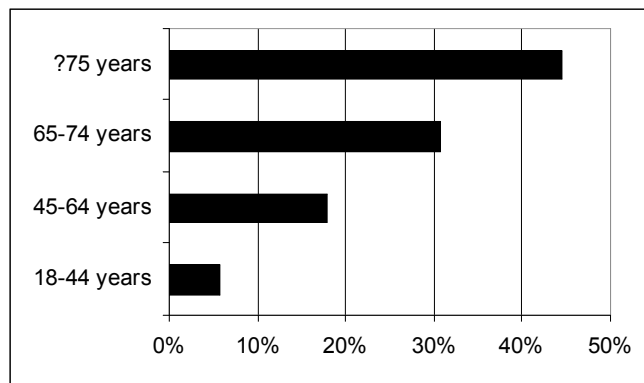
Figure 17: Percentage of Americans with in Various Age Brackets with Any Physical Difficulty[119]

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[118] "Table 30.Frequency distributions of body mass index among persons 18 years of age and over, by selected characteristics: United States, 2003." National Center for Health Statistics. <http://www.cdc.gov/nchs/data/series/sr_10/sr10_225.pdf>
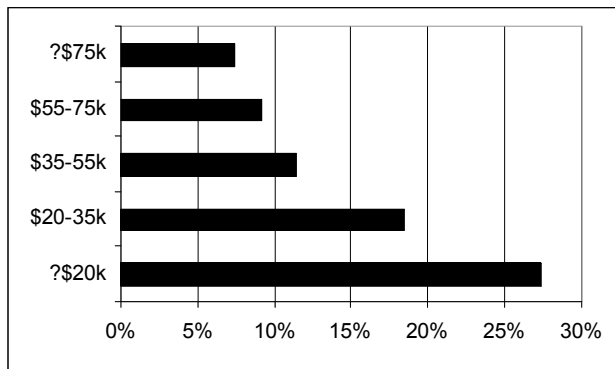
Figure 18: Percentage of Americans with in Various Income Brackets with Any Physical Difficulty
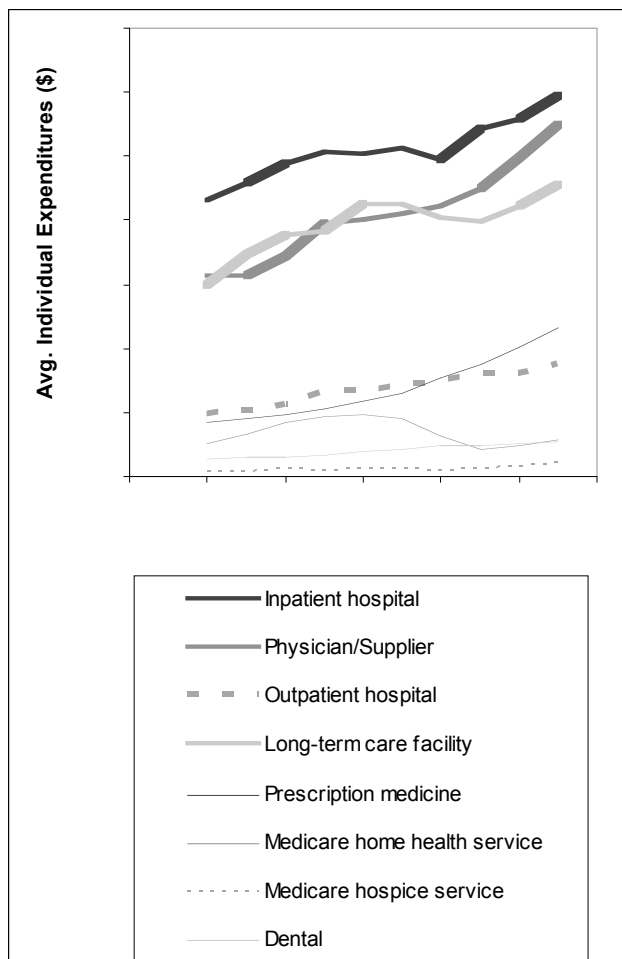
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[119] "Table 30.Frequency distributions of body mass index among persons 18 years of age and over, by selected characteristics: United States, 2003." National Center for Health Statistics. <http://www.cdc.gov/nchs/data/series/sr_10/sr10_225.pdf>

Figure 19: Average Individual Expenditures for Medicare Beneficiaries[120]
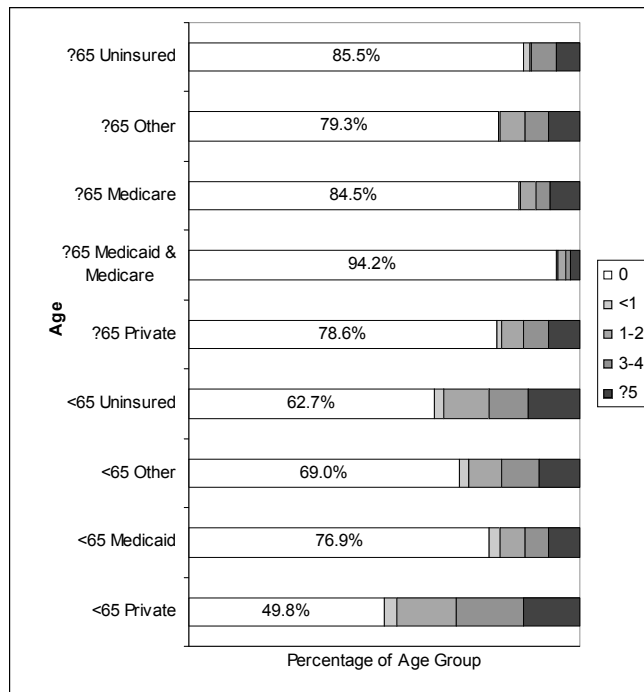
Figure 20: Frequency of Participation in Vigorous Physical Activity by Insurance Status[121]

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[120] National Center for Health Statistics, Data Warehouse on Trends in Health and Aging, Centers for Disease Control and Prevention. <http://www.cdc.gov/nchs/agingact.htm> July 27th, 2005

[121] "Table XVII. Crude percent distributions of number of leisure-time periods per week of vigorous physical activity lasting 10 minutes or more among persons 18 years of age and over, by selected characteristics: United States, 2003." Centers for Disease Control and Prevention. <http://www.cdc.gov/nchs/data/series/sr_10/sr10_225.pdf>
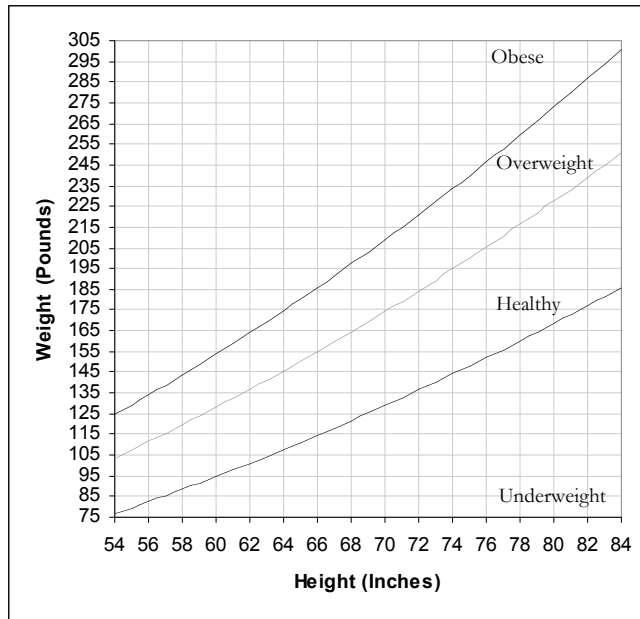
Figure 21: Effect of Height & Weight on BMI Status

Appendix C: Future Research

While much is known about healthcare, there is still room for additional research to determine the most effective means of reducing cost and increasing quality. Although I lack the resources to carry out large scale research, I would like to pose questions that can be explored by others. Hopefully, during the Decade of Health Information Technology, there will be the opportunity for someone to explore some of these questions.

- What factors determine the degree to which people comply with preventative programs?
- What is the most effective way to reduce childhood obesity?
- How can the price of health monitoring devices be reduced?
- Is it possible to overhaul America's healthcare system to create a market-based system?
- Can preventative strategies be implemented in all socioeconomic categories?

Appendix D: Glossary

ARHI: Adjustable Rate Health Insurance; a type of health insurance in which rates are reassessed on a frequent (daily or weekly) basis. Sensors such as heart rate and glucose monitors are used to frequently obtain information on health status, so that actuarial risks can be recalculated and rates can be readjusted.

Biometrics: A method of security involving authenticating by measuring a feature or features of the user. Current biometric technologies utilize fingerprints, iris scans, and voice matching.

Bluetooth: A radio-based wireless technology that allows electronic devices within a short distance of one another to exchange information.

Consumer-Driven Health Care: Healthcare in which consumers are offered choice in both their insurer and benefits. Consumers also must be provided with meaningful information about the relative quality of healthcare providers so that they can make rational consumption choices.

Co-payment: A payment that an insurance policyholder must pay after receiving a specific treatment, in addition to their regular premium.

CRM: Customer Relationship Management; software and systems that enable companies to maintain a customer-centric focus through providing for operational improvements. According to Gartner Group, the focuses of the improvements offered by CRM packages are in sales force automation, customer service & support, and enterprise marketing automation.

EMR: Electronic Medical Record; a patient health record stored within a computer system (as opposed to on paper).

GDP: Gross Domestic Product; the total amount of value generated by a country's labor over the course of a year.

Indemnity Insurance: Insurance providing financial compensation for damages.

HIT: Health Information Technology; technology used to increase the effectiveness of healthcare organizations and complementary entities within the healthcare system.

HMO: Health Maintenance Organization; a health insurance provider that works to control costs through controlling utilization via a PCP (primary care physician), while maximizing the overall health of the enrolled cohort.

Medicaid: Health insurance provided by the government for low-income people.

Medicare: Health insurance provided by the government for the aged and the disabled.

Network Effect: According to Robert Metcalfe's law, the value of a network with externalities is roughly proportional to the number of members within the network. The network effect is the

consequence of Metcalfe's law. The benefit of implementing interoperable electronic medical records increases as the number of organizations that have implemented such records increases.

PCP: Primary Care Physician; the gatekeeper in the healthcare delivery system instituted by HMOs. PCPs are generalists who assess the health of patients, and then can refer them to specialists.

PPO: Preferred Provider Organization; a health insurance provider that has a network of preferred hospitals and physicians. Policyholders pay lower co-payments when using providers within the PPO's network than when using providers outside of the network.

Provisioning Technology: Technology that dynamically allocates IT resources across a network to meet changes in demand.

RFID: Radio Frequency Identification; a technology that consists of small tags and tag readers. Tags containing numbers are affixed to the items that are being tracked. An RFID reader can determine the numbers encoded in the tags that pass by it from several feet away. RFID can be implemented in many ways; the distance at which tags are readable can be controlled, and the content of tags can be controlled. RFID tags can be used to track when items or people wearing the tags leave or enter a room.

Single Sign-On: Technology that enables a healthcare worker to access multiple, interconnected systems after authenticating once.

XML: eXtensible Markup Language; a data format that enables documents to be written in a structured and machine-readable format. XML documents contain information both about the data they contain and about the nature of the fields in which the data is stored.

XSLT: eXtensible Stylesheet Layer Transformations; a technology that enables XML documents to be transformed from one format to another. For instance, if two hospitals have different record formats but both use XML, they can employ XSLT to translate records and create interoperability.

Appendix E: Related Works and Solutions by The Author

I have attempted to implement some of the technical solutions to healthcare problems that I have mentioned in this thesis. This section contains information related to my technical solutions, as reading them helps put the theory within my thesis in context. I have also included my application letter to the Wharton School's doctoral program in Health Care Systems, as the letter integrates the motivation behind all of my research in healthcare up until the beginning of 2006. Documents within this appendix are numbered according to their original numbering scheme.

NutraSpeed

nutraspeed.mit.edu

Communicating in Cyberspace
Massachusetts Institute of Technology

Contributors:
Dmitry Kashlev
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Final Report
December 12th, 2004

Abstract

Most Americans suffering from diabetes, high blood pressure, and high cholesterol must determine their daily nutritional intake through recording their diet in a paper logbook; a rather inefficient process. Due to the cumbersome nature of keeping paper logbooks, dietary compliance is rather poor. In an attempt to provide an easier method for dietary logging, NutraSpeed was created. NutraSpeed is a web-based application that enables people to keep a dietary log by scanning the Universal Product Codes (UPCs) on their foods. NutraSpeed was designed with simplicity and legibility in mind, using an open-source toolset consisting of Linux, Apache, MySQL, and PHP. As a result of the construction of NutraSpeed, people can now determine their daily nutritional intake without having to manually record the nutritional information for the foods that they have eaten. Although functional, the current version of NutraSpeed is a prototype with a well-defined path for expansion.

