

## Chapter 1

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# Introduction

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Breakthroughs in medical science and innovations in clinical practices offer enormous opportunities for impressive improvements in the health and well being of society. Returns on investments in these endeavors can be impressive. However, we will not realize the greatest returns unless we also better engineer the system of healthcare delivery [4].

### 1. The enterprise of healthcare

Consider the architecture of the enterprise of healthcare delivery shown below [5]. The efficiencies that can be gained at the lowest level (clinical practices) are limited by nature of the next level (delivery operations). For example, functionally organized practices are much less efficient than delivery organized around processes.

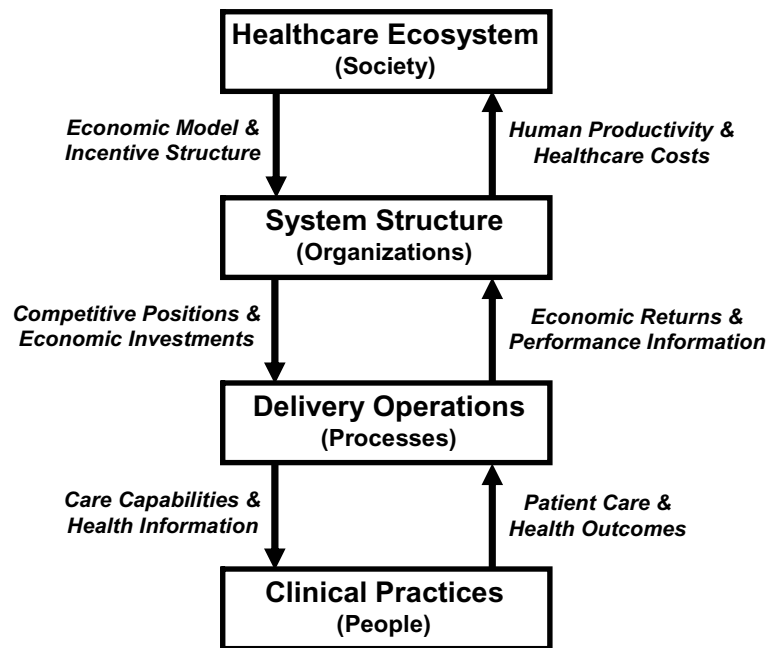
Similarly, the efficiencies that can be gained in operations are limited by the level above (system structure). Functional operations are driven by organizations structured around specialties, e.g., anesthesiology and radiology. And, of course, efficiencies in system structure are limited by the healthcare ecosystem in which organizations operate. Differing experiences of other countries provide ample evidence of this.

The fee-for-service model central to healthcare in the United States assures that provider income is linked to activities rather than outcomes. The focus on disease and restoration of health rather than wellness and productivity assures that healthcare expenditures will be viewed as costs rather than investments. Recasting of “the problem” in terms of outcomes characterized by wellness and productivity may enable identification and pursuit of efficiencies that could not be imagined within our current frame of reference.

### 2. Defining value

There is currently much commentary on two things in healthcare – universal availability and cost control. However, we do not think that people want the lowest cost, universally available healthcare system. We think the central issue should really be the creation of a healthcare system that provides the highest value.

Value is often defined in terms of the benefits of the outcomes of an expenditure, divided by the costs of the expenditure. The benefits of healthcare – from a patient’s perspective – include the quality of health outcomes, the safety of the process of delivery, and the services associated with the delivery process [3].



### The Enterprise of Healthcare Delivery

The benefits from the perspective of society also include the availability of healthy, productive people who contribute to society in a wealth of ways. When people are not healthy, these contributions are diminished. A recent study found that the cost of the lost productivity far exceeds the cost of the healthcare [2].

