

SECTION I

Medical Informatics with 20/20 Vision

Section Overview: Section I establishes the foundation for the book by defining and describing the key strategies of Collaboration, Open Solutions, and Innovation (COSI). This section will also explore the tactical areas and the specific tactics within each of the COSI strategies. It shares examples of leading organizations using Collaboration, Open Solutions, and Innovation strategies to achieve vital organizational goals. The emphasis throughout the book is around people working smarter with improved processes enabled by advanced or appropriate information technology.

Chapter 1, Medical Informatics 20/20—Vision, Model, and Strategies for Today and Tomorrow, starts with a vision of the consumer-centric Health@Anywhere where a new generation of anywhere services are available to support better health and medical care. Then the Medical Informatics 20/20 Model and the three key strategies of Collaboration, Open Solutions, and Innovation (COSI) and each of their associated tactics are defined and briefly described. The chapter frames how these strategies and associated tactics support improvements in quality of care, especially through the implementation of electronic health records (EHRs) and process improvement systems to reduce errors and improve quality.

Chapter 2, Open Solutions in Business—Definitions and Market Expansion, discusses in depth the rapid growth of Open Solutions in government and all private sector industries worldwide. It also highlights the growing acceptance and use of collaboratively developed Open Source Software by public and private sector organizations. Chapter 2 highlights and profiles selected Open Solutions from U.S. government agencies and leading business organizations in the private sector.

Chapter 3, Growth of Open Solutions in Health Care, describes the status and application of innovative Open Solutions in health care. The Open Solutions topics that are explored include collaboratively developed EHR, PHR, HIE, Public Health, and other specialized health and medical informatics. Included in the chapter are highlights of selected Free and Open Source Software (FOSS) applications.

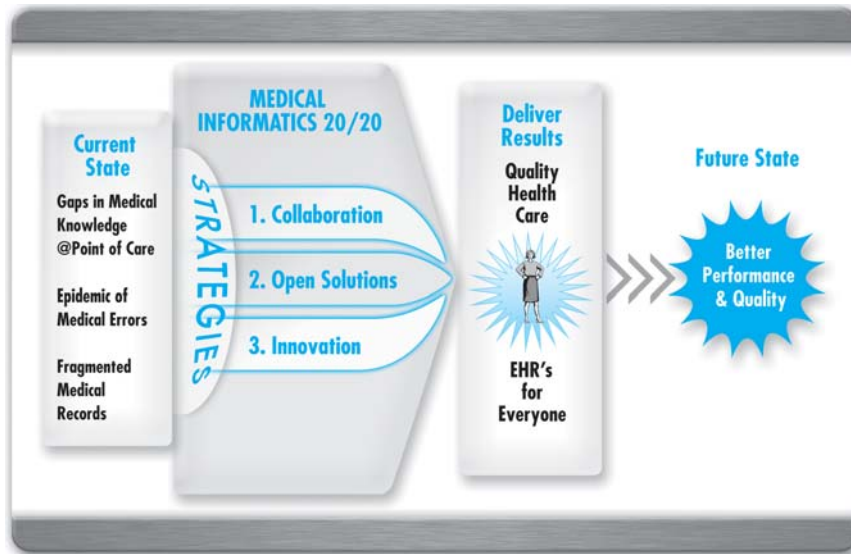


FIGURE I-1 Medical Informatics 20/20 Model

Medical Informatics 20/20: Vision, Model, and Strategies for Today and Tomorrow

“The future belongs to the unreasonable ones, the ones who look forward not backward, who are certain only of uncertainty, and who have the ability and the confidence to think completely differently.”

Bernard Shaw

“As managers, we need to shift our thinking from command and control to coordinate and cultivate—the best way to gain power is sometimes to give it away.”

Thomas W. Malone, The Future of Work, HBS Press

A 20/20 Vision for the Future

Imagine a future healthcare system that is customer-focused and patient-centered, one in which every American has health insurance and a secure, private Electronic Health Record (EHR) that is available whenever and wherever needed, enabling the highest degree of coordinated medical care based on the latest medical knowledge and evidence.

Imagine a healthcare system in which digital and mobile technologies, medical knowledge at the point of need, and collaboration among providers deliver safe, high-quality care for everyone—a healthcare system that does not require the patient to complete the same forms at every access point. Instead, imagine a healthcare system where primary care physicians have access to your specialty medical information and specialists have access to your primary care information via inter-connected “smart” EHRs that are integrated with personalized eHealth service providers and delivered directly to a multi-purpose, intelligent, mobile digital device that can be carried in one’s pocket.

This consumer-centered system will use a variety of technologies and innovations to generate the “smart” EHRs of the future that:

- ***Deliver information, services, and data via Mobile, Multi-purpose Devices (MMD) anywhere, anytime.*** Imagine a small mobile multipurpose communication and coaching device that has a phone, embedded health-coach software, GPS, instant messaging, camera, music player, and e-money dispenser, all of which are interconnected to deliver health care to active, busy citizens.
- ***Remind you when it is time for your annual checkup and anticipate your need with an intelligent digital coach.*** Imagine embedded, health-coach “mindware” programmed right in to that MMD. This mindware allows the device to “learn” each time additional medical data is added, and automated programs scan the Internet or licensed medical service databases for the latest medical research and knowledge relevant to your medical conditions and genomic type.
- ***Integrate physician records, hospital services, medication histories, and other clinical information into a unified digital record that is available to patients at home or at the point of care.*** Imagine that accessing your health records or paying medical bills is as easy and convenient as checking your banking records or paying bills online.
- ***Monitor vital signs and clinical indicator continuously and communicate wirelessly and seamlessly.*** Imagine an easier way for diabetics to monitor their glucose levels using a glucose watch or implantable “nano-tear,” a contact lens–like device that uses nanotechnology to monitor the glucose level in a person’s tears and then transmit the results to an MMD, which would then dispense insulin automatically via an implanted nano-device, as needed. Such a subscription-based monitoring service could be

sponsored by a doctor, hospital, health plan, or even your credit card company.

Medical informatics has the power to deliver these services and many more. And in the year 2020 we will see a practical application of the creativity and genius of today's clinicians, researchers, patients, and technologists who are working together to help and heal. Figure 1-1 illustrates the concept of Health@Anywhere and shows how patients will evolve into medically empowered ConsumerMDs™, surrounded and supported by a variety of interactive devices that deliver health and medical services at the point of need.

Medical informatics in 2020, through its strategies, tactics, processes, and technologies, will surround and support patients wherever they are. It will engage patients to be active partners in their medical care. And as patients become partners in their own care, they will actively support efforts to continuously improve the quality of care, reduce deadly medical errors, and cut unnecessary costs. As Figure 1-1 illustrates, they will do this in a variety of ways:

- **Web of Care** Consumers will have “always-on” access to public Internet and subscription-based medical/health knowledge databases

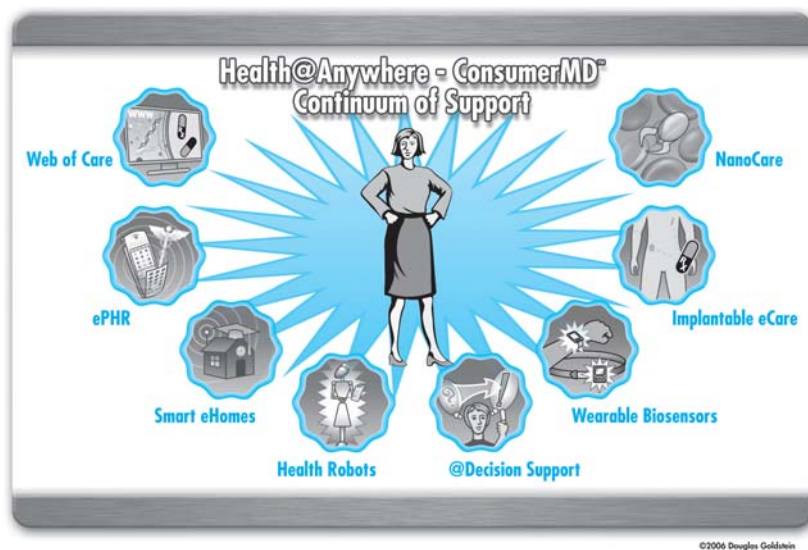


FIGURE 1-1 Health@Anywhere—ConsumerMD™ Continuum of Support

that deliver a vital connection to rapidly obtain medical knowledge based on interest, diagnosis, treatment protocol, or topic of interest.