Table of Contents

List of Figures

1. Introduction

1.1 Background and Motivation

Many Americans are currently afflicted by conditions that require diligent dietary management. Nationwide, 6.3% of Americans suffer from type II diabetes[1], 33% of suffer from high blood pressure[2], and 37% suffer from high cholesterol[3]. All of these conditions are becoming increasingly prevalent.

People who must manage their diets currently use paper logbooks to monitor their nutritional intake. As keeping a paper dietary log is time intensive, people typically only track their consumption of one or two nutrients; not the complete list of up to fifteen nutrients and thirty vitamins that are on "Nutrition Facts" labels.

While many people should track their diets, many clearly do not. The incidence of diabetes, a disease caused largely by poor nutritional habits, has increased nearly 50% in the past 10 years. As people age and suffer macular degeneration (as a result of diabetes), they become less able to read the fine print on food products and keep nutritional logs. Meanwhile, as people age, they are increasingly likely to need to monitor their diet. Thus, the lack of an efficient and easy to read method for monitoring dietary intake is a major problem in America.

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[1] "All About Diabetes." American Diabetes Association. http://www.diabetes.org/about-diabetes.jsp

[2] "Heart Disease and Stroke Statistics – 2004 Update." American Heart Association. http://www.americanheart.org/downloadable/heart/1079736729696HDSStats2004UpdateREV3-19-04.pdf

[3] "Statistics about High Cholesterol." CureResearch.com. http://cureresearch.com/c/cholesterol/stats.htm

1.2 Intended Audiences

NutraSpeed's primary audience consists of Americans who must monitor their dietary intake as a result of a medical condition. The size of this audience is huge, as nearly half of Americans have one or more medical conditions that require dietary monitoring.

NutraSpeed's secondary audience consists of people who are on diets, or are generally concerned about their health. The difference between NutraSpeed's primary and secondary audience is that members of the primary audience are motivated by external factors, and probably have a history of poorly monitoring their nutritional intake, while members of the secondary audience are internally motivated, and have a definite interest in health. Thus, although our primary audience has a greater need for external monitoring of dietary compliance, our secondary audience is more likely to be motivated to use NutraSpeed.

1.3 Statement of Objectives

Our primary objective has been to design, build, and test a web-based application that will:

•Streamline the dietary logging process

•Help people determine the aggregate nutritional content of their daily diet

•Warn people when they have exceeded self-imposed consumption limits

The objectives for our user interface are to make NutraSpeed:

•Intuitive to use

•Legible for people with poor vision

•Accessible to the blind (end-stage diabetes can cause blindness)

Our technical objectives are to make NutraSpeed:

•Browser-independent

•Expandable

•Modular

•Secure

•Stable

1.4 General Overview

NutraSpeed's mission is to help people track their diets more efficiently. As nearly all packaged food products contain both a Nutrition Facts label and a Universal Product Code (UPC), NutraSpeed simplifies dietary recordkeeping by enabling people to keep a dietary log by recording the UPCs on the packages of the foods they eat (Figure 1.1). In the event that users do not know the UPC of a food product they have eaten, they can search for its name in the database.

Figure 1.1: UPC Barcode & Nutrition Facts

NutraSpeed is a web-based application that allows people to log their daily consumption from any location. Each user has a personalized account that stores both their consumption history and their personal preferences. Users can customize which nutrients and vitamins are displayed by NutraSpeed, so that they do not have to face distraction from information that does

not interest them. Additionally, users can store personal consumption limits for each nutrient so that NutraSpeed will warn them if they are not in compliance with their diet.

Users can enter consumed food into NutraSpeed through three different methods. The quickest method is to scan the UPC on the food product using a barcode scanner attached to the computer. If the user lacks a barcode scanner, they can type the UPC into the system. If the user has thrown away the item's packaging, and does not know the UPC, NutraSpeed's database can be searched for the item's name. The Nutrition Facts for items not in the database can be entered by any user. However, in order to prevent people from defacing the database, only users with Administrator privileges can correct database entries.

The primary benefits to the users of NutraSpeed are:

•Automatic aggregation of nutritional information

•Time savings when logging nutritional information

•External monitoring of compliance with one's diet

•Increased legibility of nutritional information

•The ability to determine the nutritional content of foods whose packaging has been discarded

2. Technical Approach

2.1 Tools Used

NutraSpeed utilizes the recently-popularized LAMP ecosystem of web service

components. LAMP is a combination of the Linux operating system, the Apache web server, the

MySQL relational database, and the PHP hypertext preprocessor. These tools were chosen

because:

•LAMP consists of easy-to-use open-source tools, creating a powerful development framework

at no cost

•LAMP has been heavily tested under high-load scenarios, ensuring security and reliability

•All the members of the NutraSpeed development team have prior experience using LAMP,

eliminating the need to spend time learning a new toolset

2.2 Design Decisions

NutraSpeed was designed to be modular. The initial function specifications were written

so that each developer had a specific task to perform that was relatively independent of the tasks

of the other developers. In order to increase the flexibility of the developers, the data modeling

and viewing software were highly decoupled, allowing each developer to rearrange their code

without breaking the code of others.

To maintain a strong decoupling between form and function, Cascading Style Sheets

were used to stylize the display of the data. Additionally, a custom-built PHP backend to the

MySQL database was created to handle queries in a consistent manner.

2.3 Browser Compatibility

Due to the simplicity of the design, NutraSpeed is compatible with all browsers that support cookies. Java and JavaScript were not used, as they do not run well on older browsers. NutraSpeed has been successfully tested both Macs and PCs using Microsoft Internet Explorer, Mozilla, Netscape Communicator, and Safari. NutraSpeed also performed acceptably on the ancient text-based browser, Lynx, and on a browser for the blind, JAWS. While the layout of NutraSpeed does not make it conducive to usage on PocketPCs or other miniature devices, it is possible to implement a user interface designed for a small screen, as form has been decoupled from function through the usage of Cascading Style Sheets.

2.4 Performance Issues

Although NutraSpeed was not tested under heavy usage, NutraSpeed was built using LAMP technology, which has been optimized to withstand heavy usage. The NutraSpeed website can be hosted on any LAMP server. The technical specifications of the server are of limited importance, as the website can be moved from one LAMP server to another without modification. The current server, which was loaned to us by Andre Sugai, is in the process of being replaced by a server owned by Professor Dan Ariely's eRationality Group. As there are very few images on the NutraSpeed website, the server does not need to transfer large amounts of data to each user. Thus, NutraSpeed can perform quickly on a wide array of hardware.

2.5 Future Platform Considerations

In order to improve NutraSpeed's performance, security, and robustness, NutraSpeed will transition to using other technologies during the next iteration of its development. An InnoDB engine will soon replace the MyIASM database backend engine to better support "ACID" (Atomic, Consistent, Isolated, Durable) compliance during heavy usage. Additionally,

NutraSpeed will use the Secure Sockets Layer (SSL) to increase the security of transactions. Finally, the Concurrent Versioning System (CVS) will soon be employed to reduce the propagation of errors made during development.

3. Description of Design

3.1 Overall Metaphor for the Design

When designing NutraSpeed, the metaphor we used was the layout should be a "hybrid of Google and Nutrition Facts label". People should treat NutraSpeed in the same manner they treat Google; as a useful tool that happens to be located on the Internet. As NutraSpeed should be viewed as a tool instead of as an informational website, sparse, Google-like design was used. Screenshots and a walkthrough of NutraSpeed are featured in Appendix A.

The informational output from NutraSpeed is mostly in the form on Nutrition Facts labels. This design was chosen to indicate to the user that NutraSpeed was designed for the domain of food products with Nutrition Facts labels. Thus, NutraSpeed is a "Google" that returns Nutrition Facts instead of websites. To further reinforce this metaphor, the NutraSpeed logo is reminiscent of the Google logo.

Figure 3.1: The NutraSpeed and Google Logos

3.2 Look and Feel

The look and feel of NutraSpeed is designed to convey simplicity and clarity. In order to draw attention to the core features of the site unnecessary graphics and "eye-candy" are not part of the design. Thus, the NutraSpeed logo is the only graphic prominently displayed throughout the site. NutraSpeed's limited color scheme was chosen to allow for high contrast and legibility. The site uses the sans-serif font Arial to increase its legibility. Additionally, a sans-serif font was

chosen because a sans-serif font is used on Nutrition Facts labels, which the site is designed to emulate. All of the text on the site can be magnified as needed by users through using a browser's "Text Size" function. Since text within graphics cannot be scaled by the user, most of the text on the site is not within graphics.

3.3 Navigation

Easy navigation was considered essential due to the demographics of NutraSpeed users. As many NutraSpeed users may be unfamiliar with computers and not have many plug-ins installed in their browsers, it was important to have a navigation scheme that enables them to access the site. Navigation was simplified through the following design features:

•Limited options; users can perform less than five actions on every page

•Limited pages; the entire site consists of seven pages

•Persistent navigation bar; users experience navigational and visual consistency

3.4 User Scenarios

During usability testing, our tester was told to imagine that he was a diabetic college student who had recently been informed about NutraSpeed. The student had to register for a NutraSpeed account, and then add two items that had been eaten that day to his daily consumption. The first item, a bottle of Coca-Cola, was in the database, while the second item, a Pop Tart, was not. Although only one usage scenario was tested, the results were general as there is only one way to use NutraSpeed due to its deliberately limited set of features. For more information on the usability test, see Section 4.3.

3.5 Future Design Considerations

After presenting our design to the students in Professor Edward Barrett's Communicating in Cyberspace class, we received several comments about how our design should be changed. The following suggestions were made:

•Place the "Warning Levels" box higher on the screen

•Increase the visibility of triggered warnings

•Decrease the "boxiness" of the site

•Create a homepage for the site

•Allow the database to be browsable as well as searchable

In future revisions of NutraSpeed, we plan on implementing the first three of these suggestions. However, we do not plan on creating a homepage for the site, as a homepage would make the site feel less like an application and more like a website. Google's page only allows users to search or access other features of Google. It is not cluttered with static content in the manner of a portal such as Yahoo! Since we aimed to copy Google's simplicity, we have chosen to not create a portal-like homepage.

Additionally, we have decided that the NutraSpeed database should not be browsable. This decision was made because browsable databases require an editor to maintain them. Someone must define the categories into which foods are placed, and then make judgments on how to handle ambiguities. For instance, should Spaghetti-O's be classified as "Italian", "Grains and Pastas", "Microwavable & Ready to Eat", or all of the above? A directory is not included in NutraSpeed as data entry is largely done by the users, and we do not want to burden users with resolving these sorts of ambiguities.

4. Evaluation of Design

4.1 Problems during Development

The development of NutraSpeed was relatively straightforward. Thus, very few problems were encountered during development. The team had previous familiarity with the development tools, which further reduced problems. The problems encountered were mostly architectural:

•The ability to specify the number of servings of a food eaten has not yet been added because NutraSpeed creates the Nutrition Facts labels it displays by pulling data directly from the food database without processing it or tying it to a user record. This problem exists due to a design oversight.

•Approximately forty-five different pieces of nutritional data are associated with each food product. As a result of a lack of functions to treat all the fields in a uniform manner, updating the site to perform a different action on all of the forty-five pieces of data is time intensive. Further abstracting the data would have saved considerable development time.

As a result of these two problems, we are considering rebuilding NutraSpeed from the ground up. We feel that it is necessary to make fundamental architectural changes to NutraSpeed to enable us to easily make further improvements.

4.2 Features Currently Unimplemented

The only planned feature that went unimplemented was the ability for users to specify the number of servings of an item that have been consumed. As was mentioned in the previous section, problems were encountered implementing this feature due to design decisions that were made early in the development process. This feature will be implemented over winter break as it will be time intensive to implement.

4.3 Outcome of Usability Testing

The NutraSpeed team performed usability testing in MIT's ATIC Lab. The test subject, Matt Boulos, was given a series of tasks to perform and was videotaped as he performed them. Boulos was instructed to think aloud as he performed the tasks we had given to him, and then to rate the difficulty of each of the tasks after performing them. Boulos tested every feature of the website. After the testing, Boulos gave us input on how NutraSpeed could be improved. He revealed the following issues:

• It was unclear how many digits of a UPC should be entered during manual entry

• There was no acknowledgement when registration or item addition was successful

• When an unknown UPC was entered, it was not quickly obvious whether the UPC should have been entered again, or whether it should have been added to the database

• It was difficult to determine how to modify the profile

• The site usage directions were hard to find

• The barcode scanner performed unreliably with several types of packaging

• Adding items to the database was time-intensive

After usability testing, NutraSpeed was revised according to Boulos's suggestions. The following remedies were made:

• A picture of a UPC with the appropriate numbers circled was added above the UPC entry box to help the user determine what to enter

• An acknowledgement was created for successful registration and item addition

• The message received after the entry of an unknown UPC was simplified

• The link to the profile modification feature was placed more prominently

• The link to the site usage directions was added to more pages of the site

• Name search was added, so that the user does not have to rely on a barcode scanner when entering items already in the database

•A message was added to inform users that they do not have input '0's for unknown nutritional information when adding an item to the database

4.4 Project Management

The design of NutraSpeed reflected its managerial structure. Design decisions were made so that the three developers would all have separate domains and not interfere with each other's work. Form was divided from function using Cascading Style Sheets. Functionality was further subdivided two categories: functionality involving reading information from the database and functionality involving writing information to the database. Mock-ups of NutraSpeed were built before its development, enabling developers to work towards the same end-goal.