For many reasons it is likely people will remain in the workforce longer than in the past. In 1960's, before Medicare got started, the average age of death was 67; the average age at retirement was 65–66. By 2005, the average age of death had reached 75 and the average age of retirement was 62. We are now seeing some people planning on working longer, perhaps up to 70. Even Social Security has delayed the eligibility age for benefits, with the retirement age for people born after 1937 increasing to 66 if born before 1955 and up to 67 if born later.

If people who do not retire at the usual Social Security retirement age stay on employers' insurance, then employers will even have an increased interest in keeping people healthy for as long as possible and doing productive work for as long as possible until the worker retires and goes onto Medicare. Employer insurance companies are glad to see the older employees roll into Medicare for the same reasons; when the greater costs are incurred it is the government's problem.

Indeed, this is the exact reason some have proposed that people enroll in and own an insurance product and keep it even after they retire. That way the insurance company will now have an interest in keeping you as well as possible even after you retire, in other words, sun setting Medicare. A Federal Employees Health Care Plan model would facilitate this option.

Thus, there will be an increasing need to keep older people healthy because they will need to remain productive longer. More pervasive, due to the "flat world" [1], will be the need to keep everyone healthy and productive. Part of the value equation, therefore, should include the productivity in the future of all the workers that do not get diabetes or have heart attacks or cancer. For this to work, our value equation will have to account for future returns from today's investments.

This broader perspective emphasizes the importance of a healthy, educated, and productive population to well-being and competitiveness of a society. Of course, a central debate in the U.S concerns who pays for this value. Regardless of how this debate is resolved, however, it is difficult to make the case for an unhealthy, uneducated, and unproductive country.

### **3. Delivering value**

Value is delivered by value streams – the sequences of activities that create quality health outcomes safely with excellent service. Some activities create more value than others. These activities tend to involve direct patient-clinician interaction. Other activities such as billing, payroll and procurement are enablers. They should be done efficiently, and with good service, but should not divert resources from higher value activities.

Value streams are enabled by work processes, e.g., patient in processing and out processing or, perhaps more compelling, diabetes management. It has been found that value can be increased simply by thinking of an organization in terms of work processes. Such thinking fairly quickly leads to identifying, and hopefully eliminating, activities that do not add value. By thinking in terms of work processes rather than departments, for example, one can better allocate resources across activities to maximize the total value of the service to the patient and/or society rather than “suboptimizing” to maximize the financial value provided by or to each department.

Note that process-oriented thinking can have substantial implications for healthcare business models. For the process of diabetes management, for instance, one can imagine charging patients, or third party payers, for the health outcome of quality management of this disease rather than sundry fees for each of the departments and people involved in this process. This then would enable the provider to allocate resources across this process to maximize the value provided. Whether or not each department was “profitable” would no longer be central to decision making. Of course, this could remain a major issue for single specialty practices, which suggests a need for another level of rethinking of business models.

#### *3.1. Information*

There are two critical aspects of maximizing value by thinking in terms of value streams and work processes. First, information is required to understand and control the state of the system to achieve effective operations. A lack of understanding of the state of the system, as well as a lack of feedback of the current state of the system relative to intentions, severely limits the effectiveness of the system.

It is also very important to have information on what works and does not work. Randomized clinical trials are the “gold standard” for clinical evidence. However, we can also learn from the millions of patient transactions each day by mining this wealth of data for trends, insights, and new hypotheses. Such information may be the primary means for assessing the efficacy of large-scale organizational changes.

#### *3.2. Incentives*

Second, Incentives have to be aligned with the goal of maximizing value. If service revenue is driven by cost reimbursement for activities, then rational providers will maximize the number of activities. On the other hand, if service revenue is driven by health outcomes of services, then rational providers will attempt to maximize health outcomes for every dollar they expend.

Our sense is that providers that are good at proving quality health outcomes will make higher profits than they do currently. This requires that the initial conditions of the population of people for which a provider is responsible are taken into account so that funding available will enable the best providers to be able to realize a reward for keeping people well. Also, more providers are starting their own insurance products so they are closer to the first dollar and any efficiencies they attain translate into retained earnings that they can reinvest, use as salary, or pass on as reduced premiums to attract more business.