- **ePHR** The next generation ePersonal Health Record (ePHR) will be electronically connected to the Internet, evolving with emerging technology, and *entelligent*TM—electronically connected with the latest “health-coach” mindware that anticipates health needs and enables the storage, management, and intelligent use of a patient’s personal medical record to improve health and medical care. The ePHR will be available through multiple options supported by a health partner such as a doctor, hospital, health plan, patient advocacy group for those with chronic disease, or financial services company.
- **Smart eHomes** Homes of the future will be embedded with all types of Internet-connected monitors, including biomonitors tailored to the individual needs of the residents. Biomonitors could measure a patient’s gait or vital signs. A pillow-embedded monitor could track respiration. These technologies will involve simple, low-cost sensor technology affordable to even the lowest income earners. A data-mining element will yield additional health information for the linked ePHR, and the entire system will be customized to individual and cultural needs.
- **Health Robots** “Healthbots” will assist elderly and special needs patients at home by reminding them to visit the bathroom, take medicine, or schedule an appointment with their doctor. These healthbots will also function as a conduit for connecting patients with caregivers through the Internet. Professional caregivers will directly interact with patients remotely, reducing the frequency of visits while collecting data and monitoring patient well-being along the way.
- **Anywhere@Decision Support** Consumer health informatics (CHI) will deliver tools, resources, and support for patients and healthy people who need to better manage prevention and treatment decisions. These decision-support modules will be tailored to individual demographics, health profiles, and conditions and will be delivered through print, Web, multimedia, video, and any other communication vehicle.
- **Wearable Biosensors** Detection devices that, when worn on certain body parts, search for and identify status indicators of a biological function such as heart rate and glucose levels—will painlessly provide needed information for prevention and treatment decisions. Today, the GlucoWatch provides diabetics with automatic, non-

invasive glucose readings as frequently as every 10 minutes. Bio-sensors will monitor everything from glucose levels and heart rhythms to cancer indicator molecules and brain function.

- ***Implantable eCare*** The insertion and management of artificial devices within the human body will become increasingly common for maintaining and improving health. “Implantables” have already evolved from artificial hips and knees to assistive devices that have built-in electronics such as pace-makers and cochlear implants. Implantable eCare is the next wave: integrated, internal implants that communicate with external monitoring devices outside the body and through the Internet to an ePHR.
- ***NanoCare*** Next-generation implantable eCare, “NanoCare,” is the creation of tiny components that will be constructed, inserted, and applied within the human body. The National Institute of Health’s Nanomedicine Roadmap Initiative anticipates that in the next 20 to 30 years, nano-sized implants will search out and destroy cancer cells that would otherwise cause a tumor to develop in the body, and be used to create miniature, biological devices to replace a broken part of a cell. An insulin-dependent diabetic could use such devices to continuously monitor and adjust insulin levels autonomously and automatically.

The Health@Anywhere examples above are based on technologies that exist today and those that will evolve in the not-so-distant future. Our health and medical system is transforming, and segments of our customer-focused and patient-centered future are already in place. Now the challenge that exists for healthcare leaders, clinicians, and managers is to plan for and deploy the knowledge and information technology tools that empower patients and enable care providers. Complex systems require comprehensive processes and tools to transform care processes. And the transformation of processes must be guided by empowered and educated managers and clinicians within the framework of an advanced medical informatics paradigm.

Overview of the Medical Informatics 20/20 Model

Life is change. In the recent past, health care has evolved rapidly from an inpatient to outpatient focused business. Now the transition is to an “any-

What Is Medical Informatics?

In this book, we broadly define “medical informatics” as *the applied science at the nexus of the disciplines of medicine, business, consumer centered care, and information technology, which is instrumental for significant and measurable improvements in both healthcare quality and cost-effectiveness*. It is this integrative discipline that defines tactics and technologies along with the tools, resources, and methods required to optimize the intelligent use of the latest evidence and knowledge in health and medicine.

Medical informatics tools, technology, and tactics include not only computers and information systems, but also clinical guidelines, formal medical languages, standards, interoperability, and communication systems. The various tools, technologies, and tactics are designed to support the progressive realization of the optimal delivery of health and medical care.

According to our definition, medical informatics includes the sub-domains of clinical informatics, bioinformatics, nursing informatics, consumer health informatics, public health informatics, dental informatics, and what has recently been coined as “bio-info-nano” informatics by a NASA–Google collaboration.

where service” where patient customers are monitored and supported at home, at work, or anywhere. Just as the information technology infrastructure of the past evolved to support outpatient care, now it must transform even more radically by becoming clinically driven inside of care facilities while also extending itself to go mobile and virtual with customer patients.

The Medical Informatics 20/20 framework and strategies presented throughout this book offer an approach and a set of tools to accelerate the transformation and address the challenges we face including:

- ***Epidemic of medical errors*** due to system complexity, lack of information technology, communication gaps, etc.
- ***Not diagnosing and treating with the latest medical knowledge*** and evidence base at the point of care.
- ***Poor vital health statistic performance*** relative to other developed countries despite spending more money on health care.
- ***High failure rates in the implementation of health information technology solutions.***

- ***Partial, fragmented patient medical records*** due to paper records at numerous sites of care.

There is near-universal agreement that solving these problems will require a new and improved wave of health information technology (HIT) that supports transformed care delivery processes. Consequently, there is a dire need for a new, comprehensive model for medical informatics that is integrated with knowledge in technology, business, and medicine and that delivers strategies, tactics, tools, and techniques that address the human and system issues in overcoming the above challenges.

The sidebar “What Is Medical Informatics?” defines medical informatics and outlines its sub-domains and relationships. The Medical Informatics 20/20 nexus is the intelligent use of technology with the active engagement of clinicians, managers, and patients/consumers to transform health care within the intersection of technology, medicine, and business.

Figure 1-2 illustrates the current state of poor outcomes and nonintegrated care that can be transformed by the three strategies of Collaboration, Open Solutions, and Innovation (COSI). Later in the chapter is a series of three figures, one for each strategy, that outline tactical areas that have one or more specific tactics associated with each strategy. The COSI strategies and tactics enable the realization of intelligent and practical deployment that supports a future state of connected health care with electronic transportable patient records and higher quality care.

The multi-faceted elements of the Medical Informatics 20/20 Model are the connective tissue that will allow scientific breakthroughs to be integrated with policy, business, and information technology and effectively translated from the research bench to patient bedside or to anywhere a patient receives care.

Quality Healthcare and Electronic Health Record Implementation Through Collaboration, Open Solutions, and Innovation (COSI)

Industries and businesses throughout the world are being revolutionized through the application of three unique and powerful strategies. When combined, these strategies create a robust model for accelerating change, reducing medical errors, and improving quality in the U.S. and other countries' healthcare systems.

- **Collaboration** shares and disseminates knowledge, know-how, and resources to healthcare leaders, patients, and consumers, allowing them to save time and money across the many health and medical industry tiers and markets.
- **Open Solutions** facilitate the ability to communicate and share information in a way that is completely interoperable and transportable across large scale, macroeconomic, and information technology systems.
- **Innovation** unleashes the knowledge and applied creativity power of team members in healthcare organizations to improve processes and transform culture to better serve customers, professionals, partners, and patients.