Coordination issues were rare, as each developer was working on a separate set of files. The number of files in the site's structure was kept to a minimum in order to simplify both site usage and creation. Whenever a developer wanted to make a change to the state of a user, they did so by writing transaction information to the database. Cookies were only used to store the identity of the user currently logged into the system. Session IDs were not used and the pages passed no information between each other through means other than the database.

The NutraSpeed development team managed to reasonably follow the development timeline created at the beginning of the project. The team managed to consistently meet predefined expectations within a week of set deadlines. Software development was relatively isolated from promotional development, enabling all team members to devote their time to their component of the project.

5. Recommendations for Future Work

5.1 Future Development

As NutraSpeed is a complex tool, there are an infinite number of features that could be added to improve it. The NutraSpeed team conceived several vital features to add, and then grouped them into development phases, which have been listed below:

Phase II: NutraSpeed will allow users to enter the number of servings of each item that they have eaten. NutraSpeed will also handle nutritional information for food products without unique identification numbers, such as meat products and items at chain restaurants.

Phase III: NutraSpeed's database will be populated with nutritional information for all of the products made by Sodexho, so that users can obtain nutritional information for any item eaten in a Sodexho cafeteria. Support will be added for users entering proprietary Product Lookup Numbers (PLUs), as well as UPCs. Interfaces will be created so that vendors can input nutritional information in formats other than the government's standard Nutrition Facts format.

Phase IV: NutraSpeed will enable users to store personalized groupings of UPCs in their profiles, which will be referred to as "meals". For instance, Adam Powell's profile might contain a "cereal" meal containing one cup of Kellogg's Special K with Red Berries and one cup of Hood Skim Milk. Additionally, NutraSpeed will contain a directory of common meals that users can select, in lieu of creating their own meals.

5.2 Maintaining the Project

NutraSpeed does not require maintenance from the development team. However, it does require additional development for it to gain increased functionality. NutraSpeed is being transferred to a server that will be housed in E56 so that the site will continue to be operational year-round. We are currently seeking an on-campus organization willing to maintain and improve NutraSpeed in the long term. We have spoken to the Office of Campus Dining, the

Center for Health and Wellness at MIT, and the MIT Card Office, and feel optimistic that NutraSpeed will be eventually be acquired by one of these departments.

5.3 Long Term Outlook

In the long term, we foresee NutraSpeed being rebuilt from scratch. As new applications for NutraSpeed are planned, it is unclear whether the current website can easily be updated to support them. Thus, we intend to use the current version of NutraSpeed as a prototype for the development of a superior site.

We are currently working with Sodexho to obtain nutritional information on Sodexho products to add to the NutraSpeed database. We are also currently working on a plan to place NutraSpeed-compatible UPCs on the placards of food sold in Sodexho cafeterias. That way, NutraSpeed users will be able to obtain nutritional information when purchasing prepared food from Sodexho.

We are additionally attempting to find a way to populate the database with UPCs. The average supermarket sells 42,000 different items.[4] We have calculated that we could hire someone to populate the database with information from 50,000 different items for $10,000. An alternative to hiring someone to populate our database is to attempt to purchase the nutritional information available on Peapod.com.

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[4] Swibel, Matthew. "Nobody's Meal." *Forbes.* November 24, 2003.
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Appendices

Appendix A: Walkthrough

1. When the user visits http://nutraspeed.mit.edu, they are first presented with the login page (Figure A.1). The login page doubles as the splash page to reduce the amount of time that the user has to spend navigating the site. As the site is a utility, it is important that it is easy and quick to use.

Figure A.1: Splash Page and Login for Registered Users

2. Users that do not have an account cannot login. Thus, they must create one through registering. After clicking the "Register" link on the splash page (Figure A.1), the user is taken to the registration page (Figure A.2). On the registration page, the user creates an account through specifying their username, password, e-mail address, and name. There is also an optional space for including additional information. Once the user has completed the registration process, the user should click the "Sign up" button, which takes the user back to the login page. However, the

page differs slightly from the initial splash page, as the line "Thank you for signing up." is

inserted in large text below the NutraSpeed logo to inform the user of successful registration

(Figure A.3). From here, the user can login and proceed to the next page by clicking the "Login"

button.

Figure A.2: New Account Registration Page

Figure A.3: Login Page for Newly Registered Users

3. After logging in, the user is taken to the dashboard page (Figure A.4), where the majority of the user's time will be spent when using NutraSpeed. NutraSpeed stores the user's login information using cookies, so that the entire site can be populated with information pertaining to the user. On the dashboard page, the user can input the food products that have been eaten into the NutraSpeed system, and can also view output from the NutraSpeed system. Scanning the UPCs on items using a barcode scanner is the fastest method for inputting items. If the user lacks a barcode scanner, the user can enter UPCs manually. If the user does not know the UPC of the item in question, the user can enter part of the item's name, and then search for the item by clicking the "Name Search" button. In Figure A.4, the user has inputted the UPC "123", and is about to click the "UPC Search" button.

Figure A.4: Dashboard Page (No Items Added)

4. After clicking the "UPC Search" button, the dashboard page is updated to contain information about the food product corresponding to the UPC "123" (Figure A.5). Nutritional information for the most recently added item is displayed item is displayed in the center column of the page, while the aggregate nutritional information for all items inputted that day is displayed in the right column.

Figure A.5: Dashboard Page (Item with the UPC 123 Added)

NutraSpeed

Home / Edit profile / User Guide / About / Logout

Please enter UPC to add

5 0 1 2 3 4 5 6 7 8 9 0 6 5

UPC Search

Name Search

new user
newuser@mit.edu
i am a new user

Items Added:
Default Test Item delete
details

Warning Levels:

Nutrition Facts for
Default Test Item
1 serving

Calories 123
Calories from Fat 100

Total Fat 99 g
Saturated Fat 98 g
Polyunsaturated Fat 0 g
Monounsaturated Fat 0 g
Trans Fat 1 g
Cholesterol 0 mg
Sodium 0 mg
Potassium 0 mg
Total Carbohydrate 0 g
Dietary Fiber 0 g
Sugars 0 g
Sugar Alcohols 0 g
Protein 0 g

Vitamin A 0 %
Vitamin B6 0 %
Vitamin B12 0 %
Vitamin C 0 %
Vitamin D 0 %
Vitamin E 0 %
Vitamin K 0 %
Biotin 0 %
Boron 0 %
Calcium 0 %
Chloride 0 %
Chromium 0 %
Copper 0 %
Folate 0 %
Iodine 0 %
Iron 0 %
Lutein 0 %
Magnesium 0 %
Manganese 0 %
Molybdenum 0 %
Niacin 0 %
Nickel 0 %
Panthothenic Acid 0 %
Phosphorous 0 %
Riboflavin 0 %
Selenium 0 %
Silicon 0 %
Thiamin 0 %
Tin 0 %
Zinc 2 %

Total Nutritional Intake for
12-08-2004 (Today)

Calories 123
Calories from Fat 100

Total Fat 99 g
Saturated Fat 98 g
Polyunsaturated Fat 0 g
Monounsaturated Fat 0 g
Trans Fat 1 g
Cholesterol 0 mg
Sodium 0 mg
Potassium 0 mg
Total Carbohydrate 0 g
Dietary Fiber 0 g
Sugars 0 g
Sugar Alcohols 0 g
Protein 0 g

Vitamin A 0 %
Vitamin B6 0 %
Vitamin B12 0 %
Vitamin C 0 %
Vitamin D 0 %
Vitamin E 0 %
Vitamin K 0 %
Biotin 0 %
Boron 0 %
Calcium 0 %
Chloride 0 %
Chromium 0 %
Copper 0 %
Folate 0 %
Iodine 0 %
Iron 0 %
Lutein 0 %
Magnesium 0 %
Manganese 0 %
Molybdenum 0 %
Niacin 0 %
Nickel 0 %
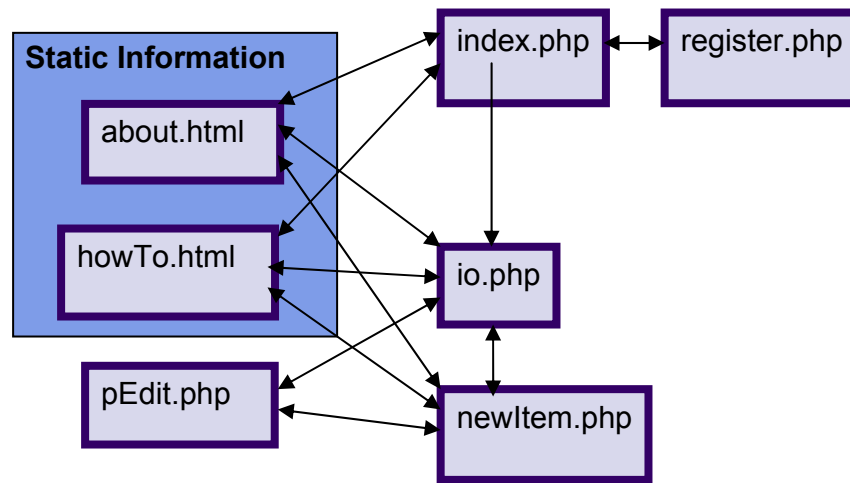Panthothenic Acid 0 %
Phosphorous 0 %
Riboflavin 0 %
Selenium 0 %
Silicon 0 %
Thiamin 0 %
Tin 0 %
Zinc 2 %

5. In addition to adding items through inputting UPCs, the user may wish to add items by searching the database for the names of items. For instance, if the user drank some Nesquik earlier in the day, but does not have the packaging nor know the UPC, the user would have to perform a name search. In Figure A.6, the user has entered a beverage's name and has clicked the "Name Search" button. After a name search is performed, NutraSpeed returns all items in the database that contain the search term. In this case, the only result of the search is "Nestle Nesquik: Chocolate Flavor". The user can then add the item to the daily intake through clicking the "Add to items list" link. In Figure A.7, the Nesquik has been added. All items that have been added are displayed in the "Items Added" box in left column. The user can them remove an item from the box by clicking the "delete" link, or can view the contents of a different item by clicking the "details" link.

Figure A.6: Dashboard Page (User Performing a Name Search for "nesquik")

Figure A.7: Dashboard Page (After Nestle Nesquik Has Been Added)

6. The user's profile can be modified by clicking the "Edit profile" link at the top of the page. On this page, the user can adjust which pieces of nutritional information are displayed on the dashboard by checking or unchecking boxes corresponding to each nutrient and vitamin. Additionally, the user can set quotas, called "warning levels", for each nutrient. If a warning level is set to a value other than zero, NutraSpeed will tell the user the percentage of the quota for a nutrient that they have consumed on the dashboard. When the user exceeds the quota, they will be warned by NutraSpeed. NutraSpeed warns users by changing the color of a nutrient to red in the "Warning Levels" box. In Figure A.8, the user has modified his or her profile so that only calories are displayed and so that the calorie warning system is calibrated to a 2,000 calorie diet.

The screenshot has been truncated, as it would be too long to display on one page if it listed all of the possible nutrients.

Figure A.8: Customizing the Site Using the Profile Modification Page

7. After the profile is modified, the dashboard is updated to reflect the changes. The customized dashboard shown in Figure A.9 only displays the amount of calories in each food item and in the aggregate diet. The calorie level is shown in the "Warning Levels" box in the left column.

Figure A.9: Updated Dashboard with Less Information and Configured Warnings

8. In Figure A.10, the user has entered an unknown UPC and clicked the "UPC Search" button.

In response to this scenario, NutraSpeed informs the user that the UPC is not in the database, and

prompts the user to either "Enter this UPC into database" or "Add another item".

Figure A.10: Unknown UPC Inputted into NutraSpeed

9. If the user clicks the "Enter this UPC into database" link shown in Figure A.10, the user is

taken to the page shown in Figure A.11. On this page, the user enters all of the information on

the product's Nutrition Facts label into the NutraSpeed database. After all applicable fields have

been filled; the user clicks the "Add UPC" button, and is taken back to the dashboard. The user

can then proceed to add the remaining items.

Figure A.11: Entering Information for an Unknown Item

Appendix B: Site Structure

Figure B.1: Site Map of Pages

As has been previously discussed, NutraSpeed employs a very modular site design. This allowed

for both easy division of labor and easy integration of components coded by separate developers.

