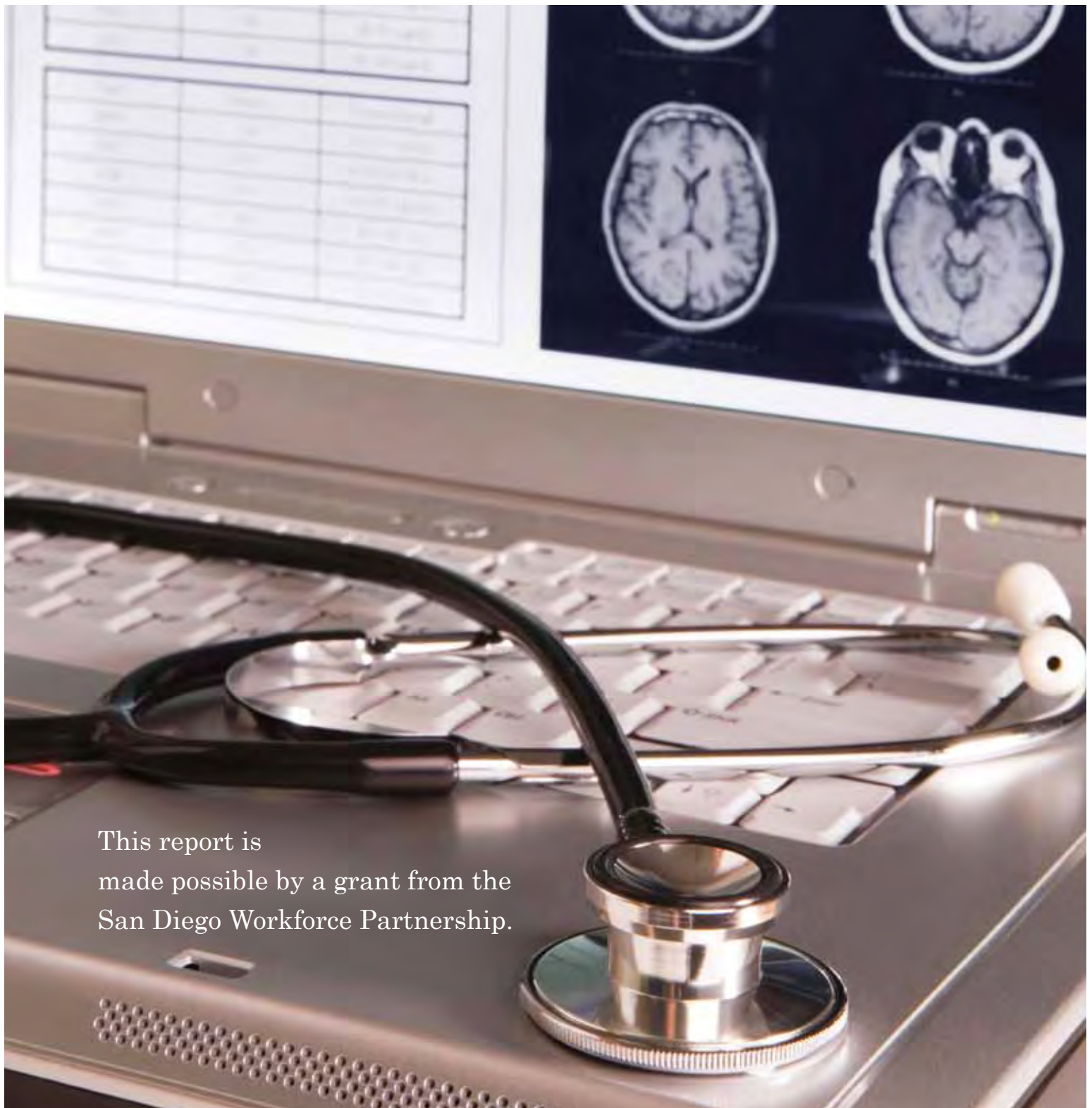


 UC San Diego | Extension

Healthcare IT Research Report 2011



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Healthcare Information Technology Research Team

From the San Diego Workforce Partnership:

- Chuck Flacks, M.P.P., M.S., Research Director

From UC San Diego Extension:

- Leslie Bruce, J.D., Director of Healthcare Leadership & Community Outreach
- Bruce Dunn, M.P.A., Associate Dean and Chief Administrative Officer
- Vicki Krantz, M.A., Director of Business, Science & Technology Programs
- Grace Miller, M.A., Director of Healthcare & Behavioral Science Programs
- Hugo Villar, Ph.D., Director of Life Science & Technology Programs

From Green LMI:

- Philip Jordan, Principal, BW Research Partnership

Funded by:



3910 University Avenue, Suite 400 San Diego, CA 92105

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Executive Summary

San Diego has clear potential to become an important hub in the field of Healthcare Information Technology (HIT). It is a leader in healthcare delivery, with 33 hospitals including representation from the military and veterans affairs, and extensive experience in managed care; ranked third in the United States in terms of concentration of life science companies; a center for over 50 research institutions; and home to an exceptionally capable technology community already leading the way in the convergence of wireless communications, commercial software solutions, and medical devices. San Diego is also the fourth largest county in the state in Information Technology employment¹ and home to wireless giant Qualcomm.

This report was commissioned by The San Diego Workforce Partnership (SDWP) to determine whether and how San Diego's HIT cluster can be strengthened and how to develop career pathways in this emerging field. Funded by a grant from the California Workforce Investment Board under their Regional Innovation Clusters of Opportunity program, this study was part of 10 statewide collaborative efforts in developing and understanding the labor market dynamics of innovative economic clusters. The study was conducted by the University of California (UC) San Diego Extension.

For the purposes of this report, healthcare information technology or HIT is the intersection of information science, computer science and healthcare. It deals with the resources, devices, and methods used to optimize the acquisition, storage, retrieval, and use of information in health and biomedicine. In turn, HIT is a combination of the information and communication technologies that are critical in healthcare delivery; from telephones to intelligent sensors and data mining, these technologies are pervasive through the entire healthcare workflow process from disease prevention to diagnostics, treatment, monitoring, and aftercare.

Methods

UC San Diego's Extension research team used both qualitative and quantitative techniques to understand the current state of the HIT sector and to assess its future. The project began with extensive one-on-one interviews with leaders in healthcare and technology. Then, based on these preliminary findings, an extensive phone survey was conducted to obtain detailed and specific data regarding HIT activity and expectations. Finally, a series of roundtables were convened to review the data and discuss their implications. In addition, Extension consulted leaders from the region's educational institutions to inventory their current offerings and understand their plans for creating additional curricula to help prepare students for careers in HIT.

Findings

As a region, San Diego is well ahead of much of the country in electronic medical record (EMR) adoption – the backbone of HIT. The Veteran's Administration and Department of Defense developed their own EMRs which the VA Medical Center San Diego and Naval Medical Center San Diego implemented long ago.

According to the Healthcare Information & Management Systems Society (HIMSS) Analytics' model of EMR Adoption,² Kaiser Permanente in San Diego and UC San Diego Medical Center have reached stage seven – the final step of meaningful use.³ Only 1.1 percent of the more than 5,000 hospitals in the HIMSS database of hospitals nationwide have achieved this level.³⁶



Sharp HealthCare has established its EMR system and will meet stage two requirements in 2011-2012. Scripps Health is well under way in deployment of its EMR systems - both ambulatory and acute care - and expects to meet meaningful use in accordance with the timelines specified by the federal Office of the National Coordinator for Health Information Technology⁴ (ONC). Rady Children's Hospital plans to finalize its rollout in 2011. San Diego's community clinic systems have also begun the journey toward EMR implementation and some are well underway. The only lag in EMR adoption is with smaller San Diego physician practices, where lack of incentives and financial/business risk, as well as reluctance to change traditional workflows stand as formidable barriers. In specialized areas where HIT can be of particular value, such as public health surveillance, mass casualty/disaster response, and telemedicine, San Diego is at the forefront of advancement.

From IT and engineering perspectives, critical barriers to HIT deployment, growth, and impact have largely to do with the issue of the transfer and exchange of patient data. EMRs have been developing for more than 30 years; yet, there are still no standards in place to ensure that different systems can talk to each other. Perhaps the most vexing problem is the lack of standards for information exchange at different levels - (1) internal communication with a common data repository, (2) information exchange across different organizations, and (3) exchange of information among pieces of equipment, which leads to the automation of other healthcare processes. San Diego is home to some of the key players in the race to define these exchange standards. A San Diego regional collaboration led by personnel from the UC San Diego School of Medicine was awarded one of 17 Beacon grants from the US Department of Health and Human Services in order to explore good practices to build and strengthen HIT infrastructure

and health information exchange capabilities. Once standards allowing some degree of information sharing have been created and deployed, the next stage will be the effort to exchange health information among different providers in a Health Information Exchange or through the Nationwide Health Information Network (NHIN)²³. Privacy and security of records are critical to this effort and San Diego's Beacon grant targets these issues as well. When standards for interoperability and information exchange are developed, significant opportunities will follow as new smarter medical devices may be developed.

During the course of the research, responses consistently affirmed the impression that the San Diego region, in particular, is well positioned to not only incubate new, successful companies in the HIT space, but also to change the way HIT is viewed. To-date, HIT strategies have primarily held a traditional view of entering patient and enterprise information into an EMR, to be distributed, mined and reported in various fashions by healthcare providers and insurers down the chain. The opportunity presented by aggressive use of medical devices and mobile- or tele-health applications, a strong-suit of San Diego entrepreneurs, suggests a method of "leaping" over the laborious conversion of existing processes, to allow data to be recorded, distributed, and applied without the need for central databases or physical intermediaries. Despite reluctance of many physicians to implement fully-automated EMR systems in their practice, for example, the acceptance of mobile technology and information sharing among physicians is widespread with physician adoption of smartphones at close to 80 percent, and tablets at 25 percent and rising.⁵ Likewise, automated data collection and analysis is where the healthcare industry is focusing to improve care, monitor patient compliance and free time for the providers. Devices are present at the most immediate point of care

(in some cases even more immediate than the physician or care giver). Their design and function is inherently based on the capture and interpretation of data from the patient. With the design of new care management and delivery processes, medical devices could ensure that data are captured, secured, distributed, and applied more rapidly and comprehensively than the common sequential and “bottleneck” processes of today.

Talent, Jobs and Workforce Development

With regard to current and anticipated need and opportunity for labor, the study found that HIT occupations could be categorized as follows:

- Digitization—those needs related to the definition, capture, storage, and security of information related to healthcare operations;
- Integration—the definition and application of policy, standards, protocols, systems, exchange, protection, and best use of patient and process information;
- Analytics—the organization, retrieval, application, adaptation, and examination of medical and institutional information for the purpose of improving healthcare outcomes;
- Business Support—related skills sets that are more general in nature, commonly organized as sales, administration, technical, and business development.

A more specific list of job functions/titles associated with each of these categories can be found in the body of this report.

San Diego has a strong contingent of employees working within the digitization function at present, while jobs in the integration, analytics, and business support areas are stable but growing at a slower pace. With regard to integration jobs, for example, according to the executive interviews, workflow analysis specialists with healthcare experience are particularly in short supply. To address this shortage, some healthcare systems are training healthcare workers familiar with the healthcare process to

become fluent in their IT systems. The research also found that software solution providers as well as consulting firms are in need of workers in this field. The skill set required for this function is higher than for digitization work, and the need will be substantial, but the total number of jobs eventually created is unlikely to be as high as the need for digitization. Additional demand will be present for analysts, project managers with training as clinicians, health communication professionals (e.g., coaches, consultants, trainers), and clinical workflow specialists.

By way of specific hiring estimates, an overwhelming majority of healthcare firms indicated that they expect the need for HIT skills in the workplace most likely to remain the same over the next year, while almost no firms expected it to decrease. At the same time, healthcare firms reported expected 12-month growth of 4.5%, far outpacing the general economy, as well as high expected turnover due to retirements. Of note, healthcare organizations reported little difficulty finding qualified applicants to fill their open positions. However, they also reported skill deficiencies across the board in understanding HIT systems. On the technology side of the sector, although San Diego technology employers with an HIT-focus make up only about 11% of the overall technology employment base, they are much more bullish than their traditional IT counterparts regarding future hiring. In fact, even after a rigorous outlier analysis, a conservative estimate from employer reporting is an incredible 62% growth over the coming year. Applying only the most conservative growth estimates, San Diego County technology firms should create between 370-450 jobs specific to HIT over the coming year.

