Marketing Study and Business Strategies of Web-based Integrated Health Information System

by

Tashan Yen
B.S. Civil Engineering
University of California - Los Angeles, 1994

Submitted to the Department of Civil and Environmental Engineering
In Partial Fulfillment of the Requirements for the Degree of

Master of Engineering in Civil and Environmental Engineering
At the

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June 2002

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Signature of Author

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May 13, 2002

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Chairman, Department Committee of Graduate Students

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Abstract

This thesis surveys the current state of U.S. healthcare industry and discusses issues regarding business strategies for a hypothetical startup vendor in the healthcare IT field. Key growth drivers and current industry trends are outlined to lay the foundation for the need of integrated health information system. Industry analysis using Porter’s Five Forces is performed to demonstrate the attractiveness of the Healthcare IT industry.

Thesis Supervisor: Professor John R. Williams
Title: Associate Professor of Civil and Environmental Engineering
Acknowledgement

The foundation of this work was laid during the initial phase of the E-Health group project and the result would not have been possible without the help and encouragement from my fellow teammates. So special thanks to the guys and gals: Sakda, Franny, Glori, Andrew, and Osamu.

Most of all I would like to thank my parents who have always encouraged me to learn.
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</tbody>
</table>
Chapter 1 – Introduction

The upcoming healthcare crisis has received much press in the media lately. One can rarely go through a major new paper without reading about items related to the dire strait that the industry is in. With this mind this thesis sets out to first examine the current state of the industry: market size, stakeholders, and key growth factors. Next the trends that shape the future of the industry are identified. Given these developments, this thesis presents the case on how a web-based integrated health information system can help healthcare providers meet these challenges.

Taking the hypothetical position as a startup vendor of integrated health information system, the thesis gives an overview of competition landscape and identifies the major players in this emerging field. A Porter analysis based on the five forces (rivalry, bargaining power of buyer, bargaining power of supplier, threat of substitutes, and barrier to entry) is performed to summarize the findings of the market research. Finally, issues concerning business strategies, such as target customer, business models, and partnership, are discussed with recommendations made to fit the profile and needs of a startup vendor.
Chapter 2 – Industry Profile

2.1 Industry Overview

Healthcare represents the largest single sector within the U.S. economy, with national health expenditures exceeding $1.4 trillion in 2001, up from $1.3 trillion in 2000. The 2001 total is projected to be about 13.4% of the nation’s gross domestic product (GDP), up from 12.2% in 1990, 8.9% in 1980, and 5% in 1960. According to the Health Care Financing Administration (HCFA) total national health expenditures are expected to increase to $2.6 trillion by 2010, reaching 15.9% of GDP (see fig.2-1). This projected growth is expected to average nearly 2% a year above the average gain forecast for GDP over the 1998 ~ 2008 period.

Fig. 2-1

U.S. National Health Care Expenditures
(in billions)
Currently, the $1.4 trillion national healthcare expenditures are being funded by a mix of public and private entities with the government paying 46% of the total outlays in 2000 (see fig. 2-2). The employer-funded private insurance constitutes 31%, self pay 18%, and charity 5%.

Fig. 2-2

Fig. 2-3 shows how the money is being spent. As indicated, hospitals take up the largest share at 33%, physicians’ service 20%, nursing homes 8%, and prescription drugs 8%. On a per capita basis this means a person in the U.S. spends an average of $4,597 per year on health care needs (see fig. 2-4).
### Use of Health Care Funds in 2000

![Pie chart showing the distribution of health care funds in 2000.](image)

Fig. 2-3

### National Health Care by Type of Expenditure and Payor, 2000

<table>
<thead>
<tr>
<th>Category</th>
<th>National Total in billions</th>
<th>Per Capita</th>
<th>Percent Paid</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Private</td>
<td>Medicare</td>
</tr>
<tr>
<td>Total</td>
<td>$1,310</td>
<td>$4,746</td>
<td>66.4%</td>
</tr>
<tr>
<td>Health Services and Supplies</td>
<td>$1,270</td>
<td>$4,597</td>
<td>65.3%</td>
</tr>
<tr>
<td>Personal Health Care</td>
<td>$1,162</td>
<td>$4,210</td>
<td>63.8%</td>
</tr>
<tr>
<td>Hospital Care</td>
<td>$432</td>
<td>$1,565</td>
<td>51.7%</td>
</tr>
<tr>
<td>Physicians' Services</td>
<td>$262</td>
<td>$949</td>
<td>72.0%</td>
</tr>
<tr>
<td>Nursing Home Care</td>
<td>$100</td>
<td>$360</td>
<td>37.4%</td>
</tr>
<tr>
<td>Other Personal Health Care</td>
<td>$368</td>
<td>$1,134</td>
<td>78.1%</td>
</tr>
<tr>
<td>Other Services and Supplies</td>
<td>$69</td>
<td>$251</td>
<td>70.3%</td>
</tr>
<tr>
<td>Research and Construction</td>
<td>$38</td>
<td>$139</td>
<td>--</td>
</tr>
</tbody>
</table>

Fig. 2-4
In 2001, according to government estimates, private sector health expenditures will grow at a faster average annual rate (7.2%) than the public sector (5.9%). This assumes that new Medicare prescription drug benefits will not be implemented. As a percentage of GDP, U.S. healthcare spending significantly exceeds that of other advanced economies, such as Canada (9.2% of GDP), Germany (10.5%), Japan (7.2%), and the United Kingdom (6.9%). Yet despite this incredible investment America continues to make health care, an astounding 15.5% of Americans (42.5 million) are without health care coverage altogether.

Meanwhile, physicians are caught between the desire for quality of care, on the part of patients and their doctors, and the desire for cost control on the part of payors, including HMOs, Medicare and Medicaid. The cost versus care debate has spawned an energetic movement to improve the quality of health care in the United States, much of it centered around patients’ rights.