When a user visits nutraspeed.mit.edu, index.php (the login/splash screen) greets the user. From

there, the user can either login and be transferred to io.php (the dashboard), or can register a new

account (register.php). After registration, the user is returned to the login screen (index.php) to

log in. Once the user has reached the dashboard (io.php), the user can input items. If the item that

is inputted is in the database, the user will stay at the dashboard. If the item is not in the database,

and the user chooses to add it, the user will then be transferred to the new item page

(newItem.php). After adding the item, the user will be returned to the dashboard. The user can

edit his or her profile by clicking a link to pEdit.php, which exists on both the dashboard and

new item pages. After the user finishes editing his or her profile, the user is returned to the page

that was previously visited. The user can access the site's static content from most of the pages.

Information about NutraSpeed's origin is provided on about.html, while a step-by-step guide to

using NutraSpeed is provided on howTo.html.

Appendix C: iCampus Proposal

Addendum: During the past week, the NutraSpeed team has determined ways in which our project could be geared to further meet the needs of both the MIT campus and Microsoft.
1. Title for this proposal

NutraSpeed: An Online Nutrition Management System

2. Name and email address of proposer

Adam C. Powell, MIT Undergraduate, Class of 2006
adampowell@adampowell.com

3. Project description

Currently, many Americans suffering from diabetes, high blood pressure, and high cholesterol must determine their nutritional intake through recording their diet in a paper logbook; a rather inefficient process. In order to increase the efficiency of this process, the Universal Product Codes on packaged food can be scanned into a computer, and the Nutrition Facts of the scanned food can be tabulated through NutraSpeed.

Our goal is to further develop the NutraSpeed website. NutraSpeed stores the UPCs of food products along with their corresponding nutritional information so that people can quickly log and tabulate their intake through scanning the UPCs on their food. As a result, people will be able to electronically log their nutritional intake by scanning UPCs with a barcode scanner.

Through an additional interface, NutraSpeed could be used at MIT to improve overall student health. Students currently purchase food from dining halls by swiping a card with a unique identifier. Afterwards, the transaction is logged in a centralized server. Student these transactions could be tied to NutraSpeed accounts so that whenever food is purchased, it is automatically added to the daily intake of the student on NutraSpeed.

Currently, nutritional information for the food served in the cafeteria is available. However, there is no streamlined method for obtaining it. Through NutraSpeed integration, students will be able to monitor their diet more easily. In the event that a student purchases an item for someone else, they can remove it from their daily intake on the website. Items not purchased through the cafeteria system can be added to the diet through the regular NutraSpeed online interface.

4. Significance

The primary significance of this project is its potential to help a large portion of American society. Currently, 6.3 percent of Americans suffer from Type II diabetes, 33 percent of adult Americans suffer from high blood pressure, and 37 percent suffer from high cholesterol. In order to manage all of these diseases, it is necessary to monitor nutritional intake. As these diseases arise from a combination of poor nutritional habits and genetics, it is important to offer sufferers a way to easily improve their understanding of their nutritional intake.

The secondary significance of this project is to improve health at MIT. Our extensions to NutraSpeed will help supplement the efforts that the food vendor Bon Appetite makes at promoting nutritional awareness on campus.

5. Key participants

Dmitry Kashlev, a computer science major, is responsible for the output provided by the website to its users, and for defining the database tables that store the NutraSpeed's information. His role has been to build the automatic nutritional report generation component of the website.

Adam Powell, a management and writing major, is responsible for managing the development of NutraSpeed, and for leading the development of all proposals and public relations material pertaining to NutraSpeed.

Akhil Shashidhar, a computer science major, is responsible for managing the input provided to the NutraSpeed website. He has enabled the entry of UPCs into NutraSpeed, and has created the mechanism through which new Nutrition Facts are entered. He has worked with Dmitry in defining the tables in the NutraSpeed database.

Andre Sugai, a comparative media studies major, is responsible for formatting the content on the website, including the UPC and Nutrition Facts input pages, and the automatically generated nutritional report page outputted by the website.

All of the key participants have agreed to work on the project next semester, and to enroll in 6.096.

6. Goals for the spring

Currently, Phase I of NutraSpeed is completed. Our goal is to complete Phases II and III in the spring, and Phases IV and V next year.

Phase I (completed): NutraSpeed will be able to manage nutritional information for packaged food products with UPCs and Nutrition Facts printed on them. NutraSpeed is currently hosted at http://nutraspeed.mit.edu

Phase II: NutraSpeed will allow users to enter the serving size of the food they have eaten. It will additionally allow the entry of nutritional information for produce, by having users to enter the four-digit produce identification code for each piece of produce consumed. NutraSpeed will handle nutritional information for food products without unique identification numbers, such as meat products and items at chain restaurants.

Phase III: NutraSpeed will be tied to the MIT Card system, so that whenever food purchases are made using an MIT Card, will be automatically entered into the purchaser's NutraSpeed account.

7. Goals for the first year

Phase IV: NutraSpeed will enable users to store personalized groupings of UPCs in their profiles, which will be referred to as "meals". For instance, Adam Powell's profile might contain a "cereal" meal containing the UPC for one serving of Kellogg's Special K with Red Berries and the UPC for one serving of Hood Skim Milk.

Phase V: NutraSpeed will contain a directory of common meals that users can select, in lieu of entering each of their components.

8. Funding

We currently need funding to hire UROPs proficient in .Net, ASP, PHP and SQL for implementing Phases II through V of NutraSpeed. Additionally, we would like to hire people to populate our database so that the initial users of NutraSpeed won't have to enter the nutritional item for every UPC they scan.

9. Advisor

Professor Dan Ariely is our advisor. He is a professor from the Sloan School of Management who studies rationality. We have spoken with him about our interest in working with him, and he has agreed to provide us with a server and stable network connection. Additionally, this project was conceived for the MIT course 21W.778, Communicating in Cyberspace. Ed Barrett, a lecturer in the writing program, has overseen this course, and given us direction this semester.

10. Other

Please visit our prototype of NutraSpeed when evaluating this proposal. Go to:
http://nutraspeed.mit.edu

NutraSpeed

America's First Voice-Based Diet Tracking System

Sergio Marulanda
Adam Powell

Please return to Adam Powell's folder at Sloan.

Team Business Plan
15.390B: New Enterprises

May 11th, 2005

1. Executive Summary

Description of the business

NutraSpeed is a company that provides health management software to the American public. Over half of the American population suffers from one or more dietary ailments, including diabetes, high blood pressure, and high cholesterol. NutraSpeed enables people to monitor their nutritional intake by verbally recounting their consumption history via an electronic/voice service. The benefit of this service is that it will allow people to more efficiently and more accurately track their dietary habits. NutraSpeed will be the most efficient to use dietary log on the market.

Opportunity and market overview

Over half of Americans have a medical condition requiring dietary monitoring. As the US has a population of approximately 300 million, the potential market size is over 150 million people. If 4 million people subscribe to NutraSpeed, priced at $2.99 per month, $127M in annual revenue can be generated. At this level, NutraSpeed will have captured less than .5% of the revenues of America's $30 billion weight loss industry.[1] NutraSpeed's market entry strategy will be to partner with weight loss organizations, which will provide marketing through well-established channels.

The product offering

NutraSpeed's first product will be a telephone and web-based dietary management service. Users will verbally or electronically tell the service their daily dietary intake, and can then hear reports about their intake over the phone, or view information about their intake on the Internet, through customized e-mail reports. Key attributes of the service include the verbal and visual interfaces, and the extensive library of nutritional information stored by the service. The value proposition of NutraSpeed is in time-savings and increased record accuracy for the user.

Business strategy

NutraSpeed will penetrate the health market by partnering with major weight loss organizations. These companies have existing marketing and sales channels for weight loss products, which we will utilize instead of creating our own. They will benefit by receiving a portion of revenues. Revenue will be generated via a monthly fee and the sale of advertisements for the website. Success will be measured by determining the number of users, and the average activity level (calls per month) by the users. As users who are relatively inactive are less likely to be long-term subscribers than active users, user activity is one way of measuring potential user turnover.

Competition and competitive advantages

NutraSpeed has one substitute and several direct competitors. Most of NutraSpeed's potential users currently keep paper logs of their dietary intake. If NutraSpeed is not substantially easier and quicker to use than a paper logbook, people will not use it. NutraSpeed's main competitor is the cell phone application "Diet TinyAssist", by Wimos. Unlike NutraSpeed, which can be used from any telephone, Diet TinyAssist ($1.99/month) has a rather cumbersome on-screen interface,

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[1] http://www.smartmoney.com/consumer/index.cfm?story=tenthings-january03

and is only usable on three models of cell phone. Our largest sustainable competitive advantage is our company's patentable voice recognition interface and brand name.

Financial prospects & model

Table 1: Yearly Forecast

Year	2005	2006	2007	2008	2009	Terminal value
Revenues						
Sales of service	,	1,305,135	12,761,320	47,854,950	127,613,200	
Advertising proceeds	-	267,120	201,600	756,000	2,016,000	
(Expenditures)						
Administrative	(124,000)	(1,040,000)	(1,064,000)	(1,596,000)	(2,394,000)	
R&D	(1,500,000)	(1,500,000)	(250,000)	(250,000)	(125,000)	
Customer Support	(15,000)	(530,000)	(2,400,000)	(9,000,000)	(24,000,000)	
Royalties		(261,027)	(2,552,264)	(9,570,990)	(25,522,640)	
Selling	(800,000)	(5,090,000)	(5,600,000)	(15,000,000)	(40,000,000)	
Net Cashflow	(2,439,000)	(6,848,772)	1,096,656	13,193,960	37,587,560	150,350,240
Net Present Value	49,826,272					

Milestones through next round of financing
- Breakeven point: 180K subscribers will be necessary to breakeven in 2007.
- Seed capital: $9,000,000 in seed capital will be necessary to launch NutraSpeed and work until generating positive Cashflow in 2007.
- Prototype development: A working prototype will be available by late 2005.
- Target: 4 million customers by 2009, resulting in $127.6 million in revenue.
- We will begin marketing and alliance formation during production of the web-based application, to ensure partnerships with vendors, for product launch in early 2006.

Financing

We are working in the first round financing to obtain $9,000,000 for the production of the phone and web-based applications and the acquisition of nutritional information for all food products widely distributed in the United States. After going to market, we wish to be acquired by mid-2008. As mergers and acquisitions have occurred much more frequently than IPOs in the post-bubble era, this appears to be a more feasible exit strategy. In addition, our partners in the weight loss industry will serve as ideal candidates for the acquisition.

Team

We currently have a team that combines technical and business expertise.   We plan to continue with our current team until late 2005, when we will begin recruiting for our development and marketing team.   Our first hires will be a CEO, a Director of Technology, two marketing/account managers and a technical manager, to work on establishing partnerships and selling advertising.

Our current team:

Adam Powell – Founder and Chief Information Architect: Adam is a Management major at Sloan with experience in wealth management at UBS and program management at Microsoft.

Sergio Marulanda – Sales and Marketing Director: Sergio is an MBA candidate at Sloan with experience in Sales and Marketing at Johnson & Johnson's Consumer Division.

2. Business Concept and Description
The industry
The diet management industry is currently undergoing rapid expansion, in part due to the growth of the number of people in the market for dietary/health related issues. As the average age of Americans climbs, there is the increasing need for services in the health sector. Since many age-related conditions require adherence to special diets, the demand for diet management products is rising. Additionally, the obesity epidemic has created a large potential market of dieters that is quickly expanding. Currently, there are several large firms, such as Atkins, Jenny Craig, and Weightwatchers that control the majority of the market for dietary management programs. As employers learn of the negative effect of obesity on employee productivity, there is the increasing trend of employers funding dietary management programs for their employees.

Currently, the size of the market for dietary management products is approximately $30 billion.[2] As the obesity epidemic continues, the size of the market is sure to expand. Over 150 million Americans need to better manage their diets, although it is clear that not all are interested in doing so, as 365,000 Americans die due to obesity-related aliments each year.[3] Due to the difficulty of complying with current dietary management techniques, only 23% of Americans ate the recommended five fruits and vegetables per day, and only 40% maintained a healthy Body Mass Index (BMI) of less than 25.[4] Thus, although there is currently a huge market for dietary management products, and several companies offering them, the overall need for dietary management tools is by no means currently being met. In spite of the Atkins Diet and the South Beach Diet, Jenny Craig and Weightwatchers, Bally and Bowflex, the majority of Americans are still in need of mechanisms for improving their health.

The newest development in the dietary management arena is the April 2005 release of "Dietary Guidelines for Americans 2005", by the Department of Health and Human Services.[5] This eighty-four page document contains an updated list of guidelines for Americans to follow in order to maintain their health. Coinciding with the release of this document is the updated Food Pyramid, the first change to the Food Pyramid since its creation in 1992. In order to help Americans follow the updated food pyramid, the Department of Agriculture created a website, MyPyramidTracker.gov, that lets people calculate their daily dietary intake by entering it into a website. The goal of NutraSpeed is to improve upon the interface to this technology by creating a similar system that lets people track their diet over the phone, via speech recognition. The government's creation of MyPyramidTracker.gov demonstrates a Federal acknowledgement (and endorsement) of America's need for better diet logging software.