Of importance, all the occupations identified require some post high-school courses and/or community college training (those often labeled as “Technician” level education), making them available to employees traditionally “left behind” (i.e. not holding four-year degrees) in the development of a highly technical industry sector. An abundance of HIT-related education exists at various levels throughout the San Diego region, starting with courses, certificates and Associate’s degrees in billing and coding (UC San Diego Extension, San Diego Mesa College, Cal State San Marcos and San Diego State University College of Extended Studies), and going as far as PhD

programs in Biomedical and Nursing Informatics (UC San Diego and National University). Most HIT-related programs offered by area not-for-profit educational institutions are certificate or Master's degree programs, which vary according to emphasis and target audience, e.g., nurses, other clinicians, IT or coding professionals. In all, information gathered about San Diego's workforce fits well with the idea that the HIT sector is in its emergent stage, since the majority of current and near-term job openings within health-care organizations fall within the Digitization category.

Conclusions and Recommendations

There are few significant barriers to the continued growth and development of the HIT sector in San Diego. In terms of commitment and attention to HIT as a solution for improved and more cost efficient healthcare, San Diego is as well developed as any region in the country, and more advanced than most. A wide variety of IT companies in the region dedicate a sizable portion of their business activity to the healthcare sector, and almost every part of the local healthcare industry boasts meaningful progress in implementing HIT solutions. This situation has resulted in a good growth path for local HIT jobs, although most new employment will be realized in relatively simple job functions such as the provision of IT services and the digitization of formerly manual records and reports.

One facet of the regional HIT picture that could limit the pace and quality of growth is the slow adoption rate of HIT by smaller physician practices. Accordingly, an initial recommendation is to:

1. *Help those physician practices and smaller healthcare systems that remain reluctant or unable to adopt HIT solutions by supplementing the tools that have already been made available by the State of California and the ONC. A variety of techniques are available to tackle this challenge are suggested in the body of this report.*

Other limitations to the continued and timely expansion of San Diego's HIT sector are of concern, but again, they are no greater concern here than in any other region, as assessed by the focus and efforts of national entities like the ONC. Issues such as interoperability of technologies, exchange of patient data between organizations, and capture and integration of disparate sources and types of information are all universal concerns that are being dealt with on a national scale, and local technologists and administrators are contributing in leadership roles. Likewise, a solid infrastructure and continued supply of research and capital, so critical to thriving business development in any growing industry, are as strong in San Diego as anywhere.

With regard to the supply of needed talent, local healthcare systems report few problems in obtaining qualified candidates for current job duties, and IT firms are likewise able to fill IT service positions. Competency requirements at the upper end of the job scale – managerial and scientific capacities – are also currently adequate to meet demand due largely to the strong base of talent at UC San Diego and the research mesa, as well as a vast array of biological and technological research and development firms already housed in San Diego. One notable exception to the otherwise satisfactory situation, however, mentioned frequently by employers, is the need for software engineers and project managers who understand the clinical environment. HIT is inherently interdisciplinary, and as such it demands professional-level talent that is equally competent in both the IT and healthcare disciplines – an asset in short supply at present. Accordingly, a second recommendation is to:

2. *Enable the creation of education and development programs that supplement foundational training in either IT or clinical fields with essential knowledge in the partnering field (e.g. IT professionals learn about the processes of health-care and healthcare professionals learn about IT practices).*

Despite the current success of HIT adoption and growth in San Diego, an almost universal message expressed by employers and workforce advocates during this study was to increase the pace and strength of the sector's development. Many individuals see San Diego as poised to leap ahead of competing regions in this industry, taking a leadership position that would provide dramatic economic and workforce gains, if a variety of appropriate actions were taken. Consistent with the expressions of employers and HIT leaders who participated in this study, and assuming a shared desire to accelerate the pace and influence of HIT development in San Diego, an additional recommendation is as follows:

3. *Create a trade group for the HIT sector — a coalition — which emphasizes San Diego's unique vision of HIT.* Consistent with this initiative, and at the direction of the coalition, undertake the following thrusts:

- *Promote San Diego aggressively as a national HIT hub, drawing more leading companies, talent and capital to the region;*

- *Consider creating and supporting a San Diego chapter of the national Healthcare Information Management and Systems Society (HIMSS);*
- *Expand the Beacon effort through additional local funding, projects and participation, and emphasize attention on overcoming inter-device and device-EMR interoperability issues;*
- *Advocate the preparation of many more workflow/process analysts, who not only interpret healthcare delivery and business methods as they currently exist, but also understand the unique approach that San Diego envisions with remote and mobile healthcare as driving solutions for decades to come;*
- *Monitor, measure, and report on progress of the HIT industry sector in San Diego on at least an annual basis.*



Introduction

Escalating health care costs coupled with an interest in reducing medical errors have focused the attention of healthcare providers, policy makers and the public on improving efficiencies, costs and outcomes in the U.S. healthcare system. On the policy front, many argue that Americans need a system that is high-quality, competitive, and responsive, with clear metrics of value. Such calls for change fuel the emerging field of Healthcare Information Technology (HIT); any effort to improve cost, quality and access in healthcare depends on the timely delivery of consistent, reliable and shared data.

San Diego has clear potential to become an important HIT hub for a variety of reasons. It is a leader in healthcare delivery, with extensive experience in managed care; a major life sciences hub; and home to an exceptionally capable technology community that is already leading the way in wireless communications, the development of commercial software solutions and medical devices. San Diego is also the fourth largest county in the state in Information Technology employment¹ and home to wireless giant Qualcomm. On the bleeding edge of research and development in this emerging cluster, over \$100 million from the Gary and Mary West Foundation funded the West Wireless Health Institute dedicated to “innovating, validating, advocating for, investing in and commercializing the use of wireless technologies to transform medicine.”⁶

San Diego’s region boasts 33 hospitals. Scripps Health, Sharp HealthCare, and Kaiser Permanente represent three of the region’s four top non-governmental employers with 40,000 employees and 7,300 medical staff and physicians. They provide over 7,000 licensed beds, 18 Emergency Rooms, and 6 Trauma Centers with total operating expenses topping \$5 billion. UC San Diego hosts the region’s only academic medical center, accounting for more than 500 beds, two Emergency Rooms, a Trauma Center and the region’s only Burn Unit. Additional local hospitals and hospital systems include the VA Medical Center San Diego, the Naval Medical Centers at Camp Pendleton and Balboa, Alvarado Hospital, Palomar Pomerado Health, Rady Children’s Hospital, Tri-CityMedicalCenter, FallbrookHospital and Paradise Valley Hospital.

There are over 7,000 active physicians in the region, 1,200 resident physicians (post medical school, 3-7 years), and 500 students attending UC San Diego Medical School. One-third of the physician population practice primary care and the other two-thirds are specialists.⁷



San Diego is home to 17 community clinic and health center organizations operating more than 130 sites in San Diego, Imperial, and Riverside Counties. These community clinics specialize in providing health care services to diverse communities with an emphasis on low-income and uninsured populations. They serve well over 700,000 individuals annually, providing over 2.2 million medical encounters a year.

UC San Diego sits at the hub of more than 50 research institutions, including The Scripps Research Institute (TSRI), many of which are helping to define the future in Health IT. This group of research organizations has already given rise to a vibrant biotechnology and medical devices industry, components of which will play a role in the HIT field. A leading firm that specializes in the convergence of healthcare and information technology is CareFusion, headquartered in San Diego with over 15,000 employees worldwide. In addition, there are a number of firms from small to large that are developing new methodologies and devices that could become significant in HIT.

This current report was commissioned by The San Diego Workforce Partnership (SDWP) to determine whether and how San Diego's HIT cluster can be strengthened and to determine how career paths might be established in these emerging industries. Funded by a grant from the California Workforce Investment Board under its Regional Innovation Clusters of Opportunity program, this study was part of 10 statewide collaborative efforts in developing and understanding the labor market dynamics of innovative clusters. The study is a result of an award to the University of California (UC) San Diego Extension. The request was to research the companies who are working with HIT in various forms, and identify barriers to their growth. Particularly, the focus was to include whether there will be a reliable supply of skilled workers, in both the near- and long-term, to enable them to grow their businesses and, in turn, grow the economy of the region.

UC San Diego's Extension research team used both qualitative and quantitative techniques to understand the current state of the HIT sector and to make predictions about its future. The project began with extensive one-on-one interviews with leaders in healthcare and technology. Based on these preliminary findings, the team conducted an extensive phone survey of both healthcare and information technology companies. Following the survey the team convened a series of roundtables with representatives from the employer, educator, and service provider stakeholder communities to review the data and discuss the future. Finally, the team gathered leaders from the region's educational institutions to inventory their current offerings and discover their plans for creating additional curricula to help prepare students for careers in HIT.

The most important finding from this research is that San Diego has every reason to aspire to becoming a leading region for the development and use of HIT. Leadership encompasses innovation, widespread application and effectiveness, commercial success, and, as is the focus of this report, enviable opportunity for the regional workforce. The challenge of achieving this leadership position begins with understanding the current HIT landscape and then defining a path to follow.

Background

The HITECH Act, built on a foundation laid by President Bush and signed into law in 2009 by President Obama, contains timelines and incentives for hospitals and physicians to adopt Electronic Medical Records (EMRs). EMRs are expected to improve the quality of care and eventually help reduce healthcare costs. That same year, the Office of the National Coordinator for Health Information Technology (ONC) projected the need for 50,000 workers to implement EMRs.⁸ While EMRs are just one component of Healthcare Information Technologies, these new regulatory requirements put them on the leading edge of a quiet revolution within the region's hospitals, clinics and doctors' offices.

One intent of the HITECH Act is to provide new impetus to the deployment of IT solutions in the healthcare environment. HIT efforts have been ongoing for several decades. In 1964, IBM worked jointly with Johns Hopkins University to introduce computer science in the delivery of healthcare. Indeed, their objectives were identical to those industries are pursuing today: seeking to achieve gains in efficiency, reduction in medical errors and containment of costs in the clinical setting. The different initiatives undertaken through the decades since then to advance HIT

solutions have been met with limited or no success and even with overt resistance. Part of this report identifies the barriers that existed and continue to limit deployment of HIT solutions. As the findings identify the different barriers for deployment, this report will pay particular attention to issues surrounding limitations in workforce availability. The particular challenges are framed on a national as well as a regional perspective.

For the purposes of this report, healthcare information technology or HIT is the intersection of information science, computer science and healthcare. It deals with the resources, devices, and methods used to optimize the acquisition, storage, retrieval, and use of information in health and biomedicine. In turn, HIT is a combination of the information and communication technologies that are critical in healthcare delivery; from telephones to intelligent sensors and data mining, these technologies are pervasive through the entire healthcare workflow process from disease prevention to diagnostics, treatment, monitoring, and aftercare. Figure 1 (page 10) further defines the environment of HIT.



Primarily because of time and fiscal constraints, the scope of the research for this report excludes from HIT the information technologies that are part of basic research that may take place in a hospital setting such as bioinformatics, genomic analysis, clinical research or pharmaceutical discovery and development. It also excludes equipment that is exclusively used for telecommunications. However, it does include new generations of smart medical devices that may acquire and communicate information, along with electronic health records and the methods used for mining data in all aspects of the clinical setting.

Because HIT is not new, professional associations and some technology providers are already well established. For example, HIMSS (Healthcare Information and Management Systems Society) and AHIMA (American Health Information Management Association) focus on providing global leadership for the optimal use of information technology (IT) and management systems for the betterment of healthcare. Commercial vendors that cater to a broad range of IT needs in the healthcare sector have been in existence for decades. Yet, despite all the activity that has surrounded HIT, adoption at a national level has been spotty and slow.