The COSI strategies of Collaboration, Open Solutions, and Innovation are absolutely essential for transforming the health and medical culture, the processes, the leadership, and the technology necessary to support better, safer, and higher quality care in the American healthcare system and other healthcare systems across the globe. In the early 21st century, the application of these strategies is already evident throughout other major industries.

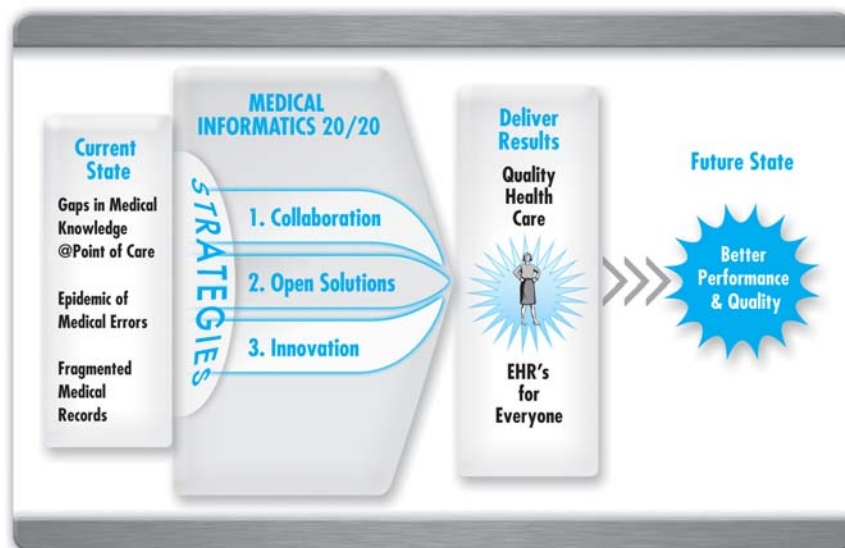


FIGURE 1-2 Medical Informatics 20/20 Model

One example of a company that has transformed itself using COSI strategies is IBM. In 1999, it began investing billions in the Linux operating system and in 2005 made 500 of its patents freely available to anyone developing and designing software standards for the health and education industries. The result is the company's "openness" strategy, which allows IBM employees to collaboratively innovate by connecting with international networks and communities active in development of open-source software and open standards.

Implementation of the COSI strategies will accelerate the adoption of the standards necessary for the seamless interoperability of Electronic Health Records (EHRs) for all Americans and will support EHR adoption in developed and developing countries worldwide. The comprehensive, progressive, and empowered implementation of these strategies is vital for public health, healthcare quality, and national defense relative to natural or man-made disasters, such as biological threats or nuclear terrorism. Additional information on these and other examples of COSI

Being "Open" for Quality

The development, deployment, and use of the VistA health informatics system by the Veterans Health Administration exemplify the principles within the COSI strategies. VistA, the world's largest health information technology system, is based on open standards and has an open architecture, and the source code is available in the public domain without license fees. The collaboration and innovation have resulted in higher quality and a wealth of data greater than any other healthcare information system.

The adoption of VistA in various forms outside of the VA is accelerating. The Indian Health Service and Military Health Service use a form of VistA, as do many other health systems around the world. Now, private health systems such as Midland Health System, private doctors, and many others are adopting forms of VistA because of its many benefits. For more information on VA quality reviews and Awards, see Chapter 12 and review information and data in the VA VistA profile.

For access to VistA software visit:

www.vistasoftware.org

www.worldvista.org

www.va.gov/cprsdemo

strategies and their associated tactics, tools, and technologies within health care are detailed in subsequent sections of this book.

The authors are patient advocates and technology agnostics. Our purpose is to accelerate the improvement of quality, the reduction of medical errors, and the enhancement of cost-effectiveness through the intelligent use of Medical Informatics 20/20 strategies and tactics. We are active in the strategy, development, deployment, and support of “open” and “closed” health information systems and applications, and view “Free and Open-Source Solutions” (FOSS) and open solutions as viable options for any healthcare provider seeking to implement clinical informatics, decrease the cost of clinical informatics, and realize better patient care by transforming care delivery using information technology.

The COSI Strategies Support the Medical Informatics 20/20 Model

The Medical Informatics 20/20 Model, with its three strategies of Collaboration, Open Solutions, and Innovation, is focused on supporting improvements in performance and quality of care by implementing comprehensive EHRs and clinical informatics systems that will be used by providers and patients everywhere. When fully deployed in 2020 and beyond, the end result will be improved health status for everyone and a lower rate of annual increase in healthcare costs.

As shown in Figures 1-3, 1-4, and 1-5 in this chapter, there are a series of tactics that support the intelligent application of the Medical Informatics 20/20 infrastructure needed for quality and EHRs. Within each tactic there are tools, technologies, and techniques that enable intelligent and integrated execution of the tactics supporting the strategies. First, let us examine the problems faced by healthcare managers and clinicians.

THE PROBLEMS TO SOLVE

Rich Country, Poor Health

The richest country in the world, the United States, ranks at or near the bottom of all industrialized countries in terms of vital health statistics. Of 13 developed countries, the United States ranked:

- 13th for low birth weight.
- 13th for neonatal mortality and infant mortality overall.

- 11th for postneonatal mortality.
- 13th for years of potential life lost.
- 11th for female life expectancy at 1 year, 12th for males.
- 10th for female life expectancy at 15 years, 12th for males.
- 10th for female life expectancy at 40 years, 9th for males.
- 7th for female life expectancy at 65 years, 7th for males.
- 3rd for female life expectancy at 80 years, 3rd for males.
- 10th for age-adjusted mortality.

(Source: Barbara Starfield, MD, MPH, JAMA July 26, 2000–Vol 284, No. 4, <http://silver.neep.wisc.edu/~lakes/iatrogenic.pdf>)

In 2005, the United States spent 16.3% of the country's Gross National Product (GNP) on healthcare services. This is the highest percentage of any developed nation, yet the resulting outcomes are some of the lowest among developed nations.

An Epidemic of Medical Errors

In addition to this poor performance in vital health statistics, there is a human-spawned epidemic of deadly, costly medical errors. Depending on which of three major studies you read, at least 44,000 people, and perhaps as many as 200,000 people, die in hospitals each year as a result of medical errors that could have been prevented. In addition to the cost in terms of human lives, medical errors have been estimated to result in total costs between \$17 billion and \$29 billion per year in hospitals nationwide.^{1,2}

But annual deaths from medical errors in hospitals are only one area of danger. There many areas of “near misses” in the chain of treatment that cause harm to patients. According to the *Journal of the American Medical Association* (JAMA), these are estimated to involve:

- 106,000 adverse reactions to improperly prescribed prescription drugs.

¹National Patient Safety Foundation at the AMA: Public Opinion of Patient Safety Issues Research Findings, Louis Harris & Associates, September 1977.

²The estimate on the number of Americans that are harmed as a result of medical errors was based on two studies of large samples of hospital admissions, one in New York using 1984 data and another in Colorado and Utah using 1992 data. They found that the proportion of hospital admissions experiencing an adverse event, defined as injuries caused by medical management, were 2.9% and 3.7%, respectively. The proportion of adverse events attributable to errors (i.e., preventable adverse events) was 58% in New York and 53% in Colorado and Utah. These estimates were multiplied against the total number of hospital admissions in a year in the United States to obtain the estimated total number of hospital medical errors.

A Deadly Medical Error Results in Leadership Collaboration for Quality

In January 2001, Josie King climbed into a hot bath and burned herself. This accident was a tragedy, but it's not what killed her. Josie made a marvelous recovery at the prestigious Johns Hopkins Children's Center in Baltimore, Maryland, and after 10 days in the pediatric intensive care unit, she was well enough to move to the intermediate-care floor. But it was in the ICU that a series of catastrophic medical mistakes—what her mother would later call “a combination of many errors, all of which were avoidable”—ended her life.