### 2.2 Stakeholders

There are a number of stakeholders in the healthcare industry. They include: patients, providers (hospitals, ambulatory centers, physician offices, etc), payers (insurance companies, Medicare, Medicaid, managed care companies), professionals (physicians, nurses, clinical workers), pharmaceutical companies, professional organizations and associations, policy makers, politicians, researchers, educators, vendors and suppliers.
Each has a different set of priority and reacts to the dynamics of the industry with a
different agenda. However, it should be noted that significant variations exist even
within the same category. For example, as a patient, the foremost concern is to receive
the highest quality of care from the professional caregivers. The overall cost, if it is
covered by his employer through insurance, is normally not a great concern with the
exception of patient’s own out-of-pocket expenses for items such as deductible. On the
other hand, if the patient is self-employed then in addition to quality of care he would be
also concerned with the total cost of premiums and the level of health care coverage.

This industry is also unique in the sense that everyone will experience the role of patient
sometime in his life. From the prenatal care received prior to delivery, to the moment of
birth, to terminal care received at the point of death, everyone is personally touched by
the health care system.

2.3 Industry Growth Drivers

Key growth drivers include the aging of the baby boom generation, a trend toward less
restrictive managed care plans, and the introduction of new and expensive branded drugs,
medical devices, and surgical procedures.

2.3.1 Baby Boomer

The “graying of America” due to the large population of the baby-boomer generation is
projected to have a tremendous impact on the utilization of health care resources over the
next 25 years. The baby boom cohort will begin attaining age 65 in 2011; by 2026, about
64.4 million Americans (18.9% of the projected population) will be aged 65 or older. Also, with increased longevity more people are experiencing chronic illnesses such as cardiovascular disease and hypertension. Simply by living longer, this group of baby boomers is expected to place great strain on the health care system.

2.3.2 Managed Care

Although managed care deserves much of the credit for taming the rampant, double-digit health care inflation of the 80's and early 90's (health care costs jumped 11% in 1990 alone), the relief from rising medical bills that consumers enjoyed for several years is over, and increases in premiums have both HMOs and employers, especially smaller ones scrambling for counter measures. The shift to managed care seems to have run of magic in terms of lowering health care costs. While employers saw health coverage premiums increase only 2% to 4% annually from 1994 through 1997, costs have been soaring ever since. In 2000, small employers saw cost increases of as much as 15% to 20%, while larger firms suffered health benefit cost increases of 9% to 12%.

2.3.3 New Medical Products and Services

Part of the explosive growth in U.S. healthcare costs is due to the widely expanding array of medical products and services that have become available. For example, rapidly rising pharmaceutical costs have been a key factor. Total prescription drugs costs rose from $12 billion in 1980 to $110 billion in 2000. By 2010, drug costs are expected to more than triple to $366 billion.
2.4 Flow of Health Care Funds

2.4.1 Historical Context

In order to understand why health care industry is in the shape it is in right now, it is critical to examine the changes in the nature of the flow of funds in a historical context. The flow of funds in health care was much simpler in 1900 than it is today, at that time, only about 3 percent of gross domestic product (GDP) was devoted to medical services, primarily spent on doctor visits and drugs purchased directly in standard two-party transactions. Hospitals were small and cared for those too poor to be nursed at home, and thus were supported by charity. Fig. 2-5 diagrams the flow of funds in medical care in 1900; a large number of two-party transactions with a small but vital third party such as acting as intermediary and intervening to close the gaps. In the case of health care, that third party was most likely to be nonprofit charitable organization funded by donations, rather than a government agency funded by taxes.
2.4.2 Current Structure

As medical care becomes more expensive, the potential for cost of illness went from burdensome to overwhelming. This has dictated the shift from a predominantly individual payments scheme to third-party financing. By 2000, individuals pay only 18% directly (as compared to 83% in 1929) with the remaining 82% of funds flowing through third-party transactions involving government, non-profit charities, and insurance (see Fig 2-6).

Physicians, who in 1900 were considered tradesman, have become highly paid and technologically sophisticated professionals who rarely talk to their patients about paying the bills. Hospitals, once a minor support for a few disabled and disadvantaged, are now technological palaces of intensive treatment and the largest user of U.S. health care funds. Whereas in 1900 hospitals were financed with a few donors and some patient fees, they are now financed almost entirely by third parties: either by government insurance such as
Medicare and Medicaid or by private insurance provided through employment or purchased directly by consumers.

2.5 Healthcare Facilities

Although all stakeholders may eventually benefit from an integrated health information system, the place where such system would be initially implemented is inside a healthcare facility. Therefore, it is crucial to examine this subset of the healthcare industry to gain a better understanding of the players involved. The U.S. healthcare facility industry includes several distinct sectors that serve different areas of human healthcare needs. Included in this group are acute-care hospitals, rehabilitation hospitals (both stand-alone facilities and those attached to a larger facility), psychiatric hospitals, nursing homes, assisted-living facilities, and home healthcare services.

2.5.1 Acute-care Hospitals

Acute-care hospitals comprise the largest sector of the industry. There are nearly 6,500 facilities nationwide, which generate an estimated $400 billion in annual revenues. Propelled by an aging domestic population and ongoing advances in healthcare technologies, the sector historically has generated annual revenue gains of 4% to 6%. The number of hospitals continues to decline as consolidation activity among the for-profit and tax-exempt chains continues. The industry remains dominated by non-profit entities, which make up approximately 85% of the total.
**Largest Healthcare Systems -1999 (latest available)**
(ranked by 1999 net patient revenues, in millions of dollars)