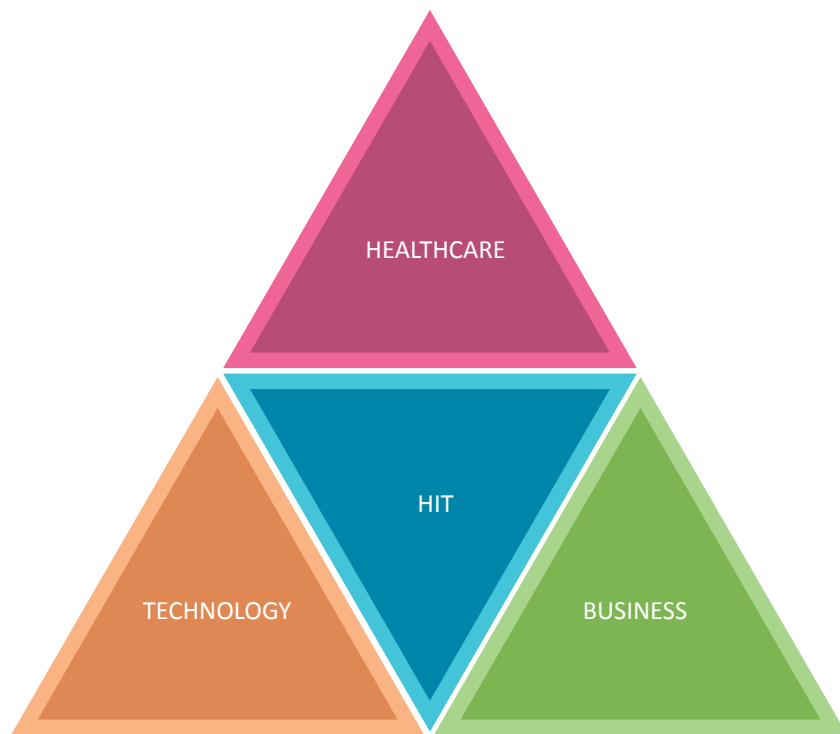


Figure 1: HIT occurs at the intersection of Healthcare and Technology. Business, Healthcare and Technology all contribute to this field. A large number of variables have to be considered to develop an accurate picture. For example, large and small healthcare providers are at different stages of HIT deployment. Business can be large established organizations, such as Philips or IBM, small, innovation driven organizations, or consulting firms providing a wide range of services. Finally, there is a wide range of technologies that come into play in HIT from smart medical devices, to off-the- shelf software solutions and their integration. This is a complex space that must be carefully dissected to understand via its multiple facets.

Methods

The project team began its research by conducting a series of fifteen executive interviews with area leaders in the healthcare, IT, and life science industries including industry associations, educational institutions, and employee groups relevant to the cluster. Executives (along with their organizations) participating in the interviews are listed in Appendix 1. The main goal of the executive interviews was to gather expert perspectives and to ensure that the research and subsequent survey questions were accurately focused on the issues and ways of thinking currently characterizing the cluster. The team also used this information to help identify the most relevant challenges facing this emerging cluster. For industry leaders, the interviews additionally examined how their businesses interface with the emerging sector, with a specific eye towards how they currently classify, recruit, and train their employees at all levels to conduct work related to HIT. For educational institutions, the team investigated their capacity to meet the near- and long-term training needs of the region through current and planned programs.

In the second phase of the research, the team conducted a survey of employers in the healthcare and information technology industries in the county. Fifty healthcare employers drawn from a representative, clustered, and stratified sample of regional medical providers were surveyed to determine their use of HIT and its employment impacts. The random sample of healthcare employers included large and small medical offices, hospitals, and private practices from throughout the county.

Similarly, the research team conducted a survey of San Diego IT firms to determine HIT incidence and to gather quantitative information on HIT development and implementation in hardware, software, internet, telecommunications, and networking industries. Two hundred and ten (210) firms were interviewed for the project, providing a representative sample

of firms by size, technology, and geographic distribution. Surveys were administered by telephone by Green LMI Consulting and BW Research Partnership, independent consulting firms, between January 20 and February 7, 2011.

Following the completion of the surveys, representatives from industry, technology and health science research, higher education, and community outreach, as well as health policy experts, at both the state and national levels, were invited to a series of three roundtable discussions. This select group of invitees included those with executive-level responsibility who are actively engaged in either the creation or use of technology improving healthcare delivery, recognized as “thought leaders,” and familiar with workforce and or policy challenges facing the cluster.

Each of the roundtable meetings, which were spread across three weeks, included between 15-20 attendees. They were organized around three major themes uncovered during the executive interviews and critical to the successful development of the HIT cluster in San Diego: “Workforce Development Issues - Gaps in Necessary Workforce Skills & Knowledge,” “HIT Interoperability Standards/Barriers to HIT Implementation & Expansion,” and “Technology Development and Future Trends for HIT as an Industry Sector.” The variety of viewpoints represented in the roundtable discussions was critical to understanding not just current market dynamics and trends, but also how jobs will be affected in the mid- and long- term by major developments in technology and/or changes in regulatory practices.

Finally, the research team conducted a focus group of ten educators from throughout the San Diego region to discuss current and planned HIT offerings. The discussion was wide ranging, from industry involvement in curriculum design to projected enrollment.

Findings

Since HIT operates at the intersection of healthcare and information technology, there is more than one perspective to the opportunities and challenges the field presents. Thus, three perspectives emerged: one from the healthcare sector; a second from the IT sector a the third from the medical device and wireless sector. Given that the national policies around healthcare reform and HIT adoption are critical to understanding the nature of regional HIT trends, the findings are presented in light of the national perspectives.

Barriers to Health IT Adoption

At a national level, there are many reasons that HIT has been slow to develop. For example, implementation of Electronic Medical Records (EMRs) has been perceived to be contrary to the economic interests of physicians. Physicians have traditionally been independent, for-profit businesspeople, working as solo practitioners or in small groups. The hospitals at which doctors have privileges are managed independently of the doctors' business. Still others – individuals, employers, insurers and the government – pay the bills.

Clayton Christensen, author of “The Innovator’s Prescription,”⁹ observes: “The U.S. system cost is fueled by a runaway reactor called fee-for-service reimbursement... [Thus] when caregivers make more money by providing more care, supply creates its own demand. By some estimates, a staggering 50 percent of health care consumed seems to be driven by physician and hospital supply, not patient need or demand. Those fighting for reform have few weapons for systemic change. Most can only work on improving the cost and efficacy of their piece of the system. There are very few system architects among these forces that have the scope and power of a commanding general to reconfigure the elements of the system.”

Like Christensen, many believe that by eliminating unnecessary services, physicians and hospitals earn less money. Some physicians’ associations claim that 91 cents of every dollar invested in EMR systems goes to the benefit of someone other than the physician – patients, insurance companies, hospitals, etc. It appears that there are not many market-based incentives for physicians to make the investment of money or time. During the executive interviews, Don Jones, Vice President of Business Development for Wireless Health for Qualcomm, observed that, “The biggest obstacle to EMR adoption by physicians is asking them to implement the solution, in other words change their workflow.” Clearly, federal monetary incentives will be insufficient given that technology adoption involves rethinking every facet of the provider-patient relationship. Until then funds for “meaningful use” of HIT will have to cover the costs of redesign and transition to make it worthwhile for the physicians.

The interviews with smaller-scale practices revealed further reluctance to adopt new HIT. In addition to the lack of perceived financial benefit, they are often overwhelmed with information from EMR vendors and consultants and do not know where to start or which product is best for them.

Ted Steuer, the Executive Director of Scripps Mercy Physician Partners, an independent practice association, indicated during the interviews that his 600-plus members are overwhelmed with EMR information. Steuer, along with Tom Gehring, CEO of the San Diego County Medical Society, agree that one of their greatest challenges is to get their members on the road toward “meaningful use” of EMRs.

The situation in San Diego is somewhat different for the healthcare sector than what was observed at a national level. Contrary to the national statistics where only 38.7 % of medical offices use EMRs, an adoption rate of 52.9% has been estimated for the total group of licensed physicians in San Diego.¹⁰ The San Diego adoption rate is even higher than the 48% EHR adoption rate for physician practices across the State of California.¹¹ A caveat to this estimate is that in many of San Diego's healthcare systems, "providers function in both the clinic and hospital, [so] it is difficult to determine the actual number of inpatient and outpatient providers and EHR adoption rates separately." In addition, Department of Defense physicians are not required to have a California license and not all licensed physicians currently practice.

Facing both the incentives and the penalties of the HITECH Act, physicians are adopting EMRs with large groups and independent practice associations leading the way. The adoption rate for smaller healthcare providers is significantly behind adoption by large providers. San Diego has, in fact, two tiers of adoption. Small providers are only somewhat ahead of the national average, while large providers are on par with the most aggressive adopters of HIT technology.

Some hospitals are equally reluctant to adopt EMRs out of concern for their bottom lines. Hospitals have become much more difficult to run because Medicare is eliminating reimbursement for hospital stays it deems too long and for preventable hospital readmissions. Therefore, hospitals need to both discharge patients sooner and prevent their readmission – both contrary to the hospitals' economic interest in a fee-for-service world. Nevertheless, in general hospitals have been much quicker to adopt EMRs than physicians. Bigger hospital systems have tended to hire more workers to implement EMRs, while smaller hospitals are more likely to outsource these projects.

The HITECH Act specifies seven levels of "meaningful use" for healthcare providers to meet according to a specified timeline in order to receive incentive payments and avoid future penalties. To be eligible for these Medicare incentive payments under the law, hospitals and physicians must use EMRs in a "meaningful" manner i.e., to exchange electronic health information to improve the quality of care, and to report on clinical quality and other measures.

As a region, San Diego is well ahead of much of the country in EMR adoption (see Table 1, page 14). San Diego has the largest population of retired military in the country with the Department of Veterans Affairs reporting that more than 260,000 veterans reside in the county.¹² The Veteran's Administration developed its own EMR which the VA Medical Center San Diego has long implemented, as has the Naval Medical Center San Diego. Kaiser Permanente in San Diego has reached stage seven – the final step of meaningful use - and UC San Diego Medical Center has reached stage six, according to Healthcare Information and Management Systems Society analytics. Less than five percent of hospitals nationwide have achieved these levels. Sharp Healthcare has established its EMR system and will meet stage two requirements in 2011-2012. Scripps Health is well under way in deployment of its EMR systems - both ambulatory and acute care - and expects to meet meaningful use in accordance with the timelines specified by the ONC. Rady Children's Hospital plans to finalize its rollout by in 2011. San Diego's community clinic systems have also begun the journey toward EMR implementation and some are well underway.

In its 2010 Beacon grant application to the ONC, principal investigator Ted Chan, MD, estimated that that 63 percent of all providers have achieved meaningful use EMR capability in either the outpatient ambulatory or inpatient setting.¹³

		AMBULATORY CARE VISITS		INPATIENT ADMISSIONS		
HOSPITAL/ HEALTH SYSTEM	ALL PROVIDERS	VISITS/YR	%EHR	ADMITS/YR	%EHR	EHR PROVIDERS
UC San Diego	1,360	520,491	98%	23,339	88%	1,173
Rady Children's	230	252,669	40%	15,104	6%	103
Sharp HealthCare	2,612	1,523,000	100%	70,302	100%	1,612
Scripps Health	2,414	1,627,000	20%	68,810	15%	800
VAMC	851	621,500	100%	6,820	100%	851
NMCS D	439	1,368,503	100%	18,9810	100%	439

Table 1: San Diego Beacon Community Clinical Partners: Sizes and EHR Adoption Rates

In addition to EMR adoption by providers, the region has developed an internationally-recognized Emergency Medical Services EMR in daily use in the pre-hospital setting.¹⁴ In San Diego, this EMR database has allowed for the creation of patient registries to target community case management for too-frequent users of emergency services, resulting in significant drops in utilization and cost.