The company and concept
NutraSpeed has been founded to address America's need for better dietary management. NutraSpeed intends to offer an interactive diet logging service that assists people in evaluating and recalling their dietary behavior. Unlike existing services, NutraSpeed utilizes speech recognition to capture dietary information from users. Thus, users can tell NutraSpeed what they

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[2] http://www.jennycraig.com/corporate/news/industry_fact_sheet.asp
[3] http://www.cnn.com/2005/HEALTH/diet.fitness/04/26/health.advice.reut/index.html
[4] http://www.cnn.com/2005/HEALTH/diet.fitness/04/26/health.advice.reut/index.html
[5] http://www.health.gov/dietaryguidelines/

have eaten at the table by placing a call on a cell phone, instead of having either to record their dietary history in a paper log, or via a graphical user interface on a computer or mobile phone. The customers of NutraSpeed will be people who need to better monitor their diets. People with health conditions and people who are electively dieting are our intended customers.
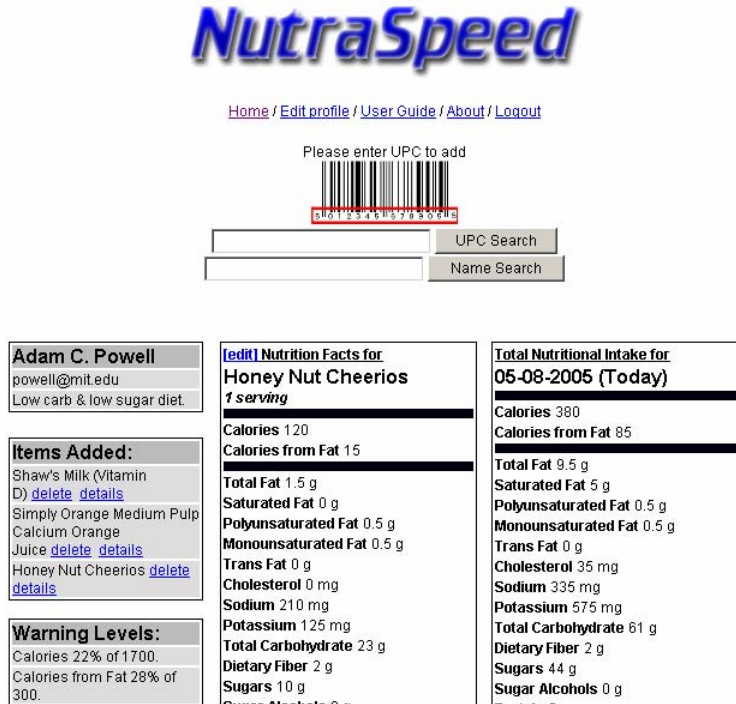

Figure 1: NutraSpeed Prototype (December 2004)

In September 2004, NutraSpeed was conceived by Adam Powell and a group of three developers as part of an academic exercise. The original mission of the company was to help people with diabetes, high blood pressure, or high cholesterol better understand their dietary history. NutraSpeed was initially an entirely web-based system, similar in nature to the recently released MyPyramidTracker.gov. A prototype was finished in December 2004, and plans were created for expanding the scope of the system. The December 2004 Prototype (see Figure 1) enabled people to determine their daily dietary intake by scanning items they had eaten with a barcode scanner, attached to a computer. After the prototype was developed, it was realized by the development team that a barcode scanner was an awkward interface, and that people do not want to create their dietary logs on a computer, as people rarely have access to a computer while consuming food. Thus, it was decided in February 2005, that for NutraSpeed to be marketable, it would have to be usable via a handheld device. Testing was done using Pocket PCs, and no graphical user interface was deemed satisfactory. Additionally, the small number of Americans owning Pocket PCs would have limited the market. In order to achieve portability for NutraSpeed, and to make its user interface more natural to use, it was decided that users should primarily interact with NutraSpeed via voice (see Figure 2). However, all was not lost with the creation of the Web-based prototype, as some customers may wish to occasionally view their dietary history over the web, in order to see charts or download records.
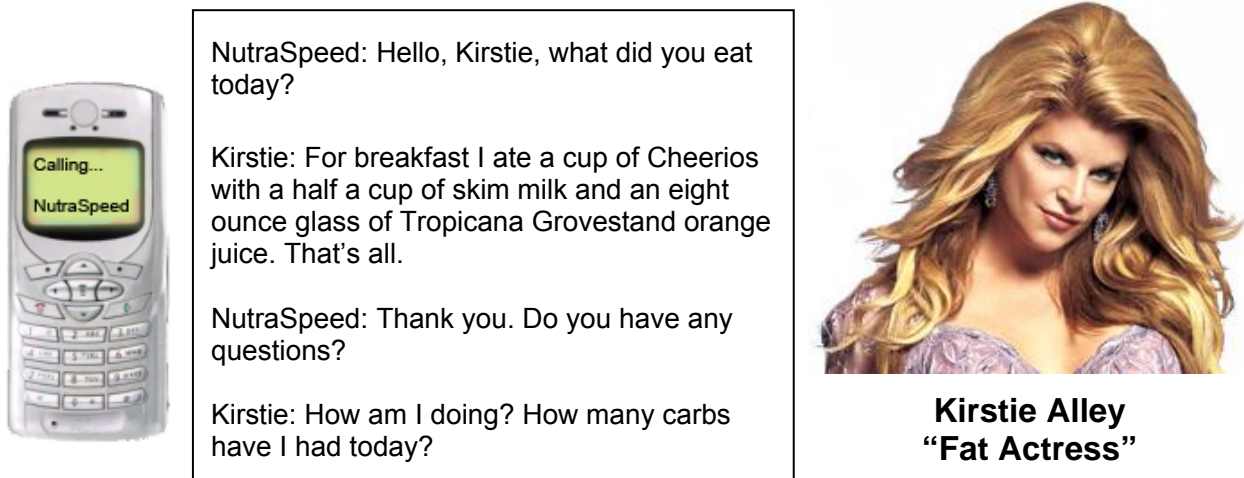
Figure 2: User Interaction with NutraSpeed

3.   Market Opportunity Overview

Market Overview

Currently, 8% of Americans suffer from Type II Diabetes[6], 33% suffer from high blood pressure[7], and 37% suffer from high cholesterol[8], and the majority of adult Americans are overweight or obese. All of these populations are increasing, and are members of the target audience for NutraSpeed. As the US has a population of approximately 300 million, and the majority of Americans have one or more of these conditions, the potential market size is over 91 million people (see Marketing Plan – Distribution). Jenny Craig, the leading prepared-food diet program in the United States, has 90,000 clients at any given time and has had 10 million clients since 1983.[9]

Customers & Segmentation

The company's customers are people that need to improve their diet for medical or cosmetic reasons. As the vast majority of Americans could benefit from dieting, there are several segments in this market. The market can be segmented into three layers (see Figure 3). The first layer consists of people who either need to diet or want to diet. This layer contains the vast majority of the American population, as very few people have neither a diet-related medical condition nor the desire to diet. Perhaps the main groups of people outside the market for NutraSpeed are athletes and children. The second layer consists of two groups; people who should diet and people who want to diet. These two groups can be broken down further into people with various diseases, people who want to lose weight, and people who want to maintain their health. NutraSpeed can potentially serve all of these market segments. However, due to a limited marketing budget, it must pick which segments should be targeted most proactively. It is to the company's advantage to first target the segments most receptive to dietary management products; voluntary dieters and people with medical conditions who are already dieting. This

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[6]http://www.ncbi.nlm.nih.gov/entrez/query.fcgi?cmd=Retrieve&db=PubMed&list_uids=11832527&dopt=Abstract
[7]http://www.americanheart.org/downloadable/heart/1079736729696HDSStats2004UpdateREV3-19-04.pdf
[8]http://cureresearch.com/c/cholesterol/stats.htm
[9] http://www.jennycraig.com/corporate/news/industry_fact_sheet.asp

target market has a proven willingness to pay for dietary products, and thus is easier to reach than the market consisting of people with medical conditions who have not yet made the decision to diet.

Customers make purchasing decisions for diet management tools largely on an individual basis. The main bases for purchasing decisions are cost and ease of use. For instance, although diet programs consisting of pre-prepared food (like Jenny Craig) are easy to use, they are costly, as they require a substantial and continual investment in purchasing special food. Meanwhile, many diets, such as the South Beach diet, require substantial change in personal behavior to follow. As people are resistant to change, diet management tools should be as simple to use as possible, and cost as little as possible. Priced at less than $36 per year, NutraSpeed is clearly an economical tool. The voice interface will help ensure that NutraSpeed is quick and easy to use.
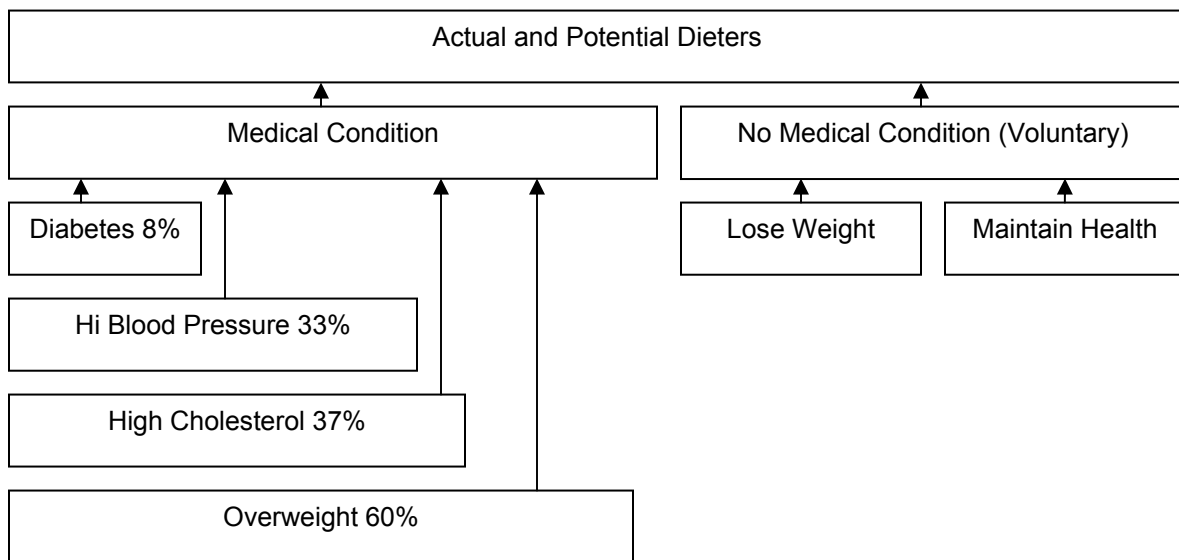
Figure 3: Market Segmentation of American Dieters, with Percentage of Americans in Each Segment

Market size and trends

As the waistlines of the American people expand, the market for NutraSpeed expands as well. The company foresees an expansion in both its market share and the market size. NutraSpeed is a tool that can be used in conjunction with surgical solutions, such as such as gastric bands or stomach stapling, which are currently being recommended for increasing numbers of obese patients. The recent increase in the frequency of bariatric surgery is yet another indicator of the epidemic. Table 2 contains projections of the number of subscribers to NutraSpeed between 2005 and 2009.

Table 2: Market Penetration

Year	2005	2006	2007	2008	2009
# of Customers	0	80,000	400,000	1,500,000	4,000,000
Percentage of Market	0.00%	0.04%	0.22%	0.83%	2.22%

As the percentage of Americans who are overweight has increased by approximately 10% per decade, it is quite possible that by 2009, 70% of Americans will be overweight.[10] It is impossible to determine the long term trajectory of the obesity epidemic. However, it is clear that in the immediate future, the majority of Americans will be facing this problem, and that the size of the epidemic will expand. Sociological influences of the epidemic include the proliferation of a toxic food culture, and increased consumption of prepared foods. Among obese adults, "about 50 million are dieting in a given year. About 15% of these dieters are using a commercial weight loss center, generating revenues of approximately $1.5 billion annually."[11]

4.   Product Offering

NutraSpeed is a one product company that will sell a service that allows people to track their nutritional intake over a telephone. The product will employ speech recognition and natural language processing technology in order to convert the user's requests into database queries that can be used to store and retrieve information from the system. In the past, there have been several successful creations of artificially intelligent natural language processing systems. The key to the ease of constructing NutraSpeed is its fixed and limited domain. The difficulty of construction will be simplified by there being less than ten types of questions that the system needs to be able to answer.

The operation of the product is shown in Figure 2. The user will tell the system what he has eaten recently, as specifically as possible, (providing quantities), and the system will then store the user's consumption history in its database. If the user wishes, he can ask the system questions, which will then be parsed and answered by querying the database. The user should be able to interact with the system entirely over the phone, as well as over the Internet (if desired).