<table>
<thead>
<tr>
<th>Chain</th>
<th>Type*</th>
<th>Net Patient Revenue</th>
<th>Total Hospitals</th>
<th>No. of States</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 U.S. Department of Veterans' Affairs</td>
<td>P</td>
<td>$20,709</td>
<td>172</td>
<td>50</td>
</tr>
<tr>
<td>2 Columbia/HCA Healthcare</td>
<td>FP</td>
<td>$16,700</td>
<td>207</td>
<td>24</td>
</tr>
<tr>
<td>3 Tenet Healthcare</td>
<td>FP</td>
<td>$9,958</td>
<td>130</td>
<td>18</td>
</tr>
<tr>
<td>4 Ascension Health</td>
<td>C</td>
<td>$5,486</td>
<td>70</td>
<td>16</td>
</tr>
<tr>
<td>5 Catholic Health Initiatives</td>
<td>C</td>
<td>$4,756</td>
<td>71</td>
<td>22</td>
</tr>
<tr>
<td>6 Catholic Healthcare West</td>
<td>C</td>
<td>$3,964</td>
<td>48</td>
<td>3</td>
</tr>
<tr>
<td>7 New York City Health and Hospitals Corp.</td>
<td>P</td>
<td>$3,692</td>
<td>11</td>
<td>1</td>
</tr>
<tr>
<td>8 New York Presbyterian Healthcare System</td>
<td>SN</td>
<td>$3,039</td>
<td>16</td>
<td>3</td>
</tr>
<tr>
<td>9 Mayo Foundation</td>
<td>SN</td>
<td>$2,775</td>
<td>18</td>
<td>6</td>
</tr>
<tr>
<td>10 North Shore-Long Island Jewish Health System</td>
<td>SN</td>
<td>$2,331</td>
<td>13</td>
<td>1</td>
</tr>
<tr>
<td>11 Sisters of Mercy Health Systems-St. Louis</td>
<td>C</td>
<td>$2,298</td>
<td>24</td>
<td>8</td>
</tr>
<tr>
<td>Los Angeles County Department of Health</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>12 Services</td>
<td>P</td>
<td>$2,239</td>
<td>6</td>
<td>1</td>
</tr>
<tr>
<td>13 Sutter Health</td>
<td>SN</td>
<td>$2,128</td>
<td>27</td>
<td>2</td>
</tr>
<tr>
<td>14 Catholic Health East</td>
<td>C</td>
<td>$2,063</td>
<td>33</td>
<td>10</td>
</tr>
<tr>
<td>15 Adventist Health System</td>
<td>OR</td>
<td>$2,045</td>
<td>29</td>
<td>8</td>
</tr>
<tr>
<td>16 St. Joseph Health System</td>
<td>C</td>
<td>$2,017</td>
<td>15</td>
<td>2</td>
</tr>
<tr>
<td>17 Marian Health System</td>
<td>C</td>
<td>$2,010</td>
<td>35</td>
<td>7</td>
</tr>
<tr>
<td>18 Catholic Healthcare Partners</td>
<td>C</td>
<td>$1,984</td>
<td>30</td>
<td>5</td>
</tr>
<tr>
<td>19 Providence Health System</td>
<td>C</td>
<td>$1,970</td>
<td>21</td>
<td>4</td>
</tr>
<tr>
<td>20 Mercy Health System</td>
<td>C</td>
<td>$1,969</td>
<td>20</td>
<td>2</td>
</tr>
</tbody>
</table>

*Types: P-Public, FP-For-profit, C-Catholic, SN-Secular not-for-profit, OR-Other religious.

Figure 2-7

**2.5.2 Nursing Homes**

Nursing homes provide residents with routine long-term care, including daily dietary, social, and recreational services and a full range of pharmaceutical services and medical supplies. As cost pressures throughout the healthcare industry have grown, nursing homes have converted segments of their facilities to provide subacute care, rehabilitation, or other higher-margin business lines. Many nursing home chains offer complex and intensive medical services to patients whose health problems are more serious than those of the typical nursing home resident. This market niche is called subacute care and
provides a cost-efficient alternative to general acute-care hospitals. The typical subacute-care patient has been discharged from an acute-care hospital, but is too sick to return home and needs continuous care. Some companies in this segment have converted a portion of a regular nursing home facility into platform for providing specialty subacute care. According to the Managed Care Digest Series/Institutional Digest 2001, the number of licensed nursing homes operating in the United States totaled 15,371 in 2000, up from 15,130 in 1999, while the number of nursing home beds rose fractionally, to 1,716,886 from 1,707,234. The number of beds in the nation’s largest 33 nursing home chains climbed 5.5% in 2000, to 489,953 from 464,354, and accounted for 28.5% of all licensed beds, up from 27.2% in 1999.

### Largest Nursing Home Chains - 2000
(Ranked by number of facilities)

<table>
<thead>
<tr>
<th>Chain</th>
<th>No. of Beds</th>
<th>No. of Facilities</th>
<th>Average Beds Per Nursing Home</th>
<th>No. of States</th>
</tr>
</thead>
<tbody>
<tr>
<td>Beverly Enterprises</td>
<td>59,963</td>
<td>541</td>
<td>110.8</td>
<td>30</td>
</tr>
<tr>
<td>Mariner Post-Acute Network</td>
<td>50,830</td>
<td>425</td>
<td>119.6</td>
<td>29</td>
</tr>
<tr>
<td>Integrated Health Services</td>
<td>40,096</td>
<td>335</td>
<td>119.7</td>
<td>34</td>
</tr>
<tr>
<td>ManorCare</td>
<td>40,046</td>
<td>296</td>
<td>135.3</td>
<td>31</td>
</tr>
<tr>
<td>Sun Healthcare Group</td>
<td>32,074</td>
<td>285</td>
<td>112.5</td>
<td>25</td>
</tr>
<tr>
<td>Vencor Inc.</td>
<td>36,288</td>
<td>281</td>
<td>129.1</td>
<td>31</td>
</tr>
<tr>
<td>Genesis Health Ventures</td>
<td>34,515</td>
<td>269</td>
<td>128.3</td>
<td>17</td>
</tr>
<tr>
<td>Life Care Centers of America</td>
<td>27,179</td>
<td>209</td>
<td>130.0</td>
<td>28</td>
</tr>
<tr>
<td>Evangelical Lutheran Good Samaritan Society*</td>
<td>16,674</td>
<td>204</td>
<td>81.7</td>
<td>25</td>
</tr>
<tr>
<td>Extendicare Health Services</td>
<td>17,920</td>
<td>169</td>
<td>106.0</td>
<td>13</td>
</tr>
<tr>
<td>Centennial Healthcare</td>
<td>10,996</td>
<td>103</td>
<td>106.8</td>
<td>22</td>
</tr>
<tr>
<td>National Healthcare</td>
<td>13,366</td>
<td>102</td>
<td>131.0</td>
<td>9</td>
</tr>
<tr>
<td>Texas Health Enterprises</td>
<td>10,942</td>
<td>99</td>
<td>110.5</td>
<td>4</td>
</tr>
<tr>
<td>Complete Care Services</td>
<td>9,998</td>
<td>89</td>
<td>112.3</td>
<td>4</td>
</tr>
<tr>
<td>Servicemaster</td>
<td>11,167</td>
<td>60</td>
<td>186.1</td>
<td>17</td>
</tr>
</tbody>
</table>

*Not-for-profit; all others are for profit.