According to the San Diego Beacon Collaborative, the community has also developed advanced health IT for public health surveillance and mass casualty/disaster response. UC San Diego and Sharp HealthCare are source nodes for hospital and Emergency Department syndromic surveillance, providing real-time patient data to the San Diego County Public Health agency and the CDC's Biosense project. Another partner in the Collaborative, California Institute for Telecommunications and Information Technology (CallT2) has developed advanced wireless informatics technologies for disaster response as a part of the NIH funded WIISARD (Wireless Internet Information Systems for Medical Response to Disasters) project utilized by the regional disaster response team.¹⁵

San Diego also has the benefit of many years of collaboration among providers, the most significant example of which is the Community Health Improvement Partners¹⁶. Known as CHIP, this consortium of hospitals, clinics and health-related nonprofit organizations is dedicated to measuring and improving the health of the population in San Diego. UC San

Diego Health Sciences has developed a telemedicine enterprise, *UCSDAnyWhere*, to provide telemedicine services of varying specialties to more than 30 partners to date. Related initiatives include outreach to international patient populations and expanding telemedicine to patients in their own homes. Equally beneficial to San Diego's strength in HIT, is its deep and broad experience with managed care. Managed care, traditionally marked by capitation reimbursement arrangements, requires providers to share risk with insurers, motivating both to collect and analyze data to improve care quality and efficiency.

Opportunities for Health IT Growth

Government agencies, as well as private sector initiatives, have attempted to provide incentives for HIT adoption that are likely to offer a cornucopia of opportunity for those who serve this area. At the same time, the healthcare environment is changing rapidly, with demands for greater efficiency and cost-reduction, thereby providing additional new opportunities for HIT-driven care.

Over the next few years, the U.S. market for electronic health records is expected to experience a compound annual growth rate of 18.1%, climbing from about \$2.2 billion in 2009 to about \$6 billion by 2015, according to a new report.¹⁷ The report predicts that federal efforts to expand EMR adoption will contribute to the projected market growth. In addition to government mandates, payers are likely to promote EMR adoption. Increasingly, hospital care is reserved for only the sickest, while more and more patients receive care in outpatient settings. This increases the opportunities for HIT. From hospice facilities to homes, healthcare information should be available in a timely fashion that is simultaneously conscious of privacy. Indeed, as Baby Boomers age, they are likely to remain in their homes, depending on wireless devices to monitor their vital signs and chronic conditions. This information will be automatically and electronically sent directly to designated clinicians using mobile phone technology. Hospitals will also use these devices, e.g. “peel and stick” disposable sensors to discharge patients more quickly and prevent readmissions.

As part of health reform legislation, Medicare has created the concept of the Accountable Care Organization (ACO)¹⁸, which is a network of healthcare providers, including doctors, hospitals, home health and hospice organizations that bands together on a voluntary basis to provide the full continuum of healthcare services for Medicare patients. The network is to receive a payment for all related care provided to a patient and will be held accountable for the quality and cost of care. Proposed pilot programs in Medicare will provide financial incentives for ACOs to improve quality and reduce costs by allowing them to share in any savings achieved as a result of these efforts.

As Medicare goes, so go the private insurers. Health plans now understand that they control the data but providers control the costs. Health plans are working to insure that appropriate data gets into the hands of providers in real time. With the proper information, providers can better coordinate and integrate care.

Currently, commercial insurers are forming ACO-like organizations of their own. Locally, Sharp Community Medical Group, Aetna and IBM are working

together to pilot a coordinated care model for the Preferred Provider Organization (PPO) environment. Health plans are widely recognized as owners of the broadest data sets. To support this effort, Aetna recently purchased Medicity, a company founded ten years ago to promote health information exchange among providers.

Also, Anthem Blue Cross has created Resolution Health to identify gaps in care and get the information back to the providers who can then provide care accordingly. Anthem is currently collaborating with Sharp Rees-Stealy, Sharp Community Medical Group and several other physician groups across the country to share data to improve care.

In addition to efforts by government and other payers, the public is also involved in furthering change. The public has embraced modern communication tools including email and instant web-access to information. Increasingly, patients want and expect to use web-based tools to make appointments and download information about their personal health histories. In fact, patients are increasingly interested in organizations offering Personal Health Records (PHRs.)¹⁹ PHRs are becoming available through different medical systems and through commercial operations such as Microsoft HealthVault.

Many providers are responding to this interest, as well as to the “meaningful use” requirements of the HITECH Act which require patient portals, by internally developing their own patient web portals.²⁰ Most large providers in San Diego provide this service to their patients, who can centralize their information, provided they use a single healthcare system for their medical needs.

Altogether, the adoption of HIT is likely to create a sea change in the delivery of healthcare. As information is more efficiently gathered and shared, providers, payers and patients are more likely to identify weaknesses in healthcare workflows. Workflows will be redesigned based on best medical practices or evidence-based medicine. This requires that the data gathered is analyzed comparatively within the organization and across different organizations to generate actionable information. Better information sharing capabilities can crystallize opportunities to

design a more effective workflow that, in the end, is expected to result in improved patient outcomes.

In the area of data gathering, many practices currently have systems for electronic data capture and smarter medical devices that capture data in real time. For data sharing and organization, improving EMRs and personal health records are some of the priorities. In addition, the area of knowledge generation and predictive analytics (i.e., the process of mining data to extract knowledge) is commonly referred to as Health (or Healthcare) Analytics. In the wake of healthcare reform, health plans are using healthcare analytics that make extensive use of data, statistical and quantitative analysis, and predictive models to drive better fact-based decisions. The emergence of healthcare analytics is enabling individual physicians, hospitals and insurers to uncover and share their best practices. Health analytics is one of the cornerstones of the development of guidelines that can result in evidence-based processes that may result in improved outcomes. Health analytics is also likely to feed the clinical decision support systems²¹ that will guide the physicians, nurses and other allied health providers in administering care.

Most of the physicians interviewed agree that workflow redesign offers the largest potential for cost containment. Among others, the ONC identified this as a key driver of success. In San Diego, we see this process occurring organically inside hospitals, one department at a time. Physicians may still be reluctant but they are aware that these efforts will result in higher levels of patient safety, quality outcomes and higher Medicare reimbursements. In addition, there is a push effect in the market as the emerging vibrant medical devices community needs to integrate its new technologies into existing workflow and IT infrastructure.

Barriers to Health IT Development

From IT and engineering perspectives, critical barriers to HIT deployment have largely to do with the issue of the transfer and exchange of patient data. EMRs have been developing for more than 30 years and yet there are still no standards in place to ensure that different systems can talk to each other. Perhaps the most vexing problem is the lack of standards for information exchange at different levels. Three types of issues came out of the research that relate to information exchange. First is internal communications, in which the different systems within a healthcare organization can contribute to a common data repository, the EMR. An example is the situation in which the physician has to be able to read, through a common interface, an X-ray or MRI, view lab reports, and provide a prescription to the patient, with each piece of information retrieved from a system developed for the host department. Imaging, nursing, pharmacy, etc. have their own electronic systems that need to be integrated. Each of those departments has developed its own standards that have to be harmonized often at great cost and complexity²² This issue makes integration of separate systems and devices within the same institution extremely difficult. This “Tower of Babel” also compels healthcare providers to purchase each new application from the same vendor to ensure that the lab system can interface with the billing system and the imaging systems, etc. within the same institution.

The second critical barrier to HIT adoption is information exchange - the challenge of exchanging information across different organizations. While some standardization may exist that allows the different components or departments of a single healthcare system to contribute to a common EMR, each healthcare system has its own sets of HIT capabilities that are usually not compatible with those of a neighboring healthcare organization. This situation presents yet another level of complexity regarding patient care. For example, patients who need portability of their records must get copies of existing records which are, in turn, duplicated by their next provider. Patients with a health issue while traveling may seek urgent care in a facility outside the system they normally attend. In this scenario, providers

should be able to exchange information promptly about the patient; although, most often they cannot.

Thirdly, there is the issue of exchange of information among pieces of equipment, which may lead to the automation of other healthcare processes. A clear example of how complexities of “interoperability” go beyond healthcare systems and affect ancillary industries is the case of medical equipment. Manufacturers of medical devices complain that their potential is blunted by their inability to connect with other systems. For example, a leader at Nuvasive, a San Diego manufacturer of spinal solutions (including surgical hardware and software), told us that their systems currently don’t connect to any others. In the operating room, monitoring equipment is kept in silos. Nuvasive is working to connect its equipment to the anesthesiologist’s data about the patient’s blood pressure, heart rate, etc. Providers and patients alike would benefit from pre- and post-operative information about the patient’s history and progress, etc., but such systems are not yet in place.

Another example of a company facing similar challenges is Alere, an *in-vitro* diagnostics firm with 1600 products distributed in 120 countries. Vice President Bob Parsons told us during the interviews that a large barrier to growth for his firm is the inability to integrate with hospitals’ customized systems. He argues that what is needed are national and global standards to make this exchange of information possible.

San Diego is home to some of the key players in the race to define these exchange standards. A San Diego regional collaboration led by personnel from the UC San Diego School of Medicine was awarded one of 17 Beacon grants from the US Department of Health and Human Services. The Beacon is not an interoperability project, but rather, a health information exchange project to share data in order to improve specific patient outcomes. After the initial national pilots, best practices will be identified from each of the programs and expanded to other hospitals and eventually to the entire healthcare community.

Once standards allowing some degree of information sharing have been created and deployed, the next stage will be the effort to exchange health information among different providers in a Health Information Exchange or through the Nationwide Health Information Network (NHIN)²³. The NHIN will enable the Centers for Disease Control and public health departments to study the health of populations and devise interventions according to the needs of specific regions, races, genders, etc. The ONC has stated that Clinical/Public Health Leaders will be needed “to achieve transformational improvement in the quality, safety, outcomes, and the value of the health services in the U.S.”

When standards for interoperability and information exchange are developed, significant opportunities will follow as new smarter medical devices may be developed. Qualcomm’s Don Jones lists as his division’s first priority: developing medical sensors and diagnostics that are either hand-held or disposable.



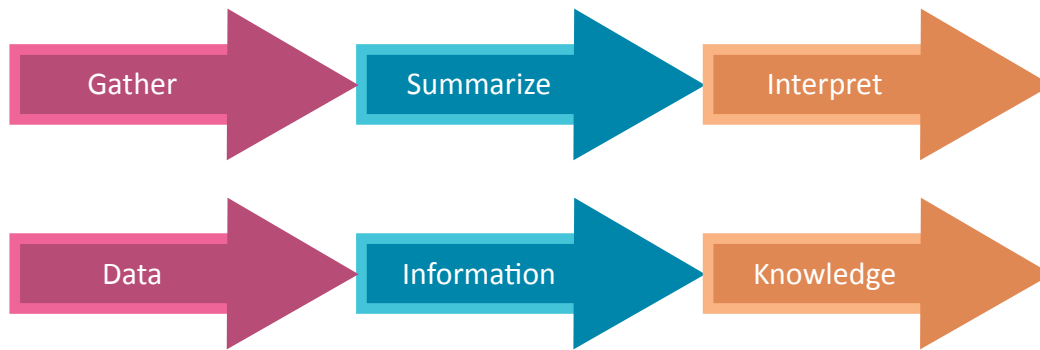


Figure 2: Basic paradigm of information flows. The flows parallel the requirements to satisfy meaningful use for the HITECH Act benefits.

Opportunities for Health IT Business Development

At a national level, business opportunities are developing and will follow the usual informatics paradigm: data is gathered; information is organized and shared; knowledge results from the system, enabling better decisions and predictions about the behavior of the system (see Figure 2). A substantial growth rate (more than 16%) of global HIT spending is expected to push EMR adoption across the world. It is estimated that the HIT market will exceed \$25 billion in 2015. EMRs are the major segment driving this market's growth. The rising demand for healthcare cost containment and the need to improve the quality of healthcare services are driving the growth of the worldwide EMR market. The global EMR market is expected to grow from \$4.355 billion in 2009 to \$9.957 billion in 2015, at an estimated Compound Annual Growth Rate of 14.9% from 2010 to 2015. These numbers are growing fast but they are only a small portion of the overall HIT market²⁴.