NutraSpeed solves the problem of cumbersome and slow interaction between users and dietary management systems. Current systems require people to write down their diets, type them into a computer, or punch in their diets via the keys of a mobile phone. As people are most accustomed to summarizing their behavior by talking, NutraSpeed offers a natural interface for dietary logging. The easier and less time intensive the dietary logging process, the more likely people are to continue to comply with it. For an investment of only $2.99 a month, users can potentially both enhance their health and improve their longevity.

There is no risk of users being stuck with an obsolete product, as NutraSpeed is a subscription-based system that is run from the server-side. If improvements are needed for NutraSpeed to remain competitive, the improvements can be made without changing anything in the user's possession. Thus, upgrades can be quickly deployed as needed (as opposed to the US Department of Agriculture's service). As the service is subscription-based and charges a low monthly fee, people can easily try the service with little risk or financial investment. The only potential drawback of NutraSpeed's business model is for the company itself, as if initial customers are dissatisfied with the service, they can quickly unsubscribe, and can spread bad publicity about the service, resulting in fewer other people subscribing as well.

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[10] http://www.obesity.org/subs/fastfacts/obesity_US.shtml
[11] eDiets.com 10-K Filing, 3/22/05

Sergio Marulanda, sergio.marulanda@sloan.mit.edu   Adam Powell, adampowell@adampowell.com

5.   Business Model and Strategy

NutraSpeed will create an automated, artificially intelligent, dietary tracking tool.   Building upon technology constructed for the web-based prototype, the first version of NutraSpeed will allow people to track their dietary information by orally recounting it over the phone. This product will help serve people in the dietary management market, which is a $30 billion market.[12]

In order to promote NutraSpeed, the company will create exclusive partnerships with existing weight loss companies such as Jenny Craig, Seattle Sutton, and WeightWatchers. These allies will be given a portion of the revenues resulting from the customers they recruit to for our service. NutraSpeed plans to share 20% of revenues with allies. Partners will additionally benefit, as if their customers use NutraSpeed in conjunction with the diet they are following, they are more likely to have satisfactory results, and then to recommend the diet to their peers. It is advantageous for these companies to partner with NutraSpeed, as otherwise they would not be able to experience the economy of scale that NutraSpeed creates by selling the service to multiple sets of users, as each individual weight loss company has substantially fewer users at any given time than necessary to easily sustain a service like NutraSpeed. After the company has established itself with a substantial subscriber-base, it will seek an acquisition by one of its allies.

Until an M&A occurs, NutraSpeed will generate revenue by selling people subscriptions to the service for $2.99 per month, and by selling advertisements to be displayed on the NutraSpeed website. This price is reasonable as it is the same as the base price of membership for eDiets.com (depending on features chosen, eDiets.com memberships can be far more expensive). It is also similar in price to the subscription cost of Diet TinyAssist (by Wimos), which is priced at $1.99 per month. As NutraSpeed costs less than one meal, it is unlikely that the price will be a strong deterrent to users. Success will be measured by determining the number of users, and the average activity level (calls per month) by the users. As users who are relatively inactive are less likely to be long-term subscribers than active users, user activity is one way of measuring potential user turnover.

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[12] http://www.smartmoney.com/consumer/index.cfm?story=tenthings-january03

6.   Competition and Competitive Advantage

NutraSpeed has several competitors and a natural substitute. The natural substitute for NutraSpeed is keeping dietary logs on paper, as people have done for many years. Although this is a free and easy substitute, it is clearly an ineffective one, as the obesity rate has rapidly increased over the years. The competitors of NutraSpeed are MyPyramidTracker.gov by the USDA, Diet TinyAssist by Wimos, and eDiets.com.

Table 3: Comparison of Products

Service	NutraSpeed	MyPyramidTracker	Diet TinyAssist	eDiets.com
Entity Type	Company	Service of government (USDA)	Program from mobile applications company	Company
Revenue in 2004	0	0	Unknown	$45.4M
Monthly Fee	$2.99	$0	$1.99	$2.99+
Year Founded	2004	2005	2004	1996
Nutrition Tracking	Yes	Yes	Yes	Yes
Exercise Tracking	No	Yes	Yes	No
Web Interface	Yes	Yes	No	Yes
Phone Interface	Yes	No	Yes	No
Voice Interface	Yes	No	No	No
Marketing Method	Alliances with diet companies	Government publicity	Marketed via wireless companies	E-mail and web advertising
Number of Customers	0	Unknown	Unknown	465,000
Advantages	Speedy voice interface. Alliances with diet companies	Free. Government-created. Free publicity due to government.	Inexpensive. Integrated into mobile phone. Provides visual info.	Well-established brand. Variety of diet options offered.
Disadvantages	Relatively new entrant. More costly than some alternatives.	Website interface requires computer to use. Small marketing budget.	Only works on three models of mobile phone. Requires key-punching.	Most expensive of the pack. Website interface requires computer to use.

The company is vulnerable to competition from all three of its competitors. However, each company competes with NutraSpeed on a different ground. MyPyramidTracker.gov will always be priced below NutraSpeed as it is a government product that is not intended to make a profit. However, as it is non-commercial, it may not have the budget necessary to make upgrades to be able to compete with NutraSpeed in the long-term, nor may it intend to. Meanwhile, it will also be possible to capture market share from Diet TinyAssist, as the program is made by a company that is focused on creating wireless applications for three models of mobile phones. Wimos has chosen to focus its resources on creating applications for a niche platform, not a niche sector, making it a weak competitor to NutraSpeed in the long term. Although eDiets.com has a formidable user base and well-established brand name, it offers a web-based interface like MyPyramidTracker.gov, and lacks the ease of use of NutraSpeed. Through patents over the voice interface, NutraSpeed can obtain a sustainable advantage over the existing competitors. Additionally, its exclusive alliances will give it a unique advantage over its competitors who do not rely on this method of marketing.

7.   Marketing Plan
Marketing Strategy
NutraSpeed will roll-out its service starting in the Northwest, and then proceed to the Midwest, West and South regions of the US, beginning in 2005.   The company believes this is the proper path for expansion, as it wants to evolve steadily while ensuring the lock-in of trade partners to deterring competitors from entry.   The potential market for NutraSpeed is 91 million people (see Distribution section below).   Society is exerting pressure on people to monitor their nutrition, and NutraSpeed believes that it can be a partner in this and ultimately benefit.

NutraSpeed's sequence of market penetration will begin in the Northeast in late 2005, and then gradually expand into the Midwest, West and South in mid 2006.   This sequence was created after observing the geographic distribution of the U.S. population.[13]

Table 4: Regional Population Distribution in the U.S.

Region	% of total US population[14]
Northeast	18.7
Midwest	22.5
South	35.9
West	22.9
Total	100.0

Product
NutraSpeed's product is described in general in the Product Offering section of this Business Plan.   In this portion of the Marketing Plan we wish to elaborate on several features.

NutraSpeed's product will be positioned as "the first voice-based nutrition tracking service in the U.S. market".   Although the USDA has launched a service that is free, NutraSpeed has several advantages over it:

- NutraSpeed is a phone based application that allows customers to record their intake without having to log on to the Internet.   This is an advantage as people can call through their mobile phones from wherever they wish, instead to having to wait to access a computer to use a website.
- NutraSpeed is a private company, unlike the Department of Agriculture (a government agency), and can quickly respond to the dynamics of the market.

Related to the previous point, and given the fact that new competitors will surely enter the market, NutraSpeed's sales expenses will be allocated to actively acquiring customers from the beginning.   NutraSpeed aims to become the standard for its end customers/users, and also for its partners.   The company believes this will deter entry for other players, who would otherwise have to acquire customers from scratch.

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[13] US Census Bureau
[14] US Census Bureau

Apart from NutraSpeed's voice recognition technology, another source of differentiation is that its platform allows creating two types of customized reports.   One type of report is created in response to user requests, while the other is automatically generated by NutraSpeed, when the system detects that a user is not accomplishing the dietary goals he has set.   For instance, if a user decides that he has a limit of 500 fat calories per day, and one day exceeds that, NutraSpeed will inform him that this has happened.

In addition to the phone-based application, the company will have a call center that resolves customer inquiries and problems.   If a user has a complaint about the information that he has received from the service, a customer service representative will clarify the issues for him, and take appropriate actions to solve it.   This call center will be located in India, which is the lowest cost supplier of this service (see Operations section for details).
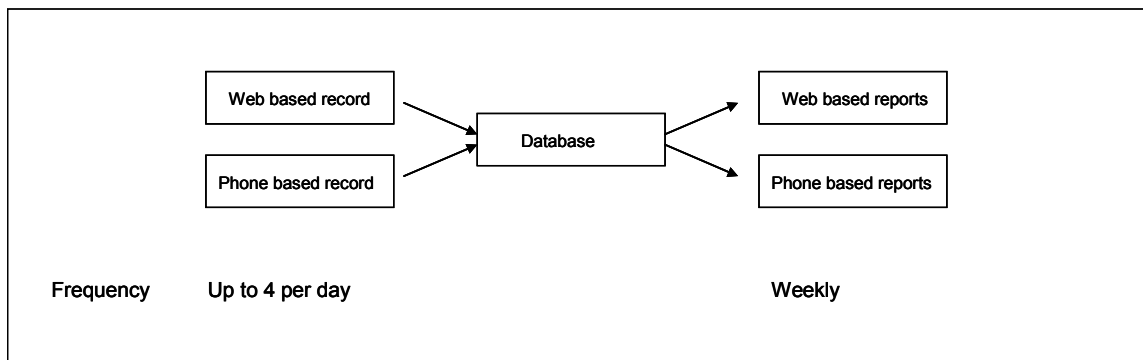
Figure 4: Front end process flow

Price

Prices will remain constant over time, as the company's efforts will be focused on customer acquisition.   NutraSpeed believes that one of its selling points for potential customers will be that prices have not been raised throughout its evolution.   One option that will be considered, if NutraSpeed achieves the desired customer level in 2006, is to offer customers the opportunity to pay a fixed sum at the beginning of the year, which would be less than twelve times the monthly rate.   Under this pricing plan, the company can provide customers with savings and also use this "float" for investment in capital markets to gain interest returns.

NutraSpeed believes it can charge a $1 per month premium over what Wimos's Diet TinyAssist charges, as we are offering substantially more value to our customers.   However, the company will closely monitor the evolution of the USDA's application to evaluate customer *willingness to pay* for the service.   If a large volume of users are observed using the USDA's service, NutraSpeed may need to adjust its pricing, and then evaluate its value proposition on a quality/cost basis.   On the other hand, it may also consider raising prices in order to send a cue to the market regarding its value proposition. Pricing is currently being examined in test markets, but projections are being carried out with a price of $2.99 per month.

NutraSpeed believes this pricing strategy will allow it to profit during the second year of operation, while allowing customers to try our product for at least one year. Given the low price point, the company believes that potential entrants will not compete on price, but instead focus

on the value added by the service.   Therefore NutraSpeed's agreements with its partners will be critical for its success.   Although it is too early in the product /service life cycle to know for certain, it is likely that the market will not be highly price sensitive as long as prices are in the current range.

Place/Segmentation/Distribution

Currently, 63% of the US population (183M) is between the ages of 18-64 years of age. This cohort has a median disposable income of $28,227 per person.[15] Given that roughly half of the population in the country suffers from at least one nutritional disorder, NutraSpeed believes that it is possible for at least 80,000 consumers to sign up for service during the first year.   The company's target customer base consists of 91 million people.   There will be demand for NutraSpeed as there is an increasing trend of health consciousness among US consumers.

Our partners will serve as our initial distribution channel.   NutraSpeed will not receive their customer database directly, but instead will establish direct marketing efforts through their invoicing service.   With this, NutraSpeed will achieve a balance between reach and frequency. NutraSpeed will initially only "reach" out to the customers of our partners, and do so two times per year. Customers will pay via credit card, allowing them to automatically pay for the service, and receive a discount for agreeing to be a member for one year.

Although the company's focus is on the US market, we are currently evaluating how to proceed when international consumers wish to use the service.   Although they are welcome, it is necessary to monitor any legal and technical issues that may occur as a result.

Promotion

NutraSpeed's main challenge is getting customers to try its product for the first time.   Therefore, new customers will be given one free month of service in order to facilitate their experiencing the service.   The value-added features of the service will make customers desire to continue subscribing to the service after their trial has ended.   The cost of this trial is included in our financial model as a lower sale (negative sales).

As part of our customer acquisition efforts, NutraSpeed will send a kit to each target customer. This kit will include a mug, a mouse pad and information about our service and how to access it. The kits will initially cost us $2.00 per customer.   However, there could potentially be savings if enough volume is purchased

NutraSpeed believes that advertising should be approached cautiously.   Currently there is an overwhelming amount of advertising by services such as eDiets.com, Slim-Fast, Jenny Craig, and WeightWatchers. If the company decides to advertise online as these services do, it will risk being confused with a weight-loss service (and maybe even end up competing against its partners in the mind of the consumer).   Therefore, one of the company's advantages will be that it promotes itself through its partners instead of independently.   All of the promotion budget will be allocated to acquiring customers via direct marketing efforts.