Figure 2-8
2.5.3 Rehabilitation Hospitals

Rehabilitation hospitals provide programs for the rehabilitation of patients experiencing disabilities from a wide variety of causes, including stroke, head injuries, orthopedic problems, neuromuscular disease, and sports-related injuries. Services include physical therapy, sport medicine, neuro-rehabilitation, occupational therapy, respiratory therapy, speech/language therapy, and rehabilitation nursing.

2.5.4 Psychiatric Hospitals

Psychiatric hospitals typically provide structured and intensive treatment programs for alcohol and drug dependency problems and mental health disorders in children, adolescents, and adults. A treatment program usually integrates physicians and other patient-care professionals with structured activities, providing patients with testing, adjunctive therapies (occupational, recreational, the like), group therapy, individual therapy, and educational programs.

2.5.5 Assisted-living Facilities

Assisted-living facilities provide 24-hour supervision of their residents and assume responsibility for residents’ welfare. Their objective is to maintain or enhance residents’ ability to stay independent as possible in a homelike environment that offers on-site medical services. Services are provided largely to private-pay, long-term clients, but many states are developing regulatory structures to provide some assisted-living reimbursement under Medicaid. According to the National Center for Assisted Living, a group representing both consumers and the assisted living industry, the top 30 largest assisted-living chains reported a decline of nearly 5% in bed capacity during 2000, to
150,241, from 157,239 in 1999. The closure of facilities with low occupancy levels was responsible for the decline. Approximately 28,000 assisted living residence house 1.15 million people in the United States. The average facility contains 43 units and houses 40 residents, but the size of individual facilities varies greatly.

Costs for assisted living are also highly divergent, depending on the size of units, services provided, and location. The average monthly cost to live in an assisted living facility is $1,807. Eighteen percent of all assisted living facilities charge less than $1,000 in average monthly rent and fees, 49% charge between $1,001 and $2,000, 26% charge between $2,001 and $3,000, and 7% charge more than $3,000 each month. The majority of fees are privately paid. About 35 states reimburse, plan to reimburse, for assisted living or board and care as a Medicaid service. Medicare does not currently reimburse for assisted-living stays.

<table>
<thead>
<tr>
<th>Top 10 Assisted Living Chains - 2000</th>
</tr>
</thead>
<tbody>
<tr>
<td>(Ranked by number of beds)</td>
</tr>
<tr>
<td>Company</td>
</tr>
<tr>
<td>Number of Beds</td>
</tr>
<tr>
<td>-------------------------------------</td>
</tr>
<tr>
<td>Alterra Healthcare Corp.</td>
</tr>
<tr>
<td>Emeritus Assisted Living</td>
</tr>
<tr>
<td>Sunrise Assisted Living</td>
</tr>
<tr>
<td>Marriot Senior Living Services</td>
</tr>
<tr>
<td>Atria Retirement &amp; Assisted Living</td>
</tr>
<tr>
<td>Assisted Living Concepts</td>
</tr>
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<td>ARV Assisted Living</td>
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<tr>
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</tr>
<tr>
<td>Merrill Gardens</td>
</tr>
<tr>
<td>Manor Care</td>
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</table>

Figure 2-9
2.5.6 Home Healthcare Services

Home healthcare services focus primarily on respiratory therapy programs, which are designed to provide complete air support for patients suffering from a variety of respiratory ailments, including asthma, emphysema, chronic bronchitis, and cystic fibrosis. Many providers also offer complete oxygen systems, which involve liquid oxygen, concentrators, pressure cylinders, and portable units, as well as mechanical ventilators, apnea monitors for newborns, and continuous positive airway pressure (CPAP) devices for adults suffering from obstructive sleep apnea.

Another important category of healthcare/outpatient treatment is intravenous and infusion services. Such services include the delivery of nutrients intravenously or through feeding tubes and infusion therapies for patients with fully or partially dysfunctional digestive tracts. Also included in this category is the intravenous administration of various drugs: antibiotics, to treat infectious diseases; analgesics (such as morphine or Demerol), to treat the pain associated with chronic or terminal conditions like cancer or AIDS; and chemotherapy agents.

Some of these agencies are embedded within hospital chains. Despite ongoing consolidation activity, the home healthcare segment remains quite fragmented. According to Managed Care Digest Series/Institutional Highlights 2001, the total number of home healthcare agencies operated by the nation’s 36 largest home-care chains plunged 23% in 2000, to 2,121 offices from 2,756 in 1999. These large chains accounted for 16.2% of all home care agencies in 2000.
<table>
<thead>
<tr>
<th>Company</th>
<th>No. of Agencies</th>
<th>No. of States</th>
<th>No.of Employees</th>
<th>Average Employees Per Office</th>
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<td>43</td>
<td>14,076</td>
<td>53.5</td>
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<tr>
<td>Interim Healthcare</td>
<td>250</td>
<td>28</td>
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<td>6,147</td>
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<td>26.5</td>
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</table>

*Not-for-profit; all others are for-profit.

Figure 2-10
Chapter 3 – Industry Trends

In addition to the escalating cost pressures placed on the entire healthcare industry, the following developments are increasingly gaining influence on how healthcare will be delivered in the future: compliance with HIPPA, growing pressure to reduce medical error, emergence of integrated delivery system, and rising patient consumerism. The impact of each factor is discussed in the next few sections.