From GE to IBM to individual consultants, HIT growth is providing a good opportunity for new business creation nationally²⁵. While some of the components that form HIT have been in place for decades, others are still being defined. As an industry that operates at the intersection of Information Technology, Computer Science and Medicine, HIT faces challenges that are unique and that differentiate it from each of these parent industries. As the introduction of IT did for other sectors, HIT is likely to catalyze deep transformation of the healthcare system. The research shows that, despite its long incubation period, the industry is not yet fully defined. Its ramifications and the full impact of its benefits remain to be realized. San Diego is well positioned to do both: incubate new companies in the HIT field and also nurture them to become established leaders in the field.

The San Diego region, in particular, is well positioned to not only incubate new, successful companies in the HIT space, but also to change the way HIT is considered. To date, HIT strategies have primarily held a traditional view of entering patient and enterprise information into an EMR, to be distributed, mined and reported in various fashions but healthcare providers and insurers down the chain. The opportunity presented by aggressive use of medical devices and mobile- or tele-health applications, a strong-suit of San Diego entrepreneurs, suggests a method of "leaping" over the laborious conversion of existing processes, to allow data to be recorded, distributed, and applied without the need for central databases or physical intermediaries.

A recent study by IBM²⁶ found that although mobile health is already well-employed by patients with debilitating chronic conditions, a far larger group of “information seekers” are poised and ready to exploit this technology. Individuals who want to take an active role in managing their health view mobile devices as the only credible solution. Furthermore, devices that determine where the patient is and whether he or she has left an approved area will become standard of care for dementia patients. For patients with mobility problems, devices will check movement levels regularly to determine if the patient is having problems. They also will provide prompts for exercise and activities to help patients maintain flexibility and mobility. Mobile devices are attractive to health providers as well. Despite reluctance of many physicians to implement fully-automated EMR systems in their practice, the acceptance of mobile technology and information sharing among physicians is widespread with physician adoption of smartphones at close to 80 percent, and tablets at 25 percent and rising.²⁷

Likewise, the increased use of medical devices in every aspect of the care experience presents the opportunity for informatics in ways not reflected by traditional data entry and retrieval processes. Automated data collection and analysis is where the healthcare industry is focusing to improve care, monitor patient

compliance and free time for the providers. Devices are present at the most immediate point of care (in some cases even more immediate than the physician or care giver). Their design and function is inherently based on the capture and interpretation of data from the patient. With the design of new care management and delivery processes, medical devices could ensure that data is captured, secured, distributed, and applied more rapidly and comprehensively than the common sequential and “bottleneck” processes of today. Along with success in overcoming the interoperability challenge, the willing and successful introduction of new, complimentary approaches to work processes will be an essential ingredient to realize the potential of this innovative paradigm.

Out of the 10 largest publicly-owned companies headquartered in San Diego, five are life sciences companies, including Life Technologies, Illumina, CareFusion, ResMed and GenProbe. All these companies have a significant interest in integrating their products with the HIT efforts in different healthcare organizations. From medical equipment to diagnostics, most of their products involve the use of IT and its integration with data coming from healthcare organization. Qualcomm, the largest company by market capitalization, has identified HIT as an area of interest.



Don Jones from Qualcomm indicated during the interviews that in the EMR field, what has traditionally been seen as HIT is well established technology that needs “only to be deployed”. Without taking away from the effort and challenges it presents, deploying EMRs was, in his view, not much different from deploying word processing capabilities in the healthcare setting. Therefore it lacks the economic incentives for new entries in the field. He thinks that growth in terms of economic opportunity will come only from the growth of services supporting healthcare needs and the automation of processes. His viewpoint is that it would be possible to have con-

sumers defray some of the costs for new products and devices, thus bypassing some of the constraints of our reimbursement based healthcare system. Companies are being created with this mind set and his company is itself working on projects at the intersection of healthcare and IT (see Figure 3).

Over the decades, the 85 research institutes housed in San Diego have spun over 600 companies, largely in the life sciences field, from biotech, to genomics, diagnostics and medical devices. According to Duane Roth from CONNECT, the region has a history of merging technology with the biomedical industry

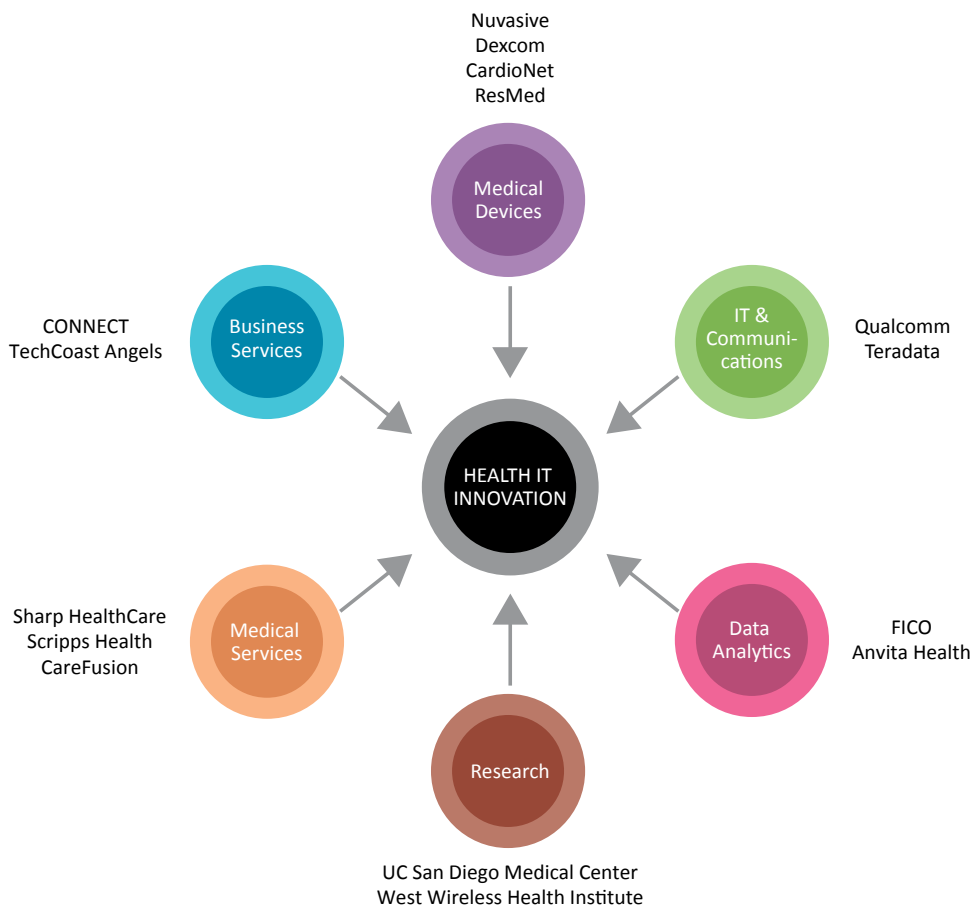


Figure 3: Innovation in HIT can be expected to occur at the interface between medical services and the industries that have traditionally been associated with emerging technologies in San Diego. The figure shows those industries and examples of local organizations operating in each industry cluster that have the potential to contribute to HIT innovation.

which is rooted in the merger of the defense industry, given our origins as a Navy town, and the UC San Diego emphasis in life sciences research. In the HIT field, San Diego is likely to continue this pattern of developing organizations that integrate IT, engineering and life sciences.²⁸

In each of these realms, companies large and small are developing new products and services. Michael Duich, of Philips Healthcare located in Carlsbad, California, offered this advice for high-school grads looking to get into medical devices: “Get a bachelor’s degree in mechanical, electronic or software engineering. An added Master’s in signal processing or systems engineering would be even more desirable. Then, gain an understanding of the regulatory environment. And, most difficult to do, but also highly desirable, is to get some work experience in a clinical environment.” Once you have a job, he further advises, “Avoid obsolescence. You’ve got to stay current with programming languages and be aware of the changing state of the industry, including regulatory and environmental issues. Also, do some long-term thinking about the life-cycle of these products.”

A characteristic typifying San Diego is what Michael Porter calls a “culture of innovation and entrepreneurship”.²⁹ Porter notes that innovation clusters tend to occur at the confluence of existing industrial nodes in a region. Because San Diego has strong players in medical services, medical devices, data mining/analytics, IT and communications, it is likely that HIT-related companies in the region will evolve at the interface between these existing industries. In addition, San Diego has a powerful ecosystem of organizations devoted to translational research and commercialization of new technologies, with particular emphasis in industries that mirror the many facets of HIT. Because of the areas in which these organizations operate, the HIT realm is a natural confluence of these capabilities. Any prospective survey of the HIT field in San Diego would be incomplete without due consideration of these areas. For example, the breadth and depth of the biomedical services industry in San Diego makes it a natural place for innovation and experimentation in HIT.

According to Porter, several additional factors are required to achieve the benefits of the “cluster effect” and these are in abundant supply in San Diego; they include a talent supply, research capabilities, capital and infrastructure.

Infrastructure: The *infrastructure* consists of business support organizations (law and accounting firms, as examples) that provide basic necessary services to HIT users and developers. The infrastructure also includes intermediary organizations, such as the Wireless Life Sciences Alliance³⁰, CONNECT,³¹ and BIOCUM,³² that foster interactions among industries and between industry and academia. The most obvious asset is the existence of an entrepreneurial community, which is ideal to further develop an emergent technology.

Research: Significant research remains to be done on all fronts, from devices for capture of information, to new analytical techniques to make appropriate use of information. Research centers of excellence will be needed to carry out this broad spectrum of activities, from the development of new devices to acquire information, to techniques for data analysis. Recognition has come, in part, in the form of an ONC Beacon award,³³ mentioned earlier.



Capital: The capital needed to develop this industry will come largely from four sources. The first source is large established organizations that may decide to fund research and development in areas they perceive to have potential for growth. An example is the effort that Qualcomm is placing in the wireless health arena which, although not their main business, is perceived as an area for growth. These companies could be in different industries but could also consist of some of the existing players in the HIT arena. Second, venture capital and angel investors will decide to gamble on some of the most creative and risky ideas. Third, healthcare industry payers will aim at developing resources and devices focused on controlling care costs. Payers include private insurers as well as government (Medicare). Fourth, healthcare systems will have to cover some expenses related to adoption and systems integration.

Investment from angel investors and venture capital, as well as from mature companies well established in their own markets (such as IBM, CareFusion, Qualcomm, etc.), provide the capital base to support the emergence of new industries. Because of the existence of a long history of entrepreneurship and innovation culture, San Diego has its own base with significant venture funds and angel groups located here. In addition, some established companies are

willing to invest in new R&D that may foster HIT related research. An example is Qualcomm's significant commitment to the area of Wireless Health. Medical device companies such as Nuvasive, Neurovigil and ResMed, among many others located in San Diego, have an interest in the HIT field and ideally, their devices should be integrated into the HIT arena. Several recent transactions show the importance that HIT is having for venture capital portfolios. As an example, Awarepoint, a wireless mesh sensor network for real-time tracking of patients, medical devices, and hospital equipment, raised \$9 million in December 2010 from top investing firms³⁴.

Because some of the funding for innovation is coming from private payers, one weakness to the development of a growth HIT industry in San Diego is the lack of payers headquartered here. Fortunately, while no major insurance companies have an analytics presence here, San Diego provider Sharp Health-Care is participating in some cutting edge pilot projects with insurers Aetna and Blue Cross.

Talent: for the industry to thrive and be sustainable, a prepared workforce is needed, as well as competent leadership that knows how to make new industries grow. Without the talent base, the industry cannot be sustainable, much less thrive.



Talent Needs and Job Opportunities

In the initial survey regarding today's current HIT workforce, San Diego employers were asked to describe their talent requirements in terms of skills and categories rather than job titles. For example, the LMI/Green research team asked companies to rate such things as the importance of technical competence in IT or knowledge of the healthcare industry in evaluating job applicants. Also they asked employers to estimate the impact of new HIT technologies on the job duties of such well defined roles as doctors, nurses, medical assistants, and billing clerks.

The results showed a significant increase in the demand for IT-related competencies and a distinct pattern emerged: The deployment of information technology in healthcare appears to be sequential, made up of three phases—1) data gathering, 2) information organization & sharing, and 3) knowledge generation and application—with each stage building on the previous one and, within each, demand for a very discrete set of skills. In addition, the entire deployment process is supported and sustained by

an infrastructure of related skills sets that are more general in nature. Within this framework then, jobs can be broadly divided into four areas: Digitization, Integration, Analytics, and Business Support. Not surprisingly, the list of job titles compiled by the federal Office of the National Coordinator (ONC) also fit well within these categories.