The first sign of trouble was Josie's desperate thirst (dehydration, it was discovered later, from a preventable catheter infection). Her mother was told not to let her drink anything. When she sucked at washcloths, the staff in charge of her care did not recognize the dehydration. Then her eyes rolled back in her head, and staff members assured her mother that Josie's vital signs were fine and children just sometimes do that. And then there was the dose of methadone, which Josie's mother questioned as there had been a previous order for no narcotics. It was administered by a veteran nurse who said the no-narcotics order had been changed. The methadone caused Josie to have a cardiac arrest while her mother was at her bedside. Josie King returned to the intensive care unit, where she died of dehydration and misused narcotics.³

Josie King's death fueled Johns Hopkins Medical Center's decision to create dedicated patient-transport teams, place pharmacists in ICUs, initiate medication reconciliation at the moment of nursing discharge, develop daily short-term goal sheets for patient rounds, and re-label buretrol and epidural catheters.

The important legacy of Josie King is one of collaboration of healthcare professionals with parents and patients. Josie's parents, Sorrell and Tony King, are committed to making sure that Josie's death was not in vain. The overarching message is that there is a need for an ongoing and balanced communication between parents and caregivers and that it is critical to know why medical errors happen so they can be prevented. Along with

³*To Err Is Human: Building a Safer Health System*, Institute of Medicine Committee on Quality of Healthcare in America, National Academy Press, Washington, DC, 1999.

their Johns Hopkins partners, the Kings want all caregivers, parents, and patients to realize that in today's complex health system there is a higher likelihood of error and that, more often than not, errors are a result of system failures, not necessarily the error of an individual.

The collaboration has taken several important forms. Sorrell King and the Josie King Foundation have been active supporters of the Institute for Healthcare Improvement (IHI) and its campaign to end the 100,000 lives lost each year to medical errors. The Patient Safety Group was established by an alliance of Johns Hopkins, the Josie King Foundation, and other nonprofit entities, and led to the development of the Comprehensive Unit-Based Safety Program (CUSP) to support improvements in safety based on the rigorous collection of empirical data. In addition, the program is an advocate for safety and creates a channel for open communication for *all* staff, from clerks to executives.

For more information visit www.josieking.org and www.patientsafetygroup.org.

- 80,000 infections in hospitals.
- 20,000 other errors in hospitals.
- 12,000 unnecessary surgeries.
- 7,000 medication errors in hospitals.⁴

In addition, there are medical errors and mishaps that cause harm or death in long-term care facilities and everywhere else along the continuum of care. For instance, it was also estimated in the JAMA article that there were 199,000 deaths from medical errors in outpatient care. By totaling these estimates there could be upwards of *424,000 annual deaths per year in the American medical system, which would make the system itself one of the leading causes of death in the United States.*

Even worse, the National Council for Patient Information and Education reported that an additional 125,000 deaths occur annually due to adverse reactions to drugs that physicians never should have prescribed. The annual death toll from synthetic prescription drugs, both from the correctly prescribed and the incorrectly prescribed, amounts to about

⁴Dr. Barbara Starfield of the Johns Hopkins School of Hygiene and Public Health (*Journal of the American Medical Association*, vol. 284, July 26, 2000).

231,000 deaths every year. To put this into perspective, this is the equivalent of a World Trade Center disaster every week for over a year and a half, or the crash of two fully loaded Boeing 747 airliners every day of the year.

Medical errors and lack of patient safety are largely due to decentralized, disconnected, and incompatible health-information technology systems. This fact is confirmed in the Institute of Medicine (IOM) report “Patient Safety: Achieving a New Standard for Care.” The report found that improved information and data systems and a national health-information infrastructure are needed to support efforts to make patient safety a standard of care in hospitals, doctors’ offices, nursing homes, and every other healthcare setting. A Markle Foundation survey indicates that 72% of Americans support such a nationwide health-information exchange or network for doctors and patients.⁵

Medical informatics, intelligently and appropriately applied to the healthcare delivery process, is integral to radically improving the quality of care and reducing near-miss and fatal medical errors. The use of the VistA electronic health record system by the Veterans Health Administration is just one example that substantiates this claim. More detail about this is provided in subsequent chapters of this book.

Medical Knowledge Gap@Point of Care

The next major factor that supports the need for serious transformation using medical informatics technologies and techniques is the gap in the delivery of clinical knowledge at the point of care. Yes, what doctors don’t know (but could know with the appropriate information systems) can hurt or kill you. When you see a doctor or go to the hospital, you’ve got a 50-50 chance you’ll be assessed using the most current medical evidence.⁶ That’s right: 50% of the time, you’re *not* getting the latest treatment information available. And the quality of treatment differs markedly by disease. For example, 76% of people with breast cancer received the recommended treatment. Only 23% of those with hip fractures did.⁷

⁵“Attitudes of Americans Regarding Personal Health Record and Nationwide Electronic Health Information Exchange,” Markle Foundation, October 2005.

⁶RAND Health Study: Landmark Study Finds American Adults Often Fail to Get Recommended Care, Posing “Serious Threats” to Health. June 25, 2003.

⁷RAND Health Study: Landmark Study Finds American Adults Often Fail to Get Recommended Care, Posing “Serious Threats” to Health. June 25, 2003.

Why aren't physicians using the most current clinical data available? It's not that they aren't good doctors; they simply don't have a way to easily access a vast array of clinical knowledge repositories at the point of care. The vast majority of Americans who visit physicians do not have an EHR. Their medical records are on paper, so receiving the most current medical evidence electronically at the point of care is impossible. Although fragmented databases do exist, they are not connected. Even more important, they are not easy to access at the point physicians need them: in the exam room with their patients. This lack of access not only impedes a physician's ability to recommend the latest treatments, but it also creates expensive duplicate tests and consultations. In fact, a new Dartmouth study indicates that one-third of the \$1.6 trillion spent on health care each year is wasted on duplicative or ineffective care.

Medical informatics provides the technical support to implement and distribute knowledge at the point of care, and most Americans support this connectivity. But we have a long way to go before we can truly integrate clinical, pharmaceutical, and administrative knowledge electronically at the point of care where it is needed; however, major inroads are being made.

The bottom line is this: achieving the vision of a safe, high-quality healthcare system that puts patients first depends on our ability to build a better mousetrap—one that combines connectivity, openness, and collaboration as a central theme. One of the biggest challenges facing health care is the implementation of interoperable health information technology that supports delivering the current evidence base at the point of need and providing an EHR for everyone.

Again, let's ask ourselves—Why, in the richest country in the world, aren't all medical records electronically maintained? Why can nearly every American access his personal bank account at an ATM anywhere in the world, but can't access his full set of medical records electronically from anywhere?

Why don't physicians have a "medical knowledge button" that links them directly to the latest clinical research and treatment guidelines, whether they are treating a patient in their office, in the hospital, at home, or at work? Yet people can find almost anything they want on the Internet with a quick search on Yahoo or Google or a next-generation search engine such as Grokker.com, Clusty.com or Live.com.

The modern medical industry has evolved piecemeal over the last 100 years across clinical, technological, business, and managerial dimensions.

At an ever-accelerating rate, we are seeing breakthrough medical treatments and cures, the birth of new clinical specialties, the addition of government health and access programs, significant changes to healthcare reimbursement mechanisms, new pharmaceuticals, a burgeoning uninsured population, and significant changes to medical facilities and equipment. The fact that each of these changes has evolved independently into its own small cottage industry has resulted in a complex web of processes, layers, and bureaucracies. Each of these systems has its own culture, its own set of norms, its own set of processes, and its own small piece of the financial payment maze.

Adding new clinical informatics and information technologies to this fragile mix of systems will require significant job-altering changes to how physicians, nurses, physical therapists, billing staff, hospital administrators, and managers perform their daily work. This is a scary proposition for most people. Generally speaking, we are asking people to modify the job they have been doing the same way for many years and begin using EHRs and other systems intelligently to improve the quality and cost-effectiveness of health care. That said, we cannot let resistance to change be the hurdle that keeps us from digitizing and humanizing health care. If we do, we will continue to put human lives at risk.