3.1 Compliance with HIPPA

Primarily enacted to protect health insurance coverage for workers and their families when they change or lose their jobs, the Health Insurance Portability Accountability Act (HIPPA) of 1996 contains confidentiality clause that requires the healthcare organizations to institute strong protection for patient’s personal health information. The regulations govern healthcare providers, managed care plans, clearinghouses, healthcare websites, pharmacies, and all other electronic, oral, and paper communications.

At the heart of HIPPA standards is an attempt to ensure certain protocols regarding patient consent, parental rights, marketing, medical research, and government access issues. The April 2003 deadline for HIPPA’s privacy regulation will keep the pressure on healthcare organizations to update their current systems and workflow practices to avoid be penalized by Department of Health and Human Services (HHS), the agency in charge of enforcing HIPPA.
HIPAA WILL CHANGE HOW HEALTH INFORMATION IS HANDLED

3.2 Pressure to Reduce Medical Error

In November 1999 Institute of Medicine (IOM) released its report “To Err is Human: Building a Safer Health System”. The report estimates that from 44,000 to 98,000 people die each year in the U.S. hospitals as a result of medical mistakes and the cost the healthcare exceeds $8.5 billion a year. Many of the preventable errors noted in the IOM report result from structural problems in the way hospitals and related healthcare institutions operate. As a direct response to this report, Leapfrog Group was formed in January 2000 by a consortium of Fortune 500 companies that had 20 million employees and $40 billion in healthcare expenditures to advocate stringent patient safety measures.
The idea is to leverage its member companies’ considerable purchasing power to influence the provider organization’s practice.

One of the initiatives advocated by the Leapfrog Group is the use of computer physician order entry (CPOE). To meet this standard, hospitals must require all physicians to enter medication orders through a computer linked through medication error prevention software; demonstrate that the system can intercept at least 50% of serious common prescribing error; require documentation by a prescribing physician of the interception prior to override; and must post a test case interception rate on a Leapfrog-designed website. With its enormous collective bargaining power, The Group is seen as an effective champion of medical safety.

### 3.3 Emergence of Integrated Delivery System

As efforts to push down costs in the healthcare system intensify, development of integrated delivery system is gathering steam across the nation. Theses systems typically comprise hospitals, physicians, managed care plans, and other providers that join forces to create a seamless delivery network. The goals are to improve medical outcomes, enhance the cost-effectiveness of healthcare services, more effectively manage patient care across the medical system, better deliver care under managed care contracts, and align the incentives of physicians, hospitals, and other providers in the system.
The most highly integrated systems either own or contract with three or more components of healthcare delivery, including at least one acute-care hospital, at least one physician component (a physician/hospital organization, independent practice association, physician practice, or physician center), and at least one other component (HMO, nursing home, home health agency, or surgery center). An integrated delivery system must also have at least one systemwide contract with a healthcare payor (employer, indemnity insurance, HMO, or government entity).

System development is occurring at many different levels. Large employer groups, hospitals, physicians, physician/hospital organizations, and HMOs are all pushing the process of integration. Hospitals, in particular, have been the driving force in the creation of networks. According to the Managed Care Digest Series/Institutional Highlights Digest 2001, 585 healthcare systems were in the process of integration at midyear 2000 (latest available). Several operating statistics published by the Managed Care Digest point to the effectiveness of integrated delivery systems. For example, the average occupancy at system hospitals in 1999 (latest available) was nearly 6% higher than at nonsystem hospitals (50.2% versus 44.4%), and the average length of stay was 4.8 days versus 5.2 days.

### 3.4 Rising Patient Consumerism

The Internet is dramatically changing the behavior of traditionally passive patients. According to a November 2000 study by the Pew Internet and American Life Project,
55% of people who access the Internet use it for gathering health care information. This places health care information use higher than online shopping, an activity reported by only 47% of web users. Study by other firms have shown that nearly one-half of people seeking online health information do so to research information on a specific disease, while many others are interested in educational services, prescription drug information, fitness and alternative medicine. According to the same Pew study, about 81% of those who searched for health care information on-line indicated that what they found was “useful” or “very useful”.

In 2000, eHealth Consumer reported that, among these online health data seekers, 83% use the Internet at least once daily. Their most common reason for turning to the Internet for health assistance is because a loved one has been diagnosed with a medical condition (40.1%), followed by an interest in changing personal dietary habits (26.3%), and being diagnosed with a chronic condition (22.1%).

The Internet is radically transforming the relationship between doctor and patient, since patients can obtain information not available from traditional sources. A Deloitte and Touche study reports that more than 66% of patients in the U.S. did not receive any informational literature while at the physician’s office and only a third received information about their medication. Consumers are now demanding the information necessary to make educated decisions regarding their medical care. The Internet has allowed patients to walk in their doctor’s offices with information in their hands that doctors did not know about or simply wouldn’t hand over in the past. Patients can also
obtain straightforward information from the web about their diseases. This empowering
of the patient forces physicians to treat the patient more like a partner. This is a
fundamental shift of knowledge from physician to patient, contributing to the rise of
patient consumerism.
Chapter 4 – The Case for Integrated Health

Information System

This section shall lay out the compelling reasons for the adoption of integrated health information system (IHIS) in a clinical setting such as a hospital. For the purpose of this paper, a bare-bone IHIS shall be defined as a web-based platform that aggregate data stored from different departments and provides rudimentary results reporting, clinical electronic medical record (EMR), nursing and physician documentation, physician order entry, clinical decision support and workflow support. A broader definition of IHIS shall include the desirable features such as physician/patient communication, patient direct scheduling, and personal electronic medical record.

To understand the need for an integrated health information system, one needs only to examine the common thread that lies under the proposed solutions that take advantage of all five recent developments in the healthcare industry as discussed in chapter 3. For a long time the industry operates primarily under the fee-for-service structure, a cost-based reimbursement scheme that encourages the use of medical resources. However, it was only recently that most of the players in the industry recognized that the economic basis of the industry has shifted from revenue generation to performance effectiveness. Coinciding with the Y2K upgrade phenomenon was a shift for the hospital from the top to the bottom line of their income statement. New reimbursement methodologies, the shift in risk by government and payors, the introduction and prosecution of payors and providers under the racketeering and collusion laws have changed the industry’s focus.
from the top to the bottom line. No longer to jam increasing amount of revenues through
the system, most participants have moved their focus to productivity measure and cost
containment in order to make a profit.