Digitization

Digitization jobs include those related to the definition, capture, storage, and security of information related to healthcare operations. Efforts to construct robust in-house EMR systems are a prime example of the sector activities likely to provide additional digitization-related jobs. To date, the greatest concentration of HIT workers in this category are working in large-scale healthcare systems or for the consulting firms that provide these services.



The types of jobs that fall into this category, including some job titles as defined by the ONC, are:

- Data entry
- Technical software and user support
- Health information management specialists
- Implementation support (project management) specialists
- Data formatting, control, and security
- Software and process trainers

Some engineering jobs also fall in this category, in particular for the development of smart medical devices, and other technologies focused on user interfaces and the capture of patient data.

Efforts in digitization are in full force. While large providers of medical services have already hired or contracted to satisfy this need, significant opportunities remain with small providers and will continue to exist for the foreseeable future in the commercial software development sector and medical devices industry. The job opportunities may be in the form of direct hires or expert consultants working as independent contractors.

Integration

Jobs falling within the integration category relate to the definition and application of policy, standards, protocols, systems, exchange, protection, and best use of patient and process information. Federal support of regional information exchanges and intra-industry efforts to define cross-system data exchange standards are examples of activities likely to provide workforce opportunities as the HIT sector enters its next growth phase.

The types of jobs that fall into this category, including some job titles as defined by the ONC, are:

- Exchange/integration analysis
- Workflow and information management redesign specialists
- Output monitoring and reporting
- System/network mapping and management
- Public health information privacy and security specialists
- Exchange system implementation and operations managers
- Exchange policy and standards development and management
- Patient information security and control

This is the area where research revealed most clearly the acute need for people who can bridge the gap between the IT and healthcare worlds, and who can navigate both comfortably. According to the executive interviews, workflow analysis specialists with healthcare experience are in short supply. To address this shortage, some healthcare systems are training healthcare workers familiar with the healthcare process to become fluent in their IT systems. This approach may successfully address the workflow analyst shortages, but consequently not increase new related job openings in the short-run. The approach may also increase existing shortages in other clinical occupations, such as nurses, radiology techs and other personnel devoted to healthcare delivery. The research also found that software solution providers as well as consulting firms are in need of workers in this field. The skill set required for this function is higher than for digitization work, and the need will be substantial, but the total number of jobs eventually created is unlikely to be as high as the need for digitization.

Analytics

Jobs related to analytics include the organization, retrieval, application, adaptation, and examination of medical and institutional information for the purpose of improving healthcare outcomes. Initial application in primarily research-oriented settings of biomedical informatics, decision support tools, and public health protocols are examples of efforts to fully realize the potential of HIT.

The types of jobs that fall into this category, including some job titles as defined by the ONC, are:

- Clinician or public health leader
- Research and development scientists
- Data mining specialist
- Decision tool developers
- Health IT technical and clinical sub-specialists

These are usually highly skilled individuals, typically holding MD or PhD degrees. Although there are currently fewer individuals with these skills than will be needed, the eventual number of the overall workforce is likely to be small. In addition, there will be jobs in this area for skilled IT or data management professionals, who can help in the implementation and use of some of the tools required by data analysts. These positions are few and highly skilled, commanding high salary levels.

Business Support

The creation of new business to support the field cannot be done without appropriate business support personnel. From survey responses, the business needs identified were, in order of importance: 1) business development, 2) sales, 3) administration, and 4) technical staff. Surprisingly though, in the same survey, employers also reported that they expected the greatest growth in the next year (2012) to be in reverse order, citing the following occupational categories (again, in order of importance): 1) technical, 2) administrative, 3) sales, and 4) business development. The personnel in these categories are likely to have some unique characteristics. For example, even though the number of the sales workforce in general is large, these particular individuals will have to know how to serve the healthcare sector and be conversant with their product lines, which can be quite technical in nature. Business development personnel will need to meet similar requirements.



Interviews with leaders within the San Diego HIT space, as well as roundtable meetings with key sector stakeholders, produced data suggesting some specific business support occupations likely to be in high demand such as:

- Skilled end-user coaches and consultants
- Software/system installers & system maintenance technicians
- Sales and marketing professionals skilled in wireless and mobile health devices

Educational Preparation

Of importance, all the aforementioned occupations require some post high-school courses and/or community college training (those often labeled as “technician” level education), making them available to employees traditionally “left behind” (i.e. not holding four-year degrees) in the development of a highly technical industry sector. The research relied on several community partners, especially the San Diego Futures Foundation, the San Diego Community College Regional Occupation Deans Consortium, and the National Veterans Transition Services,



Inc. which provided context and advice in examining this important question. Information gathered about San Diego’s workforce fits well with the idea that the HIT sector is in its emergence stage, since the majority of current and near-term job openings within healthcare organizations fall within the Digitization category.

Among those who hope to serve the industry with new technologies – specifically the medical device and wireless companies – participants at roundtable sessions suggested that there are already shortages of software engineers and programmer analysts; there is also growing interest in behaviorists whose talents are needed to make new devices user friendly. Throughout, the importance of software developers is critical. Each of the interviews with executives at medical device and wireless firms yielded the same complaint: “There is already a shortage of available, qualified talent in key occupations, and, in particular software engineers whose talents are key to creating off-the-shelf solutions for both healthcare providers and payers...”³⁵

With regard to the healthcare delivery side of the industry, survey data indicate that, according to regional healthcare employers, the HIT occupations in most demand in the healthcare sector are likely to be information workflow and management specialists, health IT systems support specialists, and technical support staff. Additional demand will be present for analysts, project managers with training as clinicians, health communication professionals (e.g., coaches, consultants, trainers), and clinical workflow specialists, all of which require a specialist (or college level) education.

As suggested previously, data collected in the present study suggest that occupational opportunities are emerging in both the Exchange and Analytics categories, although to a lesser extent than Digitization.

Regional Workforce Development

The sustainable growth of the HIT industry will largely depend on the availability of well-trained personnel. Current EMR deployment related training needs, except for perhaps baccalaureate degrees in HIT, are being met but additional shortfalls are foreseeable as the healthcare industry moves into the next phases of data analytics and health information exchange.

An abundance of HIT-related education exists at various levels throughout the San Diego region, starting with courses, certificates and Associate's degrees in billing and coding (UC San Diego Extension, San Diego Mesa College, Cal State San Marcos and San Diego State University College of Extended Studies), and going as far as PhD programs in Biomedical and Nursing Informatics (UC San Diego and National University respectively). See Appendix 2 for a summary of HIT-related educational programs in San Diego. Most HIT-related programs offered by area not-for-profit educational institutions are certificate or Master's degree programs, which vary according to emphasis and target audience, e.g., nurses, other clinicians, IT or coding professionals. It is notable that, for now, no baccalaureate programs exist specifically in HIT, possibly because of the time it takes to get new baccalaureate programs approved. It is yet unclear as to whether there is a need for such programs or whether students are equally or better served with allied health, IT, engineering or other bachelor's degrees.

Workforce development should also be considered in light of the four functional categories described above: digitization, integration, analytics, and support. Additionally, it is important to distinguish the supply- and demand-side opportunities. These opportunities are best thought of as end-users and implementers at healthcare organizations, and integrators and developers at technology firms. Though the national framework is important, determining the specific needs within the region in these ever-changing innovative industries can be challenging and a one-size-fits-all approach will lead to significant obstacles.

Healthcare Employer Needs

The survey of over 50 healthcare organizations in San Diego reports a strong adoption of HIT systems already underway (62% currently use HIT and another 12% expect to have their systems online within the next year). This large adoption rate suggests that the HIT end-user workforce (with large employers at least) is stable and beginning to mature. In fact, respondents indicated that 54.2% of their employees spend at least half of their time using HIT systems. Similarly, firms reported that 51.9% of their employees require at least some HIT skills.

When asked to provide open-ended responses to the types of employees that require HIT skills, organizations identified administrative positions, managers, medical assistants, and coders as the workers most likely to use HIT. Figure 4 (page 28) compares the types of healthcare employees requiring HIT skills.

An overwhelming majority of healthcare firms indicated that they expect the need for HIT skills in the workplace most likely to remain the same over the next year, while almost no firms expected it to decrease. At the same time, healthcare firms reported expected 12-month growth of 4.5%, far outpacing the general economy, as well as high expected turnover due to retirements.

Of note, firms reported little difficulty finding qualified applicants to fill their open positions. However, they also reported skill deficiencies across the board in understanding HIT systems. This finding strongly suggests that HIT education and training, from the end-user perspective, should be focused on including supplemental, contextualized HIT courses within existing curriculum.

Implementers are also clearly important to healthcare organizations. These workers comprise the internal or external IT staff at a medical office, for example. Implementers are tasked with the day-to-day operations of systems, including email, net-

works, security, and device management. Though they perform functions that are quite similar to their counterparts in non-healthcare settings, there are several important differences, particularly around understanding the healthcare system and “learning the lingo” so as to be able to converse appropriately with clinical staff. Figure 5 (page 29) illustrates the most important skills reported by employers for HIT workers.

Overall, healthcare organizations expect rapid growth over the next year in HIT workers, 7.8%, perhaps due to the lower than expected rate of outsourcing. (Seventy-three percent perform HIT functions in-house.) From an occupational standpoint, firms stated that the three most important HIT occupations in the healthcare sector are Information Workflow and Management Specialists, Health IT Systems Support Specialists, and Technical Support Staff (including maintenance of software for HIT applications).

Information Technology Firms

The research encompassed over 200 surveys of San Diego IT firms, including hardware, software, internet, networks, and communications companies. The sample was representative of the region by size, geography, and technology. The findings illustrate that the HIT development landscape in San Diego is small but growing, as well as diverse.

There are an estimated 3,955 IT firms in San Diego County, which employ nearly 117,000 workers. Approximately eleven percent (11.3%) of these firms, or an estimated 448 companies, are involved in the development, deployment, sale, installation, or maintenance of HIT systems in the county. Another 5%, or 195 firms, are considering entering the HIT space in the near term. It is important to note, however, that these figures do not account for new firms that will be created over the coming year; rather, they indicate how many existing firms plan to develop HIT solutions.

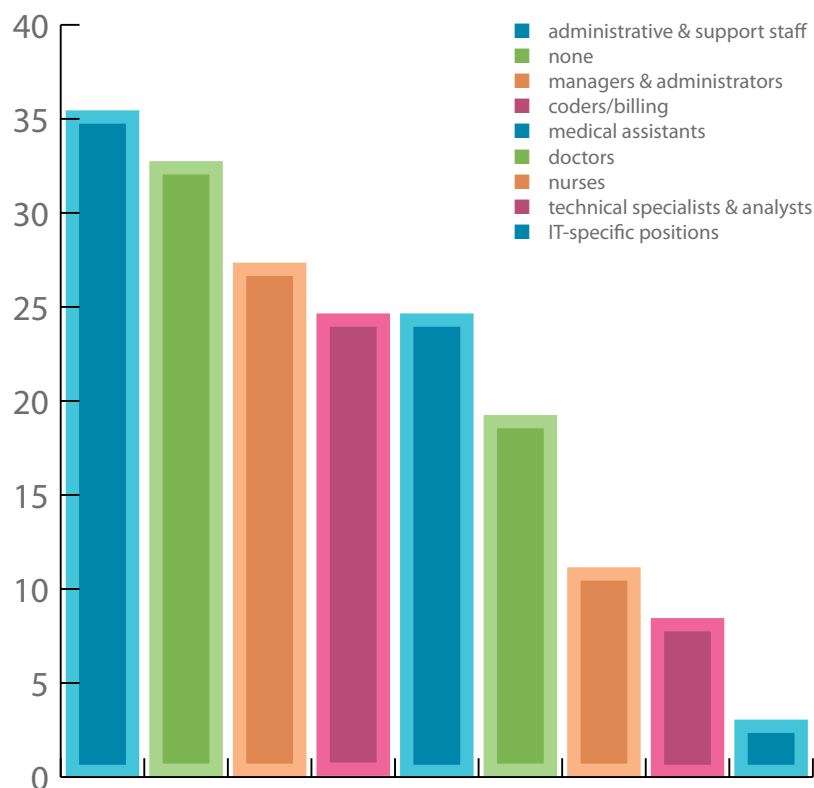


Figure 4: Comparative Need for HIT Skills among Employees in Healthcare Delivery Organizations

From an employment standpoint, approximately 5,378 employees work at HIT firms in San Diego. The firms considering HIT employ another 1,195 workers. Firms are engaged in multiple technologies, as evidenced by Table 2 (page 30).