Incentives also drive how investment dollars are allocated. If better margins can be earned from addressing “lifestyle” diseases, e.g., restless legs, then investments in treatments for those diseases will diminish investments in more pervasive diseases, e.g., malaria. Further, enormous resources will be invested in convincing people that they have such lifestyle diseases.

### 3.3. Evaluation

Analytics can provide the means to process information to make it useful, as well as devise and evaluate incentive systems. We cannot evaluate all good ideas by deploying them in the healthcare system and assessing their impact. Instead, we should use analytical methods, including simulation, to model and evaluate a wide range of possibilities, the most promising of which can then be deployed and empirically evaluated.

## 4. Implementing change

As we consider implementing ideas that make it through the analytical filters, we should ask several questions:

- Who are the key stakeholders in this change?
- How will each type of stakeholder react to this change?
- What would cause them to support the change?
- Who has to act to enable both the change and support for the change?
- What political and financial resources are needed for success?

In general, these questions are focused on how to incentivize key players to change business models that they have finely tuned to the status quo. It seems like crises are often needed to prompt such changes. Perhaps this will arise in healthcare when costs preclude even the insured from receiving care, e.g., the patient’s portion of the bill is so high that people avoid getting care.

These five questions relate to barriers that will have to be addressed and overcome if we are really to foster a high value system of healthcare. The stakeholders include providers; patients, private payers, employers, government, unions, associations (e.g., AARP), pharmaceutical companies, and device manufacturers and, to a lesser extent, the bodies that are now working to generate evidence to be used in medical decision making (AHRQ, IOM, Leapfrog Group, NQF, University Hospital Consortium).

## 5. Overview of book

This book reflects the experiences and perspectives of a rather amazing group of thought leaders in healthcare delivery. Charles Vest and Harvey Fineberg, presidents of the National Academy of Engineering and Institute of Medicine, respectively, set the stage. They lay out why the healthcare

system in the United States performs so poorly relative to healthcare expenditures, as well as how the perspectives provided in this book can contribute to engineering a system to provide affordable, quality care for everyone.

Following this introductory chapter, this book is organized into sections that systematically map out the central issues, consider how information and incentives affect healthcare delivery, elaborate perspectives of major stakeholders, and discuss why change is so difficult, as well as the prospects for change.

### *Section 1: Issues*

In Chapter 2, “Seeking Care as a System,” Donald Berwick and Eva Luo of the Institute for Healthcare Improvement provide a compelling vignette of the great difficulty our current “system” has behaving like a system. The capability, audacity, and complexity of medical care have grown steadily over the past two decades. They argue that so, too, have its hazards and costs. They note how the landmark Institute of Medicine reports, *To Err Is Human* and *Crossing the Quality Chasm*, brought health care defects and the potential for improvement to the foreground, with threats to patients’ safety the most charismatic and understandable of all those defects. In 2009, a socially urgent trio – cost, quality, and coverage – now dominate a loud national conversation, with the potential to lead, maybe at last, to health system reform. But, they ask, what “system” are we talking about that is to be “reformed”? As their opening vignette portrayed a patient’s dependence on a vast network of interacting elements, so do almost all of the performance characteristics that reform may purport to improve. The idea of a system is neither a frill nor fine point if we are to get reform right. They argue that it lies at the very center of the scientific and political challenges that stand between us and the care we seek. They conclude that with a proper understanding of systems, authentic health care redesign is feasible and socially productive. Without that understanding, they assert, “reform” will likely do more harm than good.

Chapter 3, “Patient Safety,” by Pascale Carayon and Kenneth E. Wood of the University of Wisconsin, argues that patient safety is a global challenge that requires knowledge and skills in multiple areas, including human factors and systems engineering. In this chapter, numerous conceptual approaches and methods for analyzing, preventing and mitigating medical errors