An integrated health information system can help resolve the margin squeeze by
increasing the operational efficiency through effective information sharing. The
elimination of duplicate data-entry, automation of tasks traditionally performed by
manual labor, and synergies achieved through successful collaboration among various
departments will help minimize the inefficiencies that plaque the industry. From a
provider's point of view, this means physician can access patient record without resorting
to opening multiple applications for a complete and up-to-date status of his patient. Less
wait time devoted to administrative tasks mean more time for the patient (see fig.4-1). In
addition to increasing quality of care and workflow efficiency, additional cost-saving can
also be realized by elimination of clerks that perform duplicate work and redundant
computer resources that support the operation of departmental systems. In a labor-
intensive environment such as hospital, administrative costs typically consume 45% to
50% of revenues, so any noted reduction in this department will improve the bottom line
significantly. Lastly, the consistent information viewed by users of different departments
should lead to reduced delays due to misunderstanding or contradictory information.
With the HIPPA-mandated privacy regulations about to take effect, a clinical information system based on paper, or in better cases, a conglomerate of departmental applications patched together, is a risky proposition for the hospitals to meet the new set of rules. Although by definition, the implementation of integrated health information system does not guarantee HIPPA compliance; all vendors have anticipated the upcoming change and build in the necessary feature sets to satisfy HIPPA guidelines. While it is possible to implement tactical fixes to bring the legacy systems up to compliance, this approach neglects the long-term competitiveness of the organization and can lead to potentially higher maintenance cost in the future.
Furthermore, as more and more healthcare entities tie up to form integrated delivery system, the need for a common set of clinical architecture and information exchange platform becomes ever more significant. The organizational integration necessarily entails certain amount of information integration. Without a common language, both at the presentation layer and business logic layer, unnecessary resources will be spent on bridging the gap caused by the disparity among each other’s systems. An integrated health information system can help standardize the vocabulary and reduce friction derived from incompatibility within the group’s IT structure.

Lastly, as patient demands more interaction with their caregivers, the ability to extend an existing infrastructure and share the clinical data with patients will prove invaluable. This will be less of a daunting task than configuring and custom-building additional interface for each legacy system. In an increasing competitive environment, the integrated health information system should prove to be an indispensable vector of differentiation for the hospital.
Chapter 5 – Competitor Analysis

5.1 Overview

It should be noted that despite all the advances in technology, only 5% to 7% of physicians utilize extensive electronic medical record keeping. Even more dreadful is the fact that less than 1 percent of all U.S. hospitals have an integrated health information system, i.e. few patients can walk into a clinical setting and expect all relevant information about them be stored in a digital, non-redundant fashion. This is in part due to the overwhelming autonomy enjoyed by the individual departments within a hospital in the past. Along with the autonomy came the desire to use only the best and the most sophisticated system for its own department. As a result, interoperability played second fiddle in this environment, even though everyone from the physicians down to the hospital administrators agreed on the benefit of flawless information sharing. The system vendors capitalized on such mentality by offering highly customized applications that were meant for efficient execution of specialized tasks within the department only. As a result, numerous vertical information silos were created within a typical hospital setting. Interfaces with other systems are often conducted semi-manually by running applications side-by-side and aggregating the results by hand.

However, the recent trend toward controlling escalating cost through reduction in inefficiencies has provided a significant impetus for hospitals to investigate the feasibility of an integrated health information system. Toward this end, hospitals can choose to either acquire such system from outside vendors or develop their own with in-house IT
staff. In the next section, a brief introduction to the current offerings available through outside vendors and some in-house developments is given. It should be noted that in this emerging field, no player has emerged as the dominant giant and all are moving to the web-based platform to reduce implementation cost.

Currently the vendors for the health information system market can be roughly divided into two categories: traditional enterprise vendors excelled in either building best-of-the-breed departmental application or automating the administrative and financial side of operation and are now branching into the clinical health information system, and relatively small players that specialize in clinical system and attempt to cobble together an integrated offering that addresses the administrative needs of hospital operation as well. The traditional enterprise system vendors are represented by firms such as McKesson and SMS. They are typically large in terms of revenue and offer their systems on proprietary platform that do not integrate with those of other vendors. In the pure clinical systems players, Cerner and Eclipsys stand out as the leaders of this emerging sector. In the following sections, a brief description of each firm’s offering and analysis of its relative strengths and weaknesses are outlined. Finally, in the in-house development category, Kaiser Permanente’s KPOnline has received the most publicity.

5.2 McKesson

McKesson continues to refine its 16-year-old STAR2000 health information system. The current version that came out in 2001 is Release 7.0. The core system includes functions
such as patient registration, scheduling, chart management, utilization management, and medical records administration. Optional clinical applications consist of radiology, laboratory, and pharmacy. The strength of its product derives primarily from its installed base of 1,000 hospitals. However, as in almost all cases researched, the hospitals run applications from other vendors within various departments; therefore do not have an integrated platform. Finally, the software run on non-ODBC-compliant database called Mumps but migration to Oracle or SQL Server is an available option.

5.3 Siemens Medical Solutions (SMS)

SMS’s offering in the clinical information system arena is NOVIUS Clinical Manager. Siemens is a well-known provider of outsourcing services. There is also a web portal called Dashboard. The portal currently offers functions such as viewing test results, adjusting physician schedule, emailing, and accessing clinical reference databases. However, no other transactional activities are supported as yet. SMS is also working on integrate the portal with NOVIUS Clinical Manager. Finally, NOVIUS supports iPAQ, which enables the physician to check schedules, messages, schedule and cancel patient appointment, submit lab orders, view patient history and allergy list. As the same case with other vendors in this market the installed base is small, with 18 installed and another 34 contracted.
5.4 Cerner Corporation

The portfolio of Cerner’s applications includes modules in acute, critical, cardiology, ambulatory, and emergency department settings. Its electronic medical record (EMR) offering is PowerChart which has the choice of being implemented individually, as application clusters, or as part of the full Cerner Millennium product line. The product is powered by either Oracle or DB2 relational database management system. It is marketed both as a client/server system and ASP solution. PowerChart supports enterprisewide patient record management, order entry by physicians and clerical staff, and results viewing. The optional Pocket PowerChart application allows clinicians to download selected information from PowerChart to handheld devices such as Palm V series and PocketPC-based iPAQ. Its main functions include patient lists, lab results, vital signs, current medications for selected patients, and radiology report.