Table 3, which illustrates the HIT employment segmented by technology, can be found in Appendix 3.

Technology firms in San Diego reported robust 9.3% growth expectations over the next 12 months. With over 116,000 employees in IT, this level of growth will net approximately 11,000 new jobs in San Diego over the coming year. The news for HIT-specific growth is somewhat mixed. As seen in Table 2, HIT-focused firms or efforts make up a relatively small percentage of the IT landscape, including employment. Additionally, even with 11.3% of firms that work in HIT, only 11% of their workers spend at least half of their time supporting HIT operations.

Nevertheless, HIT employers are much more bullish than their traditional IT counterparts. In fact, even after a rigorous outlier analysis, a conservative estimate from employer reporting is an incredible 62% growth over the coming year. With the lower numbers of employment and using the most conservative growth estimates, San Diego County technology firms should create between 370-450 jobs specific to HIT over the coming year.

Generally, HIT-focused firms (defined as those that reported either currently working in or planning to enter the HIT space) most often have employees in their business development and sales offices, followed by administrative staff and technician or technical staff. Specific samples for technology firms were small and must be used with caution. However, it appears that the greatest growth is expected for technical positions (45%), followed by administrative positions (39%) and business development positions (35%). Qualcomm’s Don Jones explained to us that he recruits HIT team members with some health-

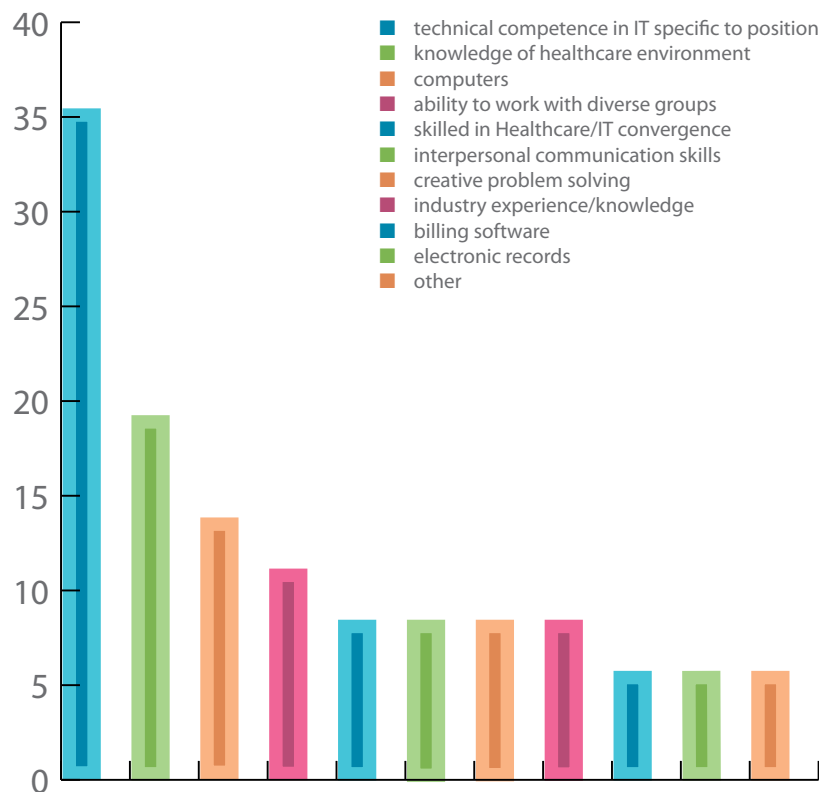


Figure 5: Most Important Skills for HIT Workers, As Reported by Healthcare Organizations

care experience. However, he is more interested in hiring people with experience in gaming, animation, graphic design and IT, feeling they can be the most creative developers of his division's first priority: developing medical sensors and diagnostics that are either hand-held or disposable. The development of new smarter medical devices will increase the demand for people who understand and can report the data and for others, mostly likely with AA degrees, who can install, adjust and repair the wireless health devices, as well as train in their use.

The lowest occupational incidence within HIT-focused technology firms was in scientific and professional positions. This is an interesting finding with wide-reaching implications for the HIT cluster in San Diego, prompting the immediate question of whether San Diego will be at the forefront of innovation or whether it will be an integration, sales, and service hub for HIT. Or, perhaps innovation will arise from outside the traditional IT industry, medical devices and wireless communications being the most likely alternates.

Reported Technology Area	Firms —Overall	Firms —Developing or Supporting HIT Development/ Operations	Firms Considering the HIT Field	Firms Not Considering the HIT Field
Total	3,955	448	195	3,312
Software (exclusive)	439	40	60	340
Computer Hardware (exclusive)	191	0	0	191
Information technology services and/ or research (exclusive)	459	76	19	363
Medical devices (exclusive)	822	76	0	745
Software & Computer Hardware	306	0	0	306
Software & Information technology services and/ or research	611	57	38	516
All Other Combinations of Multiple Sectors	134	19	0	115
	994	179	79	735

Table 2: Comparative Engagement of San Diego Technology Firms in HIT Business

Conclusions and Recommendations

There are few significant barriers to the continued growth and development of the HIT sector in San Diego. In terms of commitment and attention to HIT as a solution for improved and more cost efficient healthcare, San Diego is as well developed as any region in the country, and more advanced than most. A wide variety of IT companies in the region dedicate a sizable portion of their business activity to the healthcare sector, and almost every part of the local healthcare industry boasts meaningful progress in implementing HIT solutions. This situation has resulted in a good growth path for local HIT jobs, although most new employment will be realized in relatively simple job functions such as the provision of IT services and the digitization of formerly manual records and reports.

One facet of the regional HIT picture that could limit the pace and quality of growth is the slow adoption rate of HIT by smaller physician practices. Accordingly, an initial recommendation is to:

1. Help those physician practices and smaller healthcare systems that remain reluctant or unable to adopt HIT solutions by supplementing the tools that have already been made available by the State of California and the ONC. A variety of techniques are available to tackle this challenge such as:
 - a) Carefully crafted local pilot projects to demonstrate the cost, results and impact (both financial and quality of care) of conversion to revised work processes and more technology-based assistance in small-practice circumstances;
 - b) Supplementing the investment subsidies currently provided by the ONC (which cover only a small percentage of the cost of EMR system purchases and maintenance) to reduce the risk to small health providers. Such a supplement could perhaps come in the form of an industry “bank” where subsidies are repaid as efficiencies and returns on investment are realized. Larger health systems and IT providers, insurers, and venture capital might be the source of initial capital;
 - c) Supplementing the work of the Regional and Local HIT Extension Centers in providing implementation/transition assistance for small providers by increasing their pool of trained workflow analysis and technology implementation experts. Giving small practices quick access to talent of this type would reduce the risk of “reinventing the wheel” with each implementation.

Other limitations to the continued and timely expansion of San Diego’s HIT sector are of concern, but again, they are no greater concern here than in any other region, as assessed by the focus and efforts of national entities like the ONC. Issues such as interoperability of technologies, exchange of patient data between organizations, and capture and integration of disparate sources and types of information are all universal concerns that are being dealt with on a national scale, and local technologists and administrators are contributing in leadership roles. Likewise, a continued supply of infrastructure, research, and capital, so critical to thriving business development in any growing industry, is as strong in San Diego as anywhere.

With regard to the supply of needed talent, local healthcare systems report few problems in obtaining qualified candidates for current job duties, and IT firms are likewise able to fill IT service positions. Competency requirements at the upper end of the job scale – managerial and scientific capacities – are also currently adequate to meet demand due largely to the strong base of talent at UC San Diego and the research mesa, as well as a vast array of biological and technological research and development firms already housed in San Diego. One notable exception to the otherwise satisfactory situation, however, mentioned frequently by employers, is the need for software engineers and project managers who understand the clinical environment. HIT is inherently interdisciplinary, and as such it demands professional-level talent that is likewise firm in both the IT and healthcare disciplines – an asset in short supply at present. Accordingly, a second recommendation is to:

2. Enable the creation of education and development programs that supplement foundational training in either IT or clinical fields with essential knowledge in the partnering field (e.g. IT professionals learn about the processes of healthcare and healthcare professionals learn about IT practices). These programs need not be full degree-bearing commitments, but may take the form of continuing education, apprenticeships, work exchanges, collaborative projects, or intensive academies. The goal is to assess the level of existing knowledge and expertise in a foundational field, and then to provide the appropriate supplemental knowledge and experience to build a growing pool of individuals capable of considering both sides of the complex challenge, and serving as “translators” between otherwise technical or science specialists.

Accelerating the Growth of HIT in San Diego

Despite the current success of HIT adoption and growth in San Diego, an almost universal message expressed by employers and workforce advocates during this study was to increase the pace and strength of the sector’s development. Many individuals see San Diego as poised to leap ahead of competing regions in this industry, taking a leadership position that would provide dramatic economic and workforce gains, if a variety of appropriate actions were taken. This vision is based on three assumptions:

- Dramatic growth in employment comes not from increased use of HIT within the region, but from the “export” of HIT knowledge, experience and technologies to other regions (e.g., new business development);



- San Diego has an enviable infrastructure for and track record of new business development, especially with regard to high-technology and science-oriented products and services, which can be called upon to produce similar result with HIT;
- San Diego has unique assets which can serve as the catalyst to reinvent HIT within the next few years, placing us in a distinct leadership position. Those assets include (1) a strong commitment to medical devices as a method of information capture and exchange, and healthcare delivery, (2) a strong capability to integrate telecommunications with health care delivery, enabling remote and mobile (including in-home) care and leveraging the capacity of each care giver, and (3) the invention of new workflows that take advantage of these other assets, increasing the influence and power of information technology in the provision of healthcare.

Consistent with the expressions of employers and HIT leaders who participated in this study, and assuming a shared desire to accelerate the pace and influence of HIT development in San Diego, an additional recommendation is as follows:

3. Create a trade group in San Diego for the HIT sector – a coalition - which emphasizes San Diego’s unique vision of HIT. Consistent with this initiative, and at the direction of the coalition, undertake the following thrusts:
 - a) Promote San Diego aggressively as a national HIT hub, drawing more leading companies, talent and capital to the region;
 - b) Consider creating and supporting a San Diego chapter of the national Healthcare Information Management and Systems Society (HIMSS); initiating a formal arm of HIMSS in San Diego would not be a replacement for a HIT trade group, but rather would help provide increased visibility for San Diego’s efforts, tying the region more productively to national efforts;

- c) Expand the Beacon effort through additional local funding, projects and participation, and emphasize attention on overcoming inter-device and device-EMR interoperability issues. Beacon-like demonstration projects could be expanded to encompass many more inter-system and provider exchange situations, with emphasis on those circumstances that are either most vexing or most promising in terms of impact on medical devices and remote delivery of care. Key technology providers should be assisted in devising interoperability standards consistent with these high-priority scenarios, so that each successful result realized in San Diego becomes a welcome solution for the rest of the country;
- d) Train many more workflow/process analysts, who not only interpret healthcare delivery and business methods as they currently exist, but also understand the unique approach that San Diego envisions with remote and mobile healthcare as driving solutions for decades to come. Much of this training appropriately should be done within large healthcare organizations, re-skilling and re-purposing existing allied health and administrative workers to advocate and benefit from changes in their systems. Additionally, local education programs could be created to prepare new and additional workers, not only for San Diego, but for a nationwide need in this area – San Diego becoming an “exporter” of technical assistance at the front end of HIT implementation. Technology companies likewise may want to consider adding initial workflow/process analysis as a service they offer in connection with their products;

e) Monitor, measure, and report on progress of the HIT industry sector in San Diego on at least an annual basis. Sustainable focused effort requires sustained, actionable information. Consistent and empirical information on the progress of the San Diego HIT sector should cover the entire spectrum of the “innovation eco-system” – research effort, capital, talent, and infrastructure – in order to ensure that no portion of the sector is being hampered in its development efforts. Monitoring of the progress and success of education and workforce development efforts, as well as the “export” of product and talent to other regions, would be an important subset of that effort.