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[15] US Census Bureau

Sales Tactics

NutraSpeed's sales approach will be to establish Account Managers (AM).   These AMs will be assigned to work with a partner organization to:

- Assist in the acquisition of customers
- Maintain an ongoing relationship with the end user
- Train consultants from the partner on the benefits of NutraSpeed
- Serve as the point of contact between NutraSpeed and the partner

8.   Product Design and Development Plan

Development status and tasks

Currently, there is a working prototype of the web-based interface to NutraSpeed, available at http://acpowell.mit.edu/nutraspeed. However, the voice-based interface has not yet been developed. As speech recognition and natural language processing technology is rather expensive, development on this will not be able to occur until the company receives funding. The voice-based interface will then have to be integrated with the web-based interface for the product to be complete. As NutraSpeed is not a software company, it will buy as much off-the-shelf technology as possible, and outsource all of the necessary custom programming.

Difficulties and risks

The primary risk associated with the development plan is that the NutraSpeed system will be unable to understand the verbal commands of users. Although natural language processing has been perfected for use in limited domains, it often does not perform as well in open-ended domains. While the domain of dietary consumption is rather limited, there is the chance that it is too open-ended to work reliably with the technology that currently exists. There is the additional risk that the system will improperly recognize speech of users, resulting in erroneous behavior. If this occurs, it could potentially give the company a bad reputation that will be difficult to overcome.

Product improvement and new products

In order to offer more value to users, the company will incrementally add features to its product. The first upgrades planned will be the addition of a weight tracker and an exercise tracker. Both of these will have very similar interfaces as the dietary tracker, and can work through the same natural language processing system, so that a call to NutraSpeed will be a person's one-stop shop for health management. New products developed by the company will be lateral moves that take advantage of NutraSpeed's speech recognition system. If several applications can be created that use the system, they will help defray the cost of the system. Another of NutraSpeed's planned improvements will be to include a service for providing dietary recommendations, after NutraSpeed assesses the user's current plan. Once the company develops strong goodwill and brand recognition, it can consider producing vertical applications in the health management sector, such as electronic health management devices.

Costs

In the first year of operations, $500,000 has been allocated to NutraSpeed's initial development. In addition to that sum, $15,000 has been allocated to acquiring nutritional information about all items commonly sold in United States grocery stores and meals eaten in American homes and restaurants. As multiple companies already have this data, NutraSpeed will merely have to purchase it. If it is not able to strike a deal, it could acquire the data itself with this amount of money. The greatest anticipated expense of NutraSpeed is the creation of the voice recognition system. Thus, $300,000 will be allocated to this task. In order to improve the quality of the NutraSpeed website and enable interoperability with the telephone system, $100,000 will be allocated to web development. As the company must use patents to protect some of the results of its R&D, $50,000 will be allocated to expenses resulting from patenting. The remaining $50,000 will be reserved for unanticipated development expenses. Since NutraSpeed's business model will most likely attract new competitors from the beginning, we have devoted a substantial portion of our budget to R&D in order to remain innovative.

Proprietary issues

In order to maintain a sustainable competitive advantage, NutraSpeed will seek a patent for its voice interface once it is sufficiently developed. It will attempt to achieve a monopoly on automated, phone-based diet management. Additionally, the company is seeking exclusive contracts with major diet companies in order to have a channel for recruiting customers. As the major players in this industry have been relatively consistent over the last decade, locking even one of them into an exclusive agreement with NutraSpeed would provide a sustainable competitive advantage.

9. Operations Plan

As NutraSpeed is an electronically-based solution, its operations are quite simple:

Location

NutraSpeed will be located in Cambridge, Massachusetts.   Its administrative offices (back-office) and the hardware/server (database storage and phone based interface), will also be located there.   All its business will be conducted from this office, except for customer support.   These facilities will be leased during the third quarter of the present year.   NutraSpeed believes leasing the facilities is a better than buying them because back-office operations do not require remaining in one space permanently.   NutraSpeed has allocated $24,000 per year to cover this expense.

Call Center

NutraSpeed will outsource its call center to India, where labor costs are substantially lower. Productivity in India for this service is 25% higher than in the U.S. [16] It has established contact and with an Indian call center, and found that language/pronunciation will not be an issue. All of the customers who call the company's customer support line (1-800 number) will be redirected to this facility.   NutraSpeed is currently negotiating a variable rate per number of calls received to cover this activity. The target of these negotiations is to achieve a rate of $0.25 per call.

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[16] Destinationcrm.com
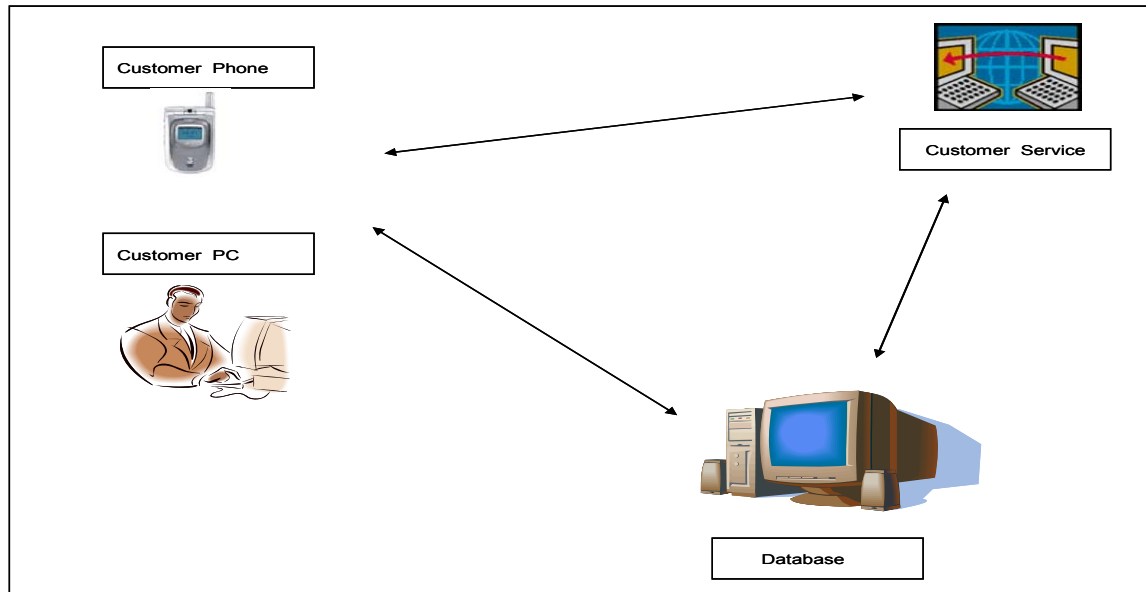
Figure 5: Process Architecture

Equipment

NutraSpeed will have a server with software worth $50,000.   It will also have a parallel back-up system that ensures that the service is permanently up and running.   The cost of having this back-up service at another location is approximately $50,000.   This back up system will be purchased at the same time as the main system.

10.   Team

NutraSpeed's current team combines technical and business expertise.   The company will continue with its current team until late 2005, when it will begin recruiting an executive and marketing team.   The team consists of:

Adam Powell – Founder and Chief Information Architect: Adam is an undergraduate majoring in Management at MIT Sloan, who has previous worked on designing a prototype of NutraSpeed.   He has interned in wealth management at UBS, and in program management at Microsoft.   Please see attached resume.

Sergio Marulanda – Sales and Marketing Director: Sergio is an MBA candidate for the Class of 2006 at MIT Sloan.   He has previous experience in Sales and Marketing at Johnson & Johnson's Consumer Division.   He will be in charge of developing partnerships with current vendors for customer acquisition, and also of advertising directly to consumers.   Please see attached resume.

NutraSpeed realizes that the current members of the team do not have the required experience to serve as CEO, and thus will seek an outside person to serve as CEO. The company's first outside hires will be a CEO to lead our company and a Director of Technology to ensure the ongoing success of our application.   The executive compensation package will be comprised of 50% fixed salary (TBD) and 50% stock options.   After this, the company will hire technical

manager who will be in charge of guaranteeing the smooth operation of the NutraSpeed platform.   Finally, two marketing associates will be hired to work on establishing partnerships and selling advertising.

In general, NutraSpeed seeks hires with the following common traits:
- Are experts in the field/profession for which we are hiring (marketing, sales, technology, etc.) We look for at least five years of previous experience in the respective field.
- A deep and profound sense of ethics.
- Younger candidates are generally preferred, given the dynamics and nature of an entrepreneurial organization.

NutraSpeed is currently working on building our board of advisors from members of the MIT faculty, to ensure it has up-to-date scientific knowledge, and from MIT Sloan to ensure it is updated on current business trends.

11.   Financial prospects & model

Table 5: Yearly Forecast (in $)

Year	2005	2006	2007	2008	2009	Terminal value
Revenues						
Sales of service	,	1,305,135	12,761,320	47,854,950	127,613,200	
Advertising proceeds	-	267,120	201,600	756,000	2,016,000	
(Expenditures)						
Administrative	(124,000)	(1,040,000)	(1,064,000)	(1,596,000)	(2,394,000)	
R&D	(1,500,000)	(1,500,000)	(250,000)	(250,000)	(125,000)	
Customer Support	(15,000)	(530,000)	(2,400,000)	(9,000,000)	(24,000,000)	
Royalties		(261,027)	(2,552,264)	(9,570,990)	(25,522,640)	
Selling	(800,000)	(5,090,000)	(5,600,000)	(15,000,000)	(40,000,000)	
Net Cashflow	(2,439,000)	(6,848,772)	1,096,656	13,193,960	37,587,560	150,350,240
Net Present Value	49,826,272					
Discount rate	30%					

Table 6: Explanatory Information for Yearly Forecast

Price of service		$2.99	$2.99	$2.99	$2.99
Number of customers	0	80,000	400,000	1,500,000	4,000,000
Hits		2.99	2.99	2.99	2.99
Advertising rate per 1000 hits[17]		6,720,000.00	33,600,000.00	126,000,000.00	336,000,000.00
Direct marketing (included in Selling Expenses)		6.00	6.00		6.00	6.00
Less sales (free month trial per customer)	105,400.00	600,000.00	2,250,000.00	6,000,000.00	
Customer support rate		0.25	0.25	0.25	0.25

Explanations:

Since payment is to be made by credit card, 3% of sales have been deducted, as this is the average charged by financial institutions.

Administrative costs for the first year are for the purchase of a server, customized database software, and premises.   Salaries have been included in the costs for every year.

Less-sales is for trial purposes of new customers.

Please see the appendix for detailed monthly cashflow.

Sensitivity analysis:

A sensitivity analysis has been conducted on the cash flow model, regarding the impact of a change in pricing and change in discount rate, to the value of NutraSpeed.

Table 7: Sensitivity Analysis

Discount rate → Price per customer ↓	20%	25%	30%	35%	40%	50%
0.99	(110,682,454)	(74,713,584)	(54,226,865)	(41,300,479)	(32,574,473)	(21,847,449)
1.99	2,668,000	(591,057)	(2,209,850)	(3,061,362)	(3,509,926)	(3,818,418)
2.99	116,018,455	73,531,470	49,807,165	35,177,754	25,554,621	14,210,613
5.99	456,069,818	295,899,050	205,858,210	149,895,104	112,748,262	68,297,707
10.99	1,022,822,090	666,511,684	465,943,286	341,090,687	258,070,998	158,442,863

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[17] Newspaper Agency Corporation

12.   Milestones through next round of financing
- Breakeven point: A subscriber-base of 141,044 is needed in order to breakeven.
- Seed Capital from 2005 will be used in the following way:
    o $500,000 for the production of the web-based and phone-based application
    o $1,000,000 for ongoing R&D
    o $15,000 for the acquisition of the nutritional information database
    o $800,000 for direct marketing efforts to acquire customers
    o $100,000 for a server and customized database software (including back up)
    o $24,000 for general administrative expenses
- Prototype development: A working prototype will be available by late 2005.   A basic prototype is currently available at http://acpowell.mit.edu/nutraspeed
- NutraSpeed is in negotiations with Jenny Craig and WeightWatchers, in an attempt to form a partnership.   At this moment, Jenny Craig appears to be more interested in the service than WeightWatchers.   Their only concern is that the service be reliable and not crash when offered to their customers.   NutraSpeed believes that this will be under control by the time the service is launched in January-February 2006.
- NutraSpeed will begin marketing during production of the web-based application, to ensure partnerships with vendors, for product launch in early 2006.
- The target is to reach 4 million Americans by 2009, resulting in $127.6M in revenue.

13.   Financing
NutraSpeed is working in the first round financing to obtain $800,000 for the production of the phone and web-based applications and for the acquisition of nutritional information for all food products widely distributed in the United States.   A tentative second round of financing of $500,000 may occur during 2006, which depends on the degree to which the desired number of customers is obtained

NutraSpeed is in the diet management business for the long-term, and intends to be present through the life-cycle of the industry.   After going to market, the company may wish to be acquired by mid-2008.   This will allow enough time for the service to be in the market and attract acquisition candidates. As mergers and acquisitions have occurred much more frequently than IPOs in the post-bubble era, this appears to be a more feasible exit strategy.   In addition, our partners in the weight-loss industry will serve as ideal candidates for the acquisition. The company will be proactive and leave maneuvering room for legal issues, such as Jenny Craig wanting to acquire NutraSpeed, but NutraSpeed having proprietary information from WeightWatchers.