The man-made epidemic of medical errors created as a result of system complexity needs immediate attention so that Americans like one-and-a-half-year-old Josie King no longer die from preventable mistakes.

Do not underestimate the time and pain involved in making this happen. Change like this is *hard*. It may take decades to do it right, but hopefully it will only take a few years to apply Medical Informatics 20/20 strategies and tactics with passion, vigor, and leadership.

Now that we have defined the problem, Chapter 1 will highlight the major tactics within each of the three main Medical Informatics 20/20 strategies. In *Section IV, Toolkit for Medical Informatics Excellence and Quality Improvement*, expanded information on each of the three COSI strategies provides detail on tactics such as process improvement tools, including Six Sigma, knowledge transfer, collaborative innovation, sharing alliances, clinical decision support, and open standards.

Failures in Implementing Information Technology

The last major factor that we have identified that supports the need for a new age of medical informatics are the past failures in deploying clinically

based information technology in health care. For various reasons, throughout many industries there is a high failure rate for the deployment of enabling information technology. One factor that stands out is the lack of understanding of the human factors involved in planning, deployment, and use of information technology. This is particularly acute in medical informatics, where success depends on integral involvement of clinicians who understand information technology, medicine, and transformation of business/clinical processes for better care.

In its list of “Barriers to Adoption” of health information technology, the Office of the National Coordinator for Health Information Technology (ONCHIT) cited the “high failure rate for electronic health implementation” as one of the major barriers hindering adoption across the country (www.os.dhhs.gov/healthit/barrierAdpt.html). Also noted is a high failure rate for business reengineering and the lack of experienced information technology (IT) professionals with both clinical and IT experience.

Scot Silverstein, MD, a leading clinician and medical informatics expert, has assembled a Web site at <http://home.aol.com/medinformaticsmd/failurecases.htm> that maintains a running list of failed health-information technology projects. In summarizing his findings over the years, he stated:

IT personnel in hospitals often believe that success in implementing management information systems applications (“business computing”) supersedes or actually renders unnecessary the mastery of medicine in leading and controlling implementation of clinical computing tools. Experts in clinical computing must provide effective solutions via seasoned application of the concepts, techniques, knowledge, and processes of medicine, and display an expert level of critical thinking in applying principles, theories, and concepts on a wide range of issues that are unique to clinical settings. Business IT experience alone does not provide a sufficient background for such responsibilities to be carried out effectively. Leaders in clinical IT must be experienced in medical sciences and in the complex social and organizational issues of health care, such as the need for multiple, contextual levels of confidentiality, the politics and psychology of medical practice and referral, the complex medical workflow and the need to rapidly improvise due to the unexpected (“there are no committees in cardiac arrest situations”), and societal and personal sensitivities towards the physician–patient interaction.

The Office of the National Coordinator for Health Information Technology (ONCHIT) also noted that another of the key problems faced is that “limited capacity for interoperability” standards are lacking in most information technology products and that the standards are not rigorous and lag behind commercialization.

Implementing information technology in any setting is hard. But implementing clinical health information is very hard due to the complexity of medicine, the fragmented nature of the current health-information ecosystem that exists in healthcare organizations, and the variability of the human body. Failure is frequently a factor due to “human” issues, which range from a lack of participation in planning and selection, to poor training and resistance to changing how work is done.

Health care is very complex. The paper-based and manual processes that have evolved over the last 100 years will not change easily. The need to involve clinicians in transforming processes from paper to electronic media is the reason that often 50% of the expenditures for implementation are not related to the technology but to involving clinicians, educating them, obtaining their input, and supporting them in learning by doing. Any technology tool will require humans to run that tool, so involvement, training, careful process mapping, and redesign are critical. In the end, medical informatics deployment is more likely to fail due to human factors rather than a failure of the technology itself. This reality demands the application of collaboration and innovation tactics related to a rigorous process-improvement methodology, an empowered knowledge-transfer effort to rapidly spread better ways of delivering care, and other tactics that are part of the Medical Informatics 20/20 Model.

In the first half of this Chapter the major problems contributing to the poor current state and need for health care transformation were outlined. Next we provide an overview of the three critical strategies—Collaboration, Open Solutions, and Innovation—and their associated tactics that enable the successful execution of the strategies.

THE MEDICAL INFORMATICS 20/20 STRATEGIES

Collaboration as a Key Strategy

Our market-based healthcare system has demonstrated over the past 25 years an inability to solve the electronic health and medical record challenge. But it has identified and developed valuable pieces needed to complete the puzzle. The federal sector has not solved the problem either, but important steps have been taken, and industry-wide collaborations are gaining traction. Out of the Josie King tragedy, dedicated professionals

and patients learned from medical mistakes and created a collaboration to support change. The Institute for Healthcare Improvement (IHI) was established more than 19 years ago by Donald Berwick, MD, and now has a worldwide collaboration in place to support improving quality and patient safety in health systems around the world. (See Chapter 5 for the case study on the collaborative efforts of IHI to transform healthcare systems into high-quality organizations.)

Within the COSI strategy of Collaboration are three major tactical areas:

- Leadership and Open Collaboration.
- Public–Private Collaboration.
- Knowledge Management.

Within each of these areas are a series of tactics used to support the successful execution of the Collaboration strategy. What follows is a brief highlight of each of the tactical areas within Collaboration, as illustrated in Figure 1-3. Details on the three COSI strategies and their associated tactics are described in depth in Chapter 11, Section IV.

- **Tactical Area: Leadership and Open Collaboration Leadership** is absolutely needed to transform healthcare organizations into places

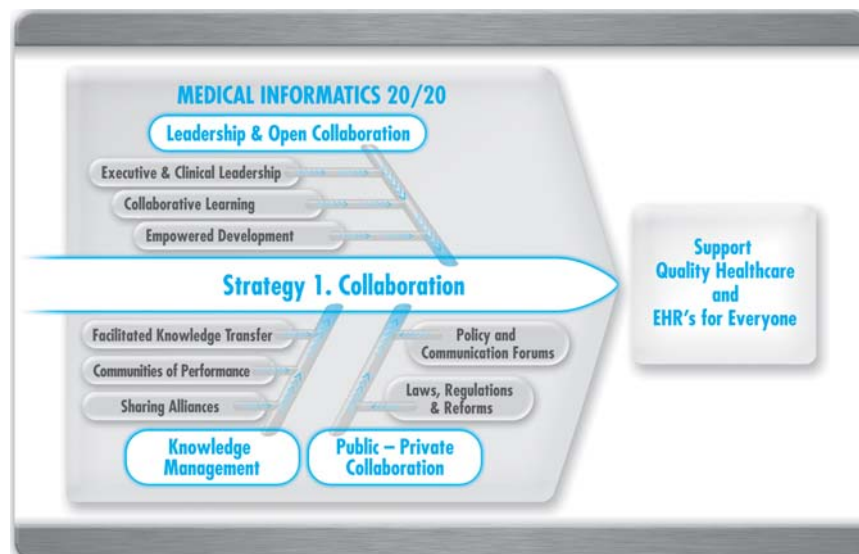


FIGURE 1-3 Tactics Supporting the Collaboration Strategy

where quality comes first. Leadership must become self-educated and engage by actively supporting the team members who will have to transform business and clinical care processes. Executive boards need to put quality performance criteria first, and compensation systems must change to reward quality before financial performance. Open Collaboration involves the use of open communication, learning, and applying problem-solving circles among diverse stakeholders. Open Collaboration is an extension of the mission-driven hospitals and health systems across the country, many of which are faith-based or nonprofit. Key tactics of Open Collaboration include:

- ***Executive and clinical leadership*** must solve the challenges of error reduction and quality care with knowledge and passion. The first question CEOs must ask when monitoring the drive for performance excellence is “How are we measuring up on quality indicators?” Clinical leaders must be empowered by an executive leadership who understands, participates, and supports rapid-cycle improvement in quality.
- ***Collaborative learning*** is an umbrella term for a variety of approaches that involve cooperative efforts by managers and clinical professionals to reduce errors and improve quality. This cooperative approach uses the conferences, virtual networks, adult learning theory, and online and computer-based learning management systems to increase medical informatics knowledge and know-how of care providers and managers in health care.
- ***Empowered development*** represents an enlightened and proactive clinical involvement in all stages of planning, development, and deployment of medical informatics technologies. Institutions such as Johns Hopkins have also engaged the patient voice. This involves increasing the technology literacy of all care-delivery associations in an organization. Tools such as Six Sigma and LEAN, described later, offer a step-by-step methodology to guide transformation, thus creating an empowered and educated development process. If clinicians are not empowered and appropriately involved in all phases of development, then the likelihood of deployment failure of information technology will rise.
- ***Tactical Area: Public–Private Collaboration*** The key underpinning of Public–Private Collaboration is that both federal and private-sector leadership must step forward to expand the forums and foun-

dations already in place. Within the federal government, the Consolidated Health Informatics efforts of all federal agencies help to establish standards for clinical data exchange. One of the most important federal efforts has been the establishment of the Office of the National Coordinator for Health Information Technology and the appointment of the first health-information technology and medical informatics czar. Key tactics are:

- ***Policy and Communication Forums*** Meetings, conferences, and events that are policy or educational based to spread the diffusion of information and provide a forum for dialogue and participation.
- ***Laws, Certifications, and Reforms*** Federal, state, and local laws that are passed or reformed in an effort to improve public health, healthcare quality, and safety. This would include ensuring patient privacy and security through regulations, certifications, and laws.
- ***Tactical Area: Knowledge Management*** Is your healthcare organization wasting resources and reinventing the wheel? Knowledge Management (KM) integrates human processes supported by technology to create, organize, and share knowledge and the intellectual capital of an enterprise. Traditional mentorship is a form of KM, but today, KM is a discipline focused on liberating the power of human capital within an organization while also capturing, archiving, and diffusing the knowledge rapidly throughout an organization. A KM program addresses all four of these fundamentals: leadership, processes, technology, and people. These elements support the achievement of organizational goals. KM involves the processes, people, and technologies for knowledge database development, organizing, searching, and application. KM is a vital component in the rapid spread of demonstrated best practices, transference of explicit and tacit knowledge, and the framework for sharing and working better and smarter. Key tactics include:
 - ***Communities of Performance™ (CoP)*** Associates with common problems collaborate over an extended period to share ideas, exchange resources, invent improved processes, and find solutions. Today, CoPs are usually supported with Internet and communication technologies that accelerate the diffusion of information, resources, and materials. CoPs connect people and leverage human capital to achieve set goals. Communities of Performance

focus on achieving measurable goals inside an organization or across inter-organizational boundaries.

- **Facilitated Knowledge Transfer (FKT)** The use of dedicated people who specialize in identifying, profiling, and archiving evidence based best practices and community based proven practices using multimedia communication and information technologies to educate and empower people to improve. FKT experts are storytellers, producers, and trainers of the organizational knowledge universe. Their mission is to identify and package, in a compelling, complete, and interesting way, a best practice so that it can be rapidly diffused to support rapid-cycle change. FKT recognizes that sharing to support goal achievement in geographically distributed and complex organizations does not often happen naturally. FKT in health care works to train and support all clinicians and managers in an organization in how to share effectively to improve performance.
- **Sharing Alliances** Formal or informal relationships to support the transfer of tacit and explicit knowledge within or across organizational boundaries. A formal knowledge-sharing arrangement between two large separate multi-location healthcare organizations would represent a Sharing Alliance. A good example of a sharing alliance are the participants in the CMS/Premier, Inc. Pay-for-Performance demonstration project who agreed to share their data with each other and publicly entered into a sharing arrangement to improve quality.

Open Solutions as a Key Strategy

Open Solutions are vital to realize a better healthcare system. Generally speaking, Open Solutions are software application source code, communications, standards, knowledge, or other assets that are available on a no-cost license basis and/or their innerworkings are exposed to the public. The Open Solutions strategy has a range of tactics to lower the implementation costs of health-information technology deployment in healthcare delivery systems, today and tomorrow. Consider this:

- **Open Solutions in the form of open standards** will be essential to support interoperability and clinical data exchange. This is critical to the successful deployment of EHRs for all Americans and will

ensure that medical records are accessible and readable across the healthcare system and wherever patients need access to care.

- ***Open Solutions in the form of open-source software*** will play a critical role in reducing the cost of health information technology in the near term by delivering competitive pressures to closed-software solution vendors and offering a viable, no-fee license option to organizations who otherwise could not afford closed-source software solutions.
- ***Open Solutions in the form of open architecture*** will be vital to connecting open and closed information technology systems for integrated and lower-cost operations that can support better health.

The benefits of Open Solutions include lower costs, better quality products (because they are constantly being improved by those using them), accelerated innovation and problem-solving, and reduced cycle time. Often overlooked, yet integral to solving the problems that face today's healthcare industry, Open Solutions are the key to achieving higher-quality health care, lower implementation costs, and better disaster preparedness with affordable solutions and greater scalability.

Frequently, Open Solutions are seen as a "commons," much like a public park where many—but not all—members of a community contribute and there are a set of norms that govern the maintenance and evolution of the commons. Commons, communities, and common actions for the common good have long and deep roots in the human psychological composition. Companies that pursue an Open Solutions business model in the open-source software field generate revenue from implementation and ongoing service and support but not from upfront license fees for the software.

Open Solutions Tactical Areas

Within the COSI strategy of Open Solutions are four major tactical areas: Open Standards, Free and Open-Source Software (FOSS), Technology Transfer, and Open Systems. This is illustrated in Figure 1-4. Each tactical area contains specific tactics, initiatives, tools, and technologies that support the Open Solutions strategy. Following are brief overviews of these. Section II and III of this book focus on the assessment, deployment, and management of Open Solutions with a specific focus on Free and Open-Source Software (FOSS) in the various forms of VistA and other EHRs being implemented in healthcare organizations around the world.

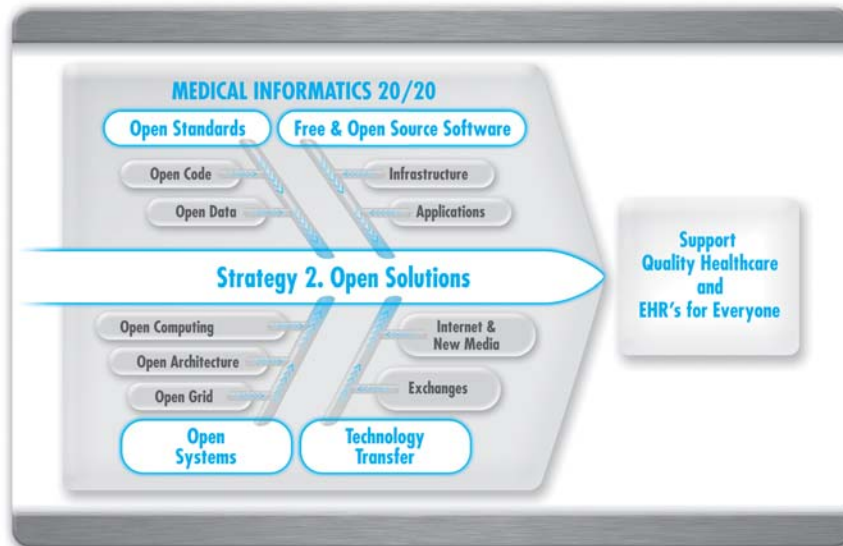


FIGURE 1-4 Tactics Supporting the Open Solutions Strategy

- **Tactical Area: Open Standards** Open Standards are the set of specifications developed to define interoperability among diverse systems. Other related concepts and tactics that support diverse health-information technology system interoperability are:
 - **Open Code** Commercial proprietary software whose source code can be obtained, viewed, and changed within the guidelines of the specific license arrangement.
 - **Open Data** Describes data formats (e.g., “Open Data Format Initiative description”) and programs to validate that a data file is “ODFI compliant”.