Among Cerner’s strengths is the capability to interface its application software with numerous diagnostic devices and third-party software and communication systems. Cerner has installed more than 2,500 individual interfaces, including 200 for diagnostic equipment and 100 for healthcare information systems and departmental applications sold by other vendors or developed in-house by hospitals. By far the most serious limitation to implement Cerner’s PowerChart is its small number of client base for reference purposes: as of March 2002, only 51 instances of PowerChart have been installed. Another drawback for the hospitals already using other vendor’s clinical information depository or departmental systems is the need to implement yet another system interface when using PowerChart for management of its patient record.
5.5 Eclipsys Corporation

Eclipsys markets a suite of application along the Sunrise brand. The following application sets compose the Sunrise product line:

- **Sunrise Access Manager** – includes patient registration, an enterprise master person identifier (EMPI), surgery management, centralized bed management, access to Sunrise Chart Manager database, patient financial management for acute care, and work quality management.

- **Sunrise Clinical Manager** – knowledge-based order management, clinical pathways, clinical documentation, clinical data repository, and result review.

- **Sunrise Chart Manager** – chart tracking, transcription, electronic signature, medical record abstracting, and medical image viewing.

- **Sunrise Decision Support Manager** – clinical and financial decision support, product line management, contract management, budgeting, quality management, manager-balanced outcomes, and centralized dictionary management.

- **Sunrise ERP Manager** – materials management, surgery management, account payable, general ledger, and the UltiPro human resources and payroll system.

- **Sunrise Patient Financial Manager** – an enterprise person identifier, scheduling, bad debt and payer alert, registration and discharge planning, and patient accounting.

Sunrise is a blend of applications Eclipsys developed in-house, those it acquired from competitors, and products marketed by partner companies. By incorporating products marketed by its partners, Eclipsys attempts to fill the gaps in the Sunrise product line and
enhanced the functionality of existing applications. For instance, it uses Ultimate Software’s UltiPro to complement the human resources and payroll functionality of Sunrise ERP Manager.

Two drawbacks for the hospital to embrace Eclipsys’ Sunrise system are the lack of departmental applications and small installed base. Since Sunrise is primarily a foundation system that provides data repository, the hospital needs to purchase departmental applications or interface with legacy applications to address the needs of individual departments such as laboratory, pharmacy, or radiology. The small installed base may also hinder a hospital’s decision to adopt Sunrise. Since its introduction in 1998, Sunrise Clinical Manager has only been installed in 20 instances.

5.6 Kaiser Permanente

Kaiser recently launched a $2 billion initiative to use the Internet to serve its members more effectively. It chose to develop the pilot project with its in-house development team. The first version was released in 2001 and currently more than 100,000 of Kaiser's 8.2 million members log on to Kaiser's online patient services site, kponline.org, where they can consult a massive self-care database, request a non-urgent appointment, ask a nurse or pharmacist a question, or join a discussion group on one of a hundred health-related topics with other Kaiser members. Future offerings as listed on the website include online test results, interactive health education, preventive health prompts, live online scheduling, real time chat, provider-patient e-mail, and an online personal medical record
5.7 Porter Analysis

Given the competition landscape outlined previously, this section aims to summarize the industry and competition analysis using the Porter’s Five Forces approach. This commonly-used approach provides a framework in which an industry is evaluated through the examination of five critical forces: rivalry among existing firms, bargaining power of buyers, threat of new entrants, bargaining power of suppliers, threat of substitute products or services (see fig. 5-1).

![Porter's Five Forces Diagram](image)

**Porter's Five Forces**

*Fig. 5-1*

The result of the analysis is summarized as follows:

**Rivalry: Medium**

- Industry growth rate is high (expected to be 15% annually in the next few years) which results in lower competition among existing players.
• Industry is highly fragmented and rapidly consolidating which increases rivalry amongst existing players as significant economies-of-scales benefit larger players.

• Product differentiation & proprietary technology is high: suppliers offer different system functionalities (transactional, real-time, and integrated) protected by various patents, thereby decreasing industry rivalry.

• Concentration is very low (top 4 suppliers have less than 20% market share) and no player has a dominant position. This results in high competition for market share among existing players.

• Switching costs are very high resulting in high customer loyalty and decreased competition amongst suppliers.

• Exit barriers are moderate to low. Suppliers usually have limited investments made other than the R&D invested in the development and deployment of their technology. This reduces industry rivalry.

**Threat of Entry: Low**

• High government regulations (Health Insurance Portability and Accountability Act, etc.) resulting in decreased threat of entry.

• Proprietary technology is advanced and hard to develop which reduces the threat of entry.

• Low capital requirements to develop and maintain the technology infrastructure which increases the threat of entry.

• High learning curve (understanding the dynamics of the health care industry) which reduces threat of entry.
• Larger, established players (e.g. Siemens) have a credibility advantage, reducing the threat of entry from smaller, non-established players as well as the threat of entry from larger players with IT credibility (e.g. IBM) but limited IT experience in healthcare.

• Economies of scale are high and the industry is consolidating, reduces the threat of entry.

**Threat of Substitutes: Low**

• Buyer propensity to substitute is low as switching costs are very high and reliability crucial.

• Few potential substitutes to integrated IT systems exist, decreasing the threat of substitutes (most important substitute is predecessor technology which is non-integrative and non-transactional).

**Bargaining Power of Buyers: Medium**

• Individual buyer volume is high as suppliers typically do not have many buyers in this highly fragmented industry. Therefore buyers have substantial bargaining power as they represent a significant portion of their suppliers’ total revenues.