Each and all of these recommendations clearly require targeted collection and application of capital, as well as some level of guided and coordinated effort. Although not the “norm” for industry development in most regions, there is an apparent belief among the many players in this sector that an organized and aggressive approach can dramatically enhance San Diego’s role as an important HIT hub, generating innovation and economic growth for the community for many years to come.

Your Thoughts?

Please join the discussion by sending your observations and ideas to HITResearch@ucsd.edu



Appendices

Appendix 1: Organizations Participating in the Executive Interviews

ORGANIZATION	PARTICIPANT NAME	TITLE
Alere	Robert Parson	VP, Global Clinical/Regional Affairs
Council of Community Clinics	Christy Rosenberg	Director, Community Clinics Health Network
HIMSS*	David Roberts	VP, Government Relations
Nuvasive	Albert Pothier	VP, Neurovision
Phillips Healthcare	Michael Duich	VP, R&D
Philometron	Darrel Drinan	CEO
Qualcomm	Donald Jones	VP, Business Development Health & Life Sciences
Scripps Mercy Physician Partners	Theodore Steuer	Executive Director
Sharp HealthCare	Stacey Hrountas Paul Durr	VP, Managed Care Contracts CFO, Sharp Community Medical Group
Sharp HealthCare	William Spooner	SVP, CIO
UC San Diego Medical Center	Margarita Baggett, RN	Chief Nursing Officer
UC San Diego School of Medicine - Beacon Grant	Theodore Chan, MD	Co-principal Investigator
UC San Diego School of Medicine**	Lawrence Friedman, MD	Co-Director
VA Medical Center	Graham Nixon	Chief of Informatics
Wireless Life Sciences Alliance	Robert McCray	CEO

*Healthcare Information and Management Systems Society

**UC San Diego School of Medicine - Southern California Telemedicine Learning Center

Appendix 2: Summary of HIT-Related Educational Programs in San Diego

SCHOOL	CURRENT PROGRAM(S)	PLANNED PROGRAM(S)	PROPOSED START DATE(S)
California State University San Marcos		<ul style="list-style-type: none"> HIT Certificate Program 	<ul style="list-style-type: none"> Winter 2012
National University	<ul style="list-style-type: none"> A.S. in HI Management (Onsite Program) B.S. in Allied Health, Concentration in Health Informatics (Onsite) M.S. in Nursing, Grad. Certificate in Informatics (Onsite) M.S. in Health Informatics (Onsite) M.S. in Cyber security, Concentration in HI Assurance Graduate Certificate, Clinical Informatics 	<ul style="list-style-type: none"> A.S. in Health Information (Online Program) M.S. in Health Informatics (Online Program) M.S. in Nursing Informatics (Online Program) M.S. in Health Data Analytics D.N.P. in Nursing Informatics M.S. in Clinical Research Informatics 	<ul style="list-style-type: none"> January 2012 October 2011 Fall 2012 Spring/Fall 2012 September 2012 TBD
San Diego Mesa College	<ul style="list-style-type: none"> A.A. Degree Allied Health HIT Workforce Training Certificates: <ul style="list-style-type: none"> Workflow Redesign Specialist Implementation Support Specialist Technical/Software Support Specialist 	<ul style="list-style-type: none"> Fee-based HIT Certificate Programs Adding track in HIT Training 	<ul style="list-style-type: none"> Fall 2011 TBD
San Diego State University	<ul style="list-style-type: none"> Online Certificate (Medical Coding) Online Certification Preparation Program (Medical Billing & Coding + Medical Terminology) M.S. in Bioinformatics: <ul style="list-style-type: none"> Classical M.S. with Research Thesis Professional Science Master's (PSM) 		
UC San Diego Extension	<ul style="list-style-type: none"> HIT Certificate Program HIT Seminar Series 	<ul style="list-style-type: none"> HIT Specialty Tracks: <ul style="list-style-type: none"> Train the Trainer Workflow Analysis Specialist Healthcare Information Exchange Data Analytics 	<ul style="list-style-type: none"> Fall 2011 Winter 2012 Winter 2012 Winter 2012
UC San Diego Jacobs School of Engineering		<ul style="list-style-type: none"> M.A.S. in Medical Device Engineering M.A.S. in Wireless Embedded Systems 	<ul style="list-style-type: none"> Fall 2011 Fall 2011
UC San Diego School of Medicine – Division of Biomedical Informatics	<ul style="list-style-type: none"> Ph.D. , Biomedical Informatics 	<ul style="list-style-type: none"> MS, Biomedical Informatics 	<ul style="list-style-type: none"> TBD
University of San Diego	<ul style="list-style-type: none"> M.S. in Nursing – Graduate Certificate, Nursing Informatics 	<ul style="list-style-type: none"> MS in Nursing Informatics Ph.D. Nursing Informatics 	<ul style="list-style-type: none"> Fall 2011 Fall 2011
West Wireless Institute	<ul style="list-style-type: none"> Post-doctoral Fellowship in Health Informatics 	<ul style="list-style-type: none"> MS, Biomedical Informatics 	<ul style="list-style-type: none"> TBD

Appendix 3: HIT Employment Segmented by Technology

Reported Technology Area	Employment —Overall	Employment —Developing or Supporting HIT Development/ Operations	Employment — Considering the HIT Field	Employment — Not Considering the HIT Field
Total	116,879	5,378	1,195	110,306
Software	5,823	184	414	5,224
Computer Hardware	1,793	0	0	1,793
Information technology services and/or research	3,185	354	148	2,683
Medical devices	8,038	582	0	7,456
Software & Computer Hardware	54,986	0	0	54,986
Software & Information technology services and/or research	7,513	1,930	183	5,400
All	21,955	23	0	21,933
Other Combinations of Multiple Sectors	13,587	2,384	467	10,735



Appendix 4: Roundtable Participants

ORGANIZATION

A-Life Medical (now part of Ingenix)	San Diego Futures Foundation
AMN Healthcare	San Diego Mesa College
Benchmark Revenue Management	San Diego Regional EDC
CareFusion	San Diego Regional EDC Foundation
Client Solution Architects	San Diego State University
Concerro	San Diego Workforce Partnership
Cuyamaca Community College	Scripps Health
Fairway Technologies Inc.	SDSIC Healthcare IT SIG Steering Committee
FirstWatch	Sotera Wireless
Green LMI	Southern California Physicians Managed Care Services
Grossmont-Cuyamaca Community College District	Syska Hennessy Group
Health Level 7, Inc.	The San Diego Union Tribune
Illumina	TheraStaff, LLC
Janus Health	UC San Diego Extension
Kaiser Permanente	UC San Diego Rady School of Management
maxIT	UC San Diego School of Medicine
MediAccess Solutions	VA San Diego Healthcare System
National University	West Wireless Health Institute
Perminova	Xifin
Resmed	

Appendix 5: HIT Research Project Community Partners

ORGANIZATION

San Diego Community College Regional Occupation Deans Consortium

San Diego Futures Foundation

San Diego Regional Economic Development Corporation

The National Veterans Transition Services, Inc.

Endnotes

¹ EMSI Complete Employment, 4th Quarter, 2010

² HIMSS Analytics employs a seven-stage model of EMR Adoption to mark the evolution of a healthcare organization's progress in adoption and meaningful use. <http://www.himssanalytics.org/stagesGraph.asp>

³ The Health Information Technology for Economic and Clinical Health (HITECH) Act provides incentive payments to eligible professionals, eligible hospitals and critical access hospitals (CAHs) as they adopt, implement, upgrade or demonstrate "meaningful use" of certified EHR technology. The Act specifies three main components of Meaningful Use:

1. The use of a certified EHR in a meaningful manner, such as e-prescribing.
2. The use of certified EHR technology for electronic exchange of health information to improve quality of healthcare.
3. The use of certified EHR technology to submit clinical quality and other measures.

Simply put, "meaningful use" means providers need to show they're using certified EHR technology in ways that can be measured significantly in quality and in quantity.

The criteria for meaningful use will continue to be staged in three steps over the course of the next five years.

- Stage 1 (2011 and 2012) sets the baseline for electronic data capture and information sharing.
- Stage 2 (expected to be implemented in 2013) and Stage 3 (expected to be implemented in 2015) will continue to expand on this baseline and be developed through future rule making.
- http://www.cms.gov/EHRIncentivePrograms/30_Meaningful_Use.asp#BOOKMARK1 Accessed July 12, 2011

⁴ www.healthit.hhs.gov

⁵ Medical Economics, "Physician smartphone adoption rate to reach 81% in 2012," Nov. 27, 2009.

⁶ <http://www.westwirelesshealth.org/index.php/the-institute/mission>

⁷ San Diego Regional Chamber of Commerce, 2010

⁸ www.healthIT.hhs.gov

⁹ The Innovator's Prescription: A Disruptive Solution for Health Care. C.M. Christensen; J.H. Grossman; J Hwang, McGraw-Hill, 2009.

¹⁰ Ted Chan, MD. The San Diego Beacon Community Collaborative Grant Proposal, 2010.

¹¹ The California Healthcare Foundation. The State of Health Information Technology in California, 2011.

¹² Report on the San Diego Region, 2010, www.GlobalSecurity.org

¹³ Ted Chan, MD. The San Diego Beacon Community Collaborative Grant Proposal, 2010.

¹⁴ Report on the San Diego Region, 2010, www.GlobalSecurity.org

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- ¹⁶ www.sdchip.org
- ¹⁷ Healthcare IT News, Becker's Hospital Review, June 2011.
- ¹⁸ <http://www.healthcare.gov/news/factsheets/accountablecare03312011a.html>
- ¹⁹ http://www.myphr.com/StartaPHR/what_is_a_phr.aspx
- ²⁰ Kaelber DC, Jha AK, Johnston D, Middleton B, Bates DW. J Am Med Inform Assoc. 2008 15:729-36.
- ²¹ http://healthit.ahrq.gov/images/jun09cdsreview/09_0069_ef.html
- ²² http://www.himss.org/ASP/topics_integration.asp
- ²³ <http://www.hhs.gov/healthit/healthnetwork/background>
- ²⁴ <http://digital-medicine.posterous.com/web-based-emrs-to-be-30-of-global-emr-markets>
- ²⁵ See as examples the new Health Analytics Center developed by IBM and GE's Healthymagination initiative:
<http://www.informationweek.com/news/healthcare/clinical-systems/229700182> and
<http://www.businesswire.com/news/home/20110516005683/en/GE%80%99s-healthymagination-Exceeds-Year-Goals-2.2b-invested>
- ²⁶ The Future of Connected Health Devices, H. Fraser, Y. Kwon, M. Neuer, IBM Institute for Business Value, 2011
- ²⁷ Medical Economics, "Physician smartphone adoption rate to reach 81% in 2012," Nov. 27, 2009.
- ²⁸ San Diego Business Journal, June 20-26, pg 1
- ²⁹ http://www.compete.org/images/uploads/File/PDF%20Files/CoC_sandiego_cluster.pdf
- ³⁰ www.wirelesslifesciences.org
- ³¹ www.connect.org
- ³² www.biocom.org
- ³³ <http://health.universityofcalifornia.edu/2010/05/04/beacon-grant-awarded>
- ³⁴ <http://www.xconomy.com/san-diego/2010/12/01/awarepoint-raises-9m-names-new-ceo-to-crack-hospital-market-for-real-time-tracking/>
- ³⁵ See Appendix 4 – Roundtable Participants
- ³⁶ http://press.himss.org/article_display.cfm?article_id=5345



9500 Gilman Dr., Mail Code 0176-O La Jolla, CA 92093-0176