An important example is the federal government’s Consolidated Health Informatics (CHI) initiative. The U.S. Department of Health and Human Services (HHS) and more than 20 federal departments that deliver healthcare services are working to identify appropriate, existing clinical data standards and to endorse them for use throughout the federal sector. This collaboration is an effort to drive adoption of the selected clinical data standards and create a tipping point so the federal clinical data standards become the private sector’s de facto standards for the next-generation national health-information

network. There are significant public and private forces collaborating in this effort. The resisting forces include the fragmentation and complexity of the healthcare system and the time it takes to move information systems to the new clinical data standards.

- ***Tactical Area: Free and Open-Source Software*** Free and Open-Source Software (FOSS) refers to a software program in which the source code is available to anyone for use and/or can be modified by anyone, free of any upfront license fee. FOSS gained significant presence in the marketplace through the growth of the Linux operating systems, which set the stage for the growth of FOSS in the infrastructure area of information technology. Progressively, FOSS has migrated from infrastructure to applications in the information technology field. Many experts feel that there is no corporate enterprise software application that is not immune to becoming a commodity because of the power of the community of software developers to create FOSS alternatives to closed-software applications.

FOSS is a central element of the Open Solutions strategy in the Medical Informatics 20/20 Model. The market is growing rapidly across all domains of information technology in both the public and private sectors. Companies such as Boeing, Amazon, Google, and E-Trade use the open-source operating system Linux extensively throughout their enterprises. IBM, Hewlett-Packard, Sun Microsystems, and other leading information technology companies are investing billions of dollars and designing significant aspects of their corporate strategies and business models around Open Solutions.

Healthcare institutions need an affordable comprehensive health-information and clinical information system to meet the Presidential agenda, homeland security requirements, and patient demands for safe, high-quality health care. Open Solutions can offer a cost-effective and viable solution, and healthcare organizations are moving in this direction. VistA Open Office (VOE) for physician offices is an example of how the federal government is using an open solutions approach to support broader access to EHR technology for small medical practices.

The time is right for various healthcare organizations and federal agencies to effectively participate with the Open Software Solutions community and healthcare industry at large, especially given the availability of VistA and the VA Computerized Patient Record System

(CPRS) as an equivalent of Free and Open-Source Software. The steps being taken by VA and HHS to develop and release the VistA Open Office (VOE) system for use in small medical practices is a step in the right direction. Chapter 3 discusses in detail the growth and development of Open Solutions and open-source software in health care. Chapters 6, 7, 8, 9, and 10 expand significantly on VistA, VistA Open Office, and other FOSS options available for health care.

- **Tactical Area: Technology Transfer** Technology Transfer has several dimensions. One focuses on “practical technology transfer” as the process of developing practical applications from the results of scientific research. Another dimension is “technology transfer exchange,” which focuses on the sharing or exchange of an actual technology, device, or software code from one organization to another via Web-based sharing or an exchange system. Companies, universities, and government organizations have now dedicated entire departments or programs toward technology transfer. For instance, the U.S. Department of Veterans Affairs (VA) has operated a Health Information Technology Sharing (HITS) office and program for a number of years focused on identifying, tracking, and facilitating the transfer of knowledge and technology between government agencies and the private sector. See Chapter 4 for an expanded case study on this program.

Think of technology transfer exchange for medical informatics as an eBay for health and medical technology resources such as software code. The best mechanism to facilitate the sharing or sale of open- or closed-software code would be an Internet exchange of some type. eBay is an example of a general-interest and goods-and-services exchange, but it is quite easy to envision an eBay for health and medical technology. Essential tactics to support technology transfer include the use of:

- **Internet and New Media** The use of various technologies such as the Web, instant messaging, and Wiki to facilitate the transfer of technology or software from one organization to another.
- **Technology Exchanges** Where technology is shared or exchanged using a communication medium and information technology system. These are formal sharing locations usually on the Web. Government Open Code Collaborative (GOCC), Avalanche Corporate Technology Cooperative, and Paradigm from Perot

System are three examples of actual software code exchanges that, through sharing, reduce both the cost of information technology and the inefficiencies of duplication. These cases are explored in Chapter 4.

- **Tactical Area: Open Systems** Creating a national health-information network is a complex undertaking within a market-based economy. Such a network could support broad public health, personal health, and national defense goals, as long as the system addresses critical security, fraud, and privacy issues. Open Systems play a vital and irreplaceable role because they allow the seamless communication and interoperability of diverse health-information systems. Open Systems involve hardware and/or software systems that use and/or adhere to open standards. Open Systems are not necessarily Free and Open-Source Software where the source code of the software is available at no cost. Open Systems and open architecture in particular are critical to interoperability. For a national health-information network to be viable, Open Systems and Open Standards must be used to link a diverse ecosystem of closed software and open-source software programs. Any health information or medical informatics computer program must be developed or modified to communicate using Open Standards with any other system within the context of a national health-information network. Major tactics within Open Systems are:
 - **Open Architecture** Is an information technology (IT) architecture with public specifications and a platform for interoperability.
 - **Open Computing** This is a general term used to describe an “open” philosophy in building information technology systems.
 - **Open Grid** Refers to the Open Grid Services Architecture (OGSA) developed by leading government research labs with Globus Alliance protocols to support supercomputing “grid” development and management.

Innovation as a Key Strategy

Within the Innovation component of the COSI strategies, there are three major tactical areas: Innovation Methodologies, Process Improvement, and Applied Knowledge. Within each of these are specific tactics, initiatives, tools, and technologies that support the Innovation strategy. This is

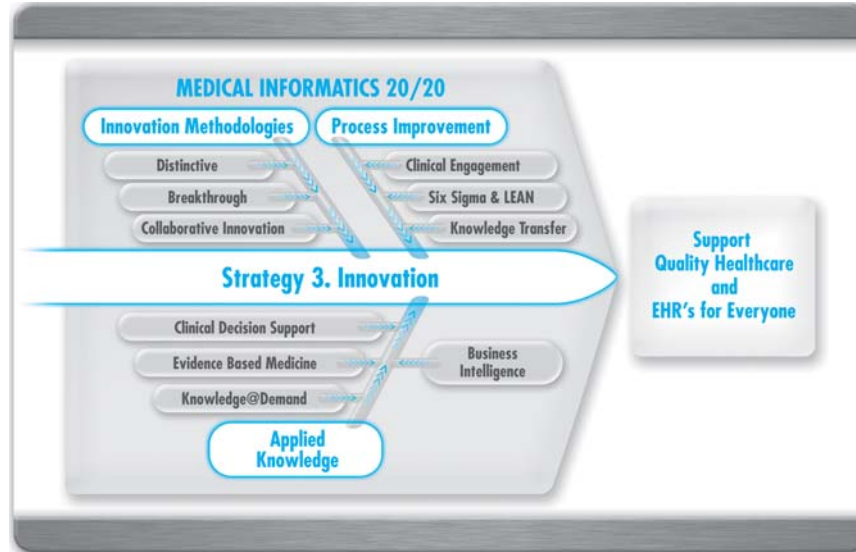


FIGURE 1-5 Tactics Supporting the Innovation Strategy

shown in Figure 1-5. A brief description of each follows, and more information is provided in *Section IV: Toolkit for Medical Informatics Excellence and Quality Improvement*.