• Buyer concentration is low because many consumers exist with cumulatively low bargaining power therefore buyers are not price setters.

• Because integrated healthcare IT systems are very differentiated, there is no uniform pricing thereby decreasing bargaining power of buyers.

• Buyers do not have the ability to backward integrate, reduces buyer bargaining power.
• Substitute products are few, limiting the purchasing options of buyers and reducing bargaining power of buyers.

**Bargaining Power of Suppliers**

• Most of the components utilized in Healthcare IT systems are made with standard components which can be purchased from numerous vendors thereby reducing supplier bargaining power.

• Supplier concentration is low resulting in low bargaining power of suppliers.

• Threat of forward integration is low reducing supplier bargaining power.

In conclusion, the healthcare IT industry is attractive as it is a high growth industry with moderate rivalry amongst existing players, low supplier bargaining power, few existing substitutes and high barriers to entry. In addition the technological advances of the past decade as well as the expected future technological advances will increase the attractiveness of this industry as well as the profit potential of the players involved in it.
Chapter 6 – Business Strategies

6.1 Target Customer

Initially the target customer segmentation should be the for-profit hospitals that are part of a network system. The reasons are two fold: with a profitability mandate, those hospitals have the most incentive to cut cost and improve their bottom line, while the network should provide a good springboard for future sales to other sister hospitals within the network. Currently there are 883 for-profit hospitals out of 5890 (15%) all hospitals and 1327 hospitals belong to a network.

As the assisted-living market grows, however, the vendor for integrated health information system may also consider adding the features that facilitate the information exchange between patient and caregiver and market the product to the operators of assisted-living facilities. The resident of these facilities are primarily self-paid with the average monthly rent of $1,807. It is conceivable that the software vendor can package the software as a value-added service to enhance the appeal of the community. Since major hotel chains are beginning to leverage their experience in the lodging business to become active builders and operators of assisted-living facilities, they are a prime target for such alliance, as their community typically caters to the high end of the retiree population.
6.2 Business Model: ASP vs. Licensing

One of the most important issues for the software vendor to consider is the business model. Traditionally in the health care IT market, the enterprise software vendors have taken the licensing approach: charging an upfront fee for setup and configuration and an annual fee for the number of licensed “seats”. Often time a separate maintenance service contract is also purchased by the hospitals to address the needs of technical support during the year. For the software vendor the advantages of this approach are twofold: First, this method of implementation is familiar to the hospitals as buyers of software product and therefore alleviate the need to educate the conservative hospital CFO or other decision makers on the financing arrangement. Second, this method has the advantage of providing the vendor a significant amount of cash flow immediately following the sale of its product and enabling the company to use the periodic payments to fund normal operation expenses such as research and development. For a startup that starves for cash, the promise of steady cash flow to fund the daily operation is indeed quite attractive. This would be the ideal business model for a startup in integrated health information system.

In recent years, another mode of implementation has emerged as an alternative business model to the traditional licensing arrangement: application service provider (ASP). Essentially the hospital signs a service contract with the software vendor but does not purchase the applications software or server hardware. All data processing occurs at the vendor’s central processing site. Typically, the hospital transmits updated information to the processing site in real time over the Internet.
The ASP model offers the hospital one major advantage over the licensing arrangement: the reduced outlays in hardware and licensing fees means the hospital has more working capital to expend on other aspects of its operation. Although the relatively generous financial requirement may entice the hospital to enter a contract with the software vendor, the vendor needs to be aware of the fact that the burden to raise and maintain sufficient working capital is now shifted onto its shoulder. Numerous ASP providers underestimated such implication and have fallen victim to overly optimistic sales projection with insufficient working capital to carry the firm through the lengthy sales cycle.

Additionally, various variations off the two models exist as well, depending on the size and market strategies of software vendor. For example, a software vendor with ample resources may form an alliance with the hardware and networking vendors and offer a turnkey system to the hospitals. Turnkey purchases can be advantageous to small healthcare organizations whose information technology (IT) department is not large enough to implement and maintain a network or multiple networks. Since one vendor supplies all components, there is a single point of contact for all software and hardware failures. One disadvantage of turnkey systems for the hospital is little or no user customization of the applications software. Other disadvantages include the inability to leverage investment in existing hardware and the inability to take advantages of discounts from third-party suppliers.
6.3 Partnership

Assuming the vendor is a startup, it is recommended that the vendor of the integrated health information system forms a partnership with other major players to increase the chance of survival. During the research and development stage, it is highly recommend forming an alliance with a high profile hospital since the added credential and access to opinion leaders should provide the intangible assets that a startup lacks. Another alternative for partnership may be with the software platform vendor such as Microsoft or Oracle. As the firm matures and comes to a stage for extending into other geographical area, it may wish to consider forming alliance with local distributor to minimize the risk in lacking of local knowledge.
Chapter 7 - Conclusion

As illustrated in the previous chapters, today’s $20 billion healthcare IT market will continue to grow at a rapid pace in the foreseeable future for a number of reasons: favorable demographic trend, provider’s need to improve efficiency, and emergence of integrated delivery system. The regulatory environment favors this growth with the passage of HIPPA while the private sector’s push, as represented by the Leapfrog Group, to reduce medical error poses significant pressure on the providers to transform their practices. These trends together will place greater demand on the healthcare providers to improve the information sharing process and reduce inefficiency. However, today’s legacy systems are ill-equipped to provide a satisfactory solution. In order to answer these challenges, the providers need to implement an integrated health information system.

While there are many niche players in existence catering to specific needs of clinical information, the market for integrated health information system today is still largely fragmented with the top 4 players making up less than 20 percent of total market share. Based on the Porter Analysis, the stage is set for an ambitious startup to enter the field with an innovative product that can fulfill the need of the providers. With the right mix of features and pricing structure, the startup stands a chance to capitalize on this coming wave of investment in health care IT. However, the new entrant should be focused on its target customer and consider the appropriate business model. Finally, it should also
actively explore the opportunity to form alliance with other complementary players to
increase the chance of success.
Reference


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