14. Proposed Company Offering
The company is seeking $9,000,000 of seed capital in exchange for 25% of NutraSpeed's equity. This percentage of equity has a NPV that far exceeds $9,000,000.   The excess return will reward the investors nicely.   In addition with this NutraSpeed will offer a permanent seat on the board of directors. The investment of $9,000,000 ($2.5M for 2005 and $6.5M for 2006) will have an expected annual return of 55% during the 5 years of the forecast, as measured against 25% of the company. In exchange for the funding, we are willing to negotiate, according the generally practiced VC industry requirements, on liquidation rights and/or tag along options.

Monthly Cashflow Forecast for 2005

Account	January	February	March	April	May	June	July	August	September	October	November	December	Total 2006
Revenues							-						-
Sales of service													-
Advertising proceeds													-
(Expenditures)													-
Administrative							(20,667)	(20,667)	(20,667)	(20,667)	(20,667)	(20,667)	(124,000)
R&D							(250,000)	(250,000)	(250,000)	(250,000)	(250,000)	(250,000)	(1,500,000)
Customer Support							(15,000)						(15,000)
Royalties													-
Selling										(400,000)	(400,000)		(800,000)
Net Cashflow							(285,667)	(270,667)	(270,667)	(670,667)	(670,667)	(270,667)	(2,439,000)

Monthly Cashflow Forecast for 2006

Account	January	February	March	April	May	June	July	August	September	October	November	December	Total 2006
Revenues													
Sales of service	-	8,701	20,302	31,903	75,408	58,006	107,311	142,115	168,217	229,124	232,024	232,024	1,305,135
Advertising proceeds	1,512	3,528	5,544	13,104	10,080	18,648	24,696	29,232	39,816	40,320	40,320	40,320	267,120
(Expenditures)													-
Administrative	(86,667)	(86,667)	(86,667)	(86,667)	(86,667)	(86,667)	(86,667)	(86,667)	(86,667)	(86,667)	(86,667)	(86,667)	(1,040,000)
R&D	(125,000.00)	(125,000.00)	(125,000.00)	(125,000.00)	(125,000.00)	(125,000.00)	(125,000.00)	(125,000.00)	(125,000.00)	(125,000.00)	(125,000.00)	(125,000.00)	(1,500,000)
Customer Support	(3,000)	(7,000)	(11,000)	(26,000)	(20,000)	(37,000)	(49,000)	(58,000)	(79,000)	(80,000)	(80,000)	(80,000)	(530,000)
Royalties	-	(1,740.18)	(4,060.42)	(6,380.66)	(15,081.56)	(11,601.20)	(21,462.22)	(28,422.94)	(33,643.48)	(45,824.74)	(46,404.80)	(46,404.80)	(261,027)
Selling	-260000	-200000	-370000	-490000	-580000	-790000	-800000	-800000	-800000	0	0	0	(5,090,000)
Net Cashflow	(473,155)	(408,178)	(570,881)	(689,040)	(741,260)	(973,614)	(950,122)	(926,743)	(916,277)	(68,048)	(65,727)	(65,727)	(6,848,772)

DocIT Business Plan for the MIT $50K Competition

Description of Business

DocIT is a telemedicine health services business connecting Rural Medical Practitioners (RMPs) in Indian villages with top-tier urban and regional hospital practitioners on a fee-for-service basis. It is a multi-tiered health services infrastructure for rural India, enabled by wireless technologies. DocIT will also sell related health insurance policies from national health insurance companies. According to a World Bank study, there are only 48 doctors for every 100,000 Indians, with the distribution of doctors skewed towards urban areas. DocIT is an effort to improve access to quality health advice for rural India at an affordable price, on a real time basis.

DocIT can be used via making a phone call from any telephone or via the Internet. No new technology or devices will need to be developed or deployed to enable DocIT. When a person is sick, they will consult an RMP trained by DocIT, who will then call DocIT to speak with a medical technician, who forwards the call to a specialist. While this business model is common in the West and in urban India, it is not yet prevalent in rural India, where treatment currently ends with the RMP. The exclusive tie with the RMP will ensure that he is an integral link in the chain. This is important because the RMP has an established local medical practice, can prescribe medicines, and can interact with the medical specialists in a professional manner. This link mitigates remote diagnostic liability issues and allows the doctors to use appropriate imaging technologies and pathological tests.

DocIT identifies critical cases that can be referred to hospitals for advanced treatment as the need arises. As partnerships with well-known area hospitals are vital to success, DocIT has partnered with Escorts Hospital in Faridabad - a district near New Delhi. Escorts is a corporate super specialty hospital with 250 beds and over 100 specialist consultants. Escorts has branches in other major north Indian cities and provides e-consultation services.

The Insurance Regulatory and Development Authority mandates that insurance firms must conduct a fixed percentage of their business in rural areas. Currently, the firms struggle to acquire rural customers and are willing to pay for assistance in doing so. DocIT aims to use its channel to enable insurance companies to acquire and service its clients thereby creating an additional revenue stream.

Opportunity and Market

The market for DocIT is potentially 640,000 villages. According to a 2001 census, approximately 700 million of India's 1,027 million citizens live in rural areas. These citizens are served by RMPs who charge a fee to their rural patients. RMPs are often not linked to the rest of the medical community, and do not have the means or the motivation to upgrade their knowledge. DocIT aims to bridge the critical gap in between rural and urban healthcare.

The DocIT program will be initiated in the 62 villages in the Faridabad district where Escorts Hospital is already running a social development and rural health care program. In five years, we will serve three-thousand RMPs in five states and eighty districts. DocIT will create a network of connected hospitals and franchisees across regions to improve quality of services.

Revenue sources for DocIT:
- A transaction fee each time practitioners call the service. This would be based on time of day of call and whether a GP or specialist was consulted.
- A small fixed franchise fee charged to practitioners. This fee would cover the basic training, regional hospital affiliation, health camps with DocIT experts, a newsletter, and conferences organized by DocIT.
- Customer acquisition fees from alliances with insurance firms.

Vishal has had experience pioneering a successful rural insurance product tied to a local hospital in India. The revenue sharing partnership with Escorts Hospital has been finalized, and negotiations have been initiated with two of the leading insurance firms in India.

Competition and Competitive Advantages

DocIT's competitors are RMPs not using the service and charity groups providing care. Practitioners not using the service will be slightly cheaper, but affiliation DocIT allows RMPs to provide better service with greater credibility.

The second group of competitors consists of charities which run "Health Camps" visiting villages. The problem with the philanthropic approach is that it cannot scale, as it requires stable financial support as it grows. We plan to partner with philanthropic organizations and corporations to build in a charitable component in our regular rural health camps.

There have also been several small scale telemedicine projects run in various parts of the country. These rural experiments have not been very successful due to a lack of training and infrastructural support in government hospitals. We aim to meet these challenges by providing training, collaboration opportunities with leading hospital chains and a dedicated organizational structure.

The main barrier to entry for future competitors will be a series of exclusive contracts with prominent urban Indian hospitals. As there is usually only one large hospital in each set of districts, we will be able to set up exclusive contracts in the areas that we serve. In order to concentrate our efforts, we will begin in a limited number of states in northern India. We are striving to create social value by implementing a model that can be observed by other organizations and replicated in other regions of the country.

Financial Prospects

We project that cash flow will become positive in third year (2008) of operations and that the cash flow will break even in the fifth year (2010) of operations. We project that we will need Rs. 300 Lacs ($6.6m USD) of financing, as that is our peak amount of debt. We will need Rs.175 Lacs ($3.85m USD) to begin work in 2006. The money will be spent primarily on training RMPs and constructing infrastructure. Socially-minded VCs will be sought to provide the capital.

Team

Ashok Mittal – Mason fellow at the Kennedy School, Harvard University. He is a senior government official with experience in rural, district, and state-level positions, and has worked in Faridabad. He currently serves on the boards of NGOs in the education and healthcare sectors.

Vishal Sehgal – Student at the Kennedy School, Harvard University. He has had over twelve years of experience in consulting, banking and IT with ICICI bank in India. He is an expert in structuring and implementing large scale ICT-based service delivery platforms, and has implemented several large e-government projects in rural India.

Adam Powell – Student at the Sloan School of Management at MIT. He is in the process of finishing a book examining the role of information technology in reducing the cost and increasing the quality of healthcare in America.

Board of Advisors

Dr Alex (Sandy) Pentland – Toshiba Professor of Media Arts and Sciences at the MIT Media Lab. He has extensive experience in creating technologies for use in developing countries, including India.

Dr. N.K. Pandey – Director of Escorts Hospital, Faridabad. He is the President of the India chapter of the International College of Surgeons.

S.N. Roy - Senior officer of the Indian Administrative Services and currently a Secretary to the Government of Haryana. He has held the position of Director of Health Services to the Government of Haryana.

Dr. (Capt.) M. Kamatchi - Retired Director of Medical Service of the Government of Tamil Nadu and currently a consultant to the World Bank. He has executed a telemedicine project for the Tamil Nadu Government.

As a diabetic and a physician, my father has had to cope with declining health while managing an increasingly challenging career. Watching him measure his glucose between appointments with patients made me realize how difficult it must be for the average person to cope with health-related problems. Consequently, I became determined to learn more about healthcare and its delivery. Since I've always been interested in technology, I began to think about ways in which technology could be used to help people cope with disease. During the beginning of my junior year at MIT, I designed NutraSpeed, a web application that enables individuals to measure their daily nutritional intake, in the hope that it might be a step towards decreasing the enormous obesity problem facing this country. Since I wanted to place this technology in the hands of real users, I spent the next term writing a business plan. However, I was pre-empted when the United States Department of Agriculture released a similar application in April 2005 (MyPyramidTracker.gov).

It is clear that many improvements to healthcare are based upon reducing costs and increasing quality. My senior thesis, <u>To Our Health: The Role of IT in Healthcare,</u> detailed how information technology could be used to positively impact both these domains. When I finished the first draft of my thesis at the end of last summer, I realized that I had enjoyed the evenings and weekends that I spent working on it far more than I had enjoyed working as a program manager at Microsoft. My thesis gave me the opportunity to help others while engaging in the activities that give me great pleasure: reading, synthesizing ideas, and writing.

This semester, I have been working on a healthcare application of information technology that involves organizational design. Along with Ashok Mittal and Vishal Sehgal, graduate students at the Kennedy School of Government, I have been designing a system for delivering healthcare to rural Indians. Since healthcare in India is of much higher quality in cities than in villages, we are constructing an organization that utilizes IT to link rural practitioners with urban physicians via telephony. This project has been a useful learning experience for me because I have had to consider how our design decisions will affect the cost and quality of healthcare that our clients receive. If we require physicians to charge for care by the minute, they may be motivated to work more slowly and take more time than is necessary. Alternatively, if physicians charge by the episode of care, they have the incentive to save time, at the expense of quality of care. I have found that small decisions in organizational design can have significant effects on healthcare.

While there are many sectors in which technological improvements can be employed to drive increased productivity, the use of these improvements in the healthcare sector is by far the most powerful for two reasons. First, the healthcare industry underutilizes technology, relative to other sectors. Second, errors in conveying medical information often translate into errors in the practice of medicine. While technological improvements in other sectors may improve the bottom line, technological improvements in healthcare can save lives as well.

I am applying to Wharton because its doctoral program in Health Care Systems offers the opportunity to continue to study how healthcare can be improved through managerial and technical change. Professor J. Sanford Schwartz's research in decision-making in the adoption of medical technology is highly relevant to my work on the improving medical care through information technology. Professor Sankey Williams's work in measuring the cost and quality of care received by hospitalized patients is also of interest to me, as I explored these topics in my thesis. In addition to its outstanding faculty, Wharton has excellent students with whom I would like to collaborate.

There is no business school with a better program in healthcare than Wharton. While most other schools may boast a professor or two interested in the area, Wharton is unique in that it has a dedicated department. The Leonard Davis Institute of Health Economics and the Wharton Center for Health Management and Economics both offer superb opportunities for studying the role of management in healthcare. Wharton's location is beneficial, as Philadelphia is near America's corporate and political centers. The University of Pennsylvania's well-regarded medical school enables potential collaborative research opportunities. These opportunities will be a great asset, as my interests overlap the disciplines of management, information technology, and medicine.

My father, like millions of other Americans, continues to suffer from poor health and the vagaries of the American healthcare system. As a doctoral student at Wharton and eventually as an academic, I intend to teach and to conduct research that will help people. I also hope to serve as a role model to others, and to be as helpful to students as many of my professors have been to me. I want to maintain the momentum that I have built and to continue the development of my research. I can do both at Wharton.

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