- **Tactical Area: Innovation Methodologies** In general, Innovation is the introduction of new ideas, goods, services, and practices that are intended to be useful. As healthcare executives, managers, and clinicians, we must commit to constantly learning how to use new tactics, technologies, and tools that empower our teams to address the challenges before us. There are several primary types of innovation tactics that can be applied in the Medical Informatics 20/20 Model's Innovation Strategy.
 - **Breakthrough Innovation** The invention of a novel, unique process, idea, concept, formula, technology, or tool that promises to change the way people live and work. Breakthrough innovations are leapfrog events such as the invention of television or the invention of the electric lightbulb.
 - **Distinctive Innovation**TM A term generally used to describe new but incremental inventions and the application of the innovation to solve a practical problem in a short time frame. Distinctive Innovation is the process of using a rigorous methodology, such

as Six Sigma, to improve something—a process, procedure, product, or invention—that results in a distinctly different outcome than the original. The invention of the electric lightbulb was a breakthrough innovation, but finding a long-lasting filament to make it practical was a Distinctive Innovation.

- **Collaborative Innovation** The improvement process that involves an extended network of colleagues working together to solve problems using the Internet and collaboration software tools to support connection, communication, and creation. This is a relatively new discipline and is a powerful trend in many industries. Linux and the open-source software movement are examples of Collaborative Innovation. Collaborative Innovation is quite evident in the technology, government, and service sectors. Growth in the healthcare sector is just beginning to accelerate. Two examples of Collaborative Innovation are *IBM's Openness strategy*, which is founded on the principles of Collaborative Innovation, and *Wikipedia*, the world's largest online encyclopedia and an ongoing Collaborative Innovation effort of tens of thousands of people around the world.

Collaborative Innovation is a natural extension of the mission-driven nature of health care and motivations of healthcare professionals to help others. Chapters 12 and 13 expand on this tactic in detail.

- **Tactical Area: Process Improvement** In past years, total quality management (TQM) dominated healthcare improvement efforts. Recently, many leaders have realized that more rigorous and expansive methodologies are needed to map current processes, to assess problems using statistical and other tools, and to develop solutions targeted at the root causes that will have the biggest impact on outcomes. Consequently, Six Sigma and LEAN have become vital tactics and tools in the hands of healthcare organizations seeking to significantly improve behavior and to hold the gains once improvement has been realized.
- **Clinical Engagement** is crucial for process improvement in healthcare settings. Clinical leaders must lead for quality care to be realized. Healthcare processes can only be transformed with the active commitment and engagement of *all* clinical care and support professionals in a healthcare organization. Quality must come first in thinking and reporting.

- **Knowledge Transfer** is frequently being seen as the rocket fuel for the diffusion of proven practices that are developed under a quality-improvement program. A multi-year knowledge transfer program with the active support of senior management, integrated with quality-improvement efforts, solves key healthcare organization challenges for rapid diffusion and support of best-practice implementation. *Section IV, Tool Kit for Medical Informatics Excellence and Quality Improvement*, delivers extensive information about the implementation of Knowledge Transfer in healthcare organizations.
- **Six Sigma** is a quality-management program that measures and improves the performance of an organization by identifying and correcting defects in an organization's procedures, processes, and services.
- **LEAN** (or Lean Production), originally developed by Toyota, is a methodology that emphasizes "Right." It focuses on getting the right things to the right place at the right time the first time within a context of reducing waste, as well as optimizing processes and embracing changes that support customers.
- **Tactical Area: Applied Knowledge** The three key tactics of Applied Knowledge are:
 - **Clinical Decision Support (CDS)**, which involves a variety of systems and processes to support diagnosis and treatment of medical conditions using the most current medical knowledge. From a systems perspective, Clinical Decision Support Systems (CDSS) include interactive computer/Internet information systems that directly assist physicians, researchers, and other healthcare professionals with decision-making tasks related to patient care.
 - **Evidenced-Based Medicine (EBM)**, is the application of the scientific method to medical practice. EBM has become a discipline and movement in medicine internationally to bring the latest medical information into clinical practice for patients. It recognizes that many long-established medical traditions are not yet subjected to adequate scientific scrutiny. Community-Based Proven Practices (CBPP) represent practices that have been proven to improve quality within a one or more healthcare organizations, but have not necessarily gone through extensive documentation necessary to be identified as an EBM. Many healthcare

organizations are engaged in sharing CBPP to support rapid-cycle improvement.

- ***Knowledge@Point of Care and Knowledge on Demand***, are two closely related tactics within the overall field of “open knowledge.” Knowledge@Point of Care represents the delivery, through information and communication technology, of the most current evidence base and medical knowledge to assist in the diagnosis and treatment of patients. Knowledge on Demand uses technology to enable information acquisition and deliver knowledge and information at the point of need for a worker or customer. Google, Yahoo, Live.com, and the more advanced Grokker.com are Internet-based services for knowledge at the point of need.
- ***Business Intelligence (BI)*** is a series of business processes for collecting and analyzing business information. In health care this would include both business and medical information necessary to support the ongoing positioning and success of an organization. The BI discipline also involves the technology used in these processes, and the knowledge, insight, and strategies aggregated through set processes. With the rapid increases in health and medical knowledge on both the clinical and business side of care, extensive amounts of data are being generated. Various tools such as data warehouses, data mining, enterprise application integration, neural networks, artificial intelligence, and other technologies and techniques are used to achieve BI goals and objectives. BI in the 21st century is both a science and an art as large amounts of data are assessed, analyzed, and extracted against goals to realize actionable knowledge.

Applied knowledge in all of its current and future forms is an exciting field within Medical Informatics 20/20 and promises to deliver vital and lifesaving knowledge to professionals and patients from the point of care to before the point of care as preventive care rapidly evolves into “pre-emptive care.”

The three key strategies of the COSI Model, Collaboration, Open Solutions, and Innovation are interlinked in concept and execution within the Medical Informatics 20/20 Model. The various tactics that we have highlighted in Chapter 1 support a more efficient and effective execution of health-information technology deployment in delivery systems

today and tomorrow because such tactics—Six Sigma, Facilitated Knowledge Transfer, Collaborative Learning, and the others—address the human factors necessary for medical informatics success.

Section IV: Toolkit for Medical Informatics Excellence and Quality Improvement expands on the themes established in Chapter 1. Other sections of the book expand on the many aspects of Open Solutions in Medical Informatics 20/20. Given the demands for transformation to a patient-centered model, the limited capital resources of many organizations, and the demand for quality, open strategies, tactics, tools, techniques, and technologies are indispensable for success. Chapter 11 delivers expanded descriptions of key tactics within the Collaboration and Innovation strategies of the Medical Informatics 20/20 Model.

The remaining chapters provide a road map for healthcare leaders and organizations to seize this opportunity. Section I establishes a foundation by defining the three key strategies of the COSI Model: Collaboration, Open Solutions, and Innovation. Included in these chapters are the nuts and bolts of these core strategies and their associated tactics and technologies. A high-level review of the status of COSI in business and health care, as well as case-study insights, demonstrate how COSI strategies are being successfully used to improve care. Emphasis is placed on the implementation of EHR systems and their impact on quality of care and concomitant improvements in overall performance by healthcare provider organizations.

It is time to rigorously test the existing processes of our healthcare systems, our hospitals, our ICUs, our physician offices, our nursing homes, and begin to determine how we can provide access to critical medical information in the right place, at the right time. Using Collaboration, Open Solutions, and Innovation, we can analyze health care's complex processes and lay out a plan for moving from the present state to a future state. This web of data networks—from federal and public health agencies to private physician practices—will allow clinicians to care for patients within a true culture of safety, and share clinical information easily, securely, and confidentially. Throughout the book we emphasize people and process enabled by advanced and appropriate technology. That is why we have wrapped “Collaboration” on the front end of “Open Solutions” and “Innovation” on the back end within the context of deploying medical informatics for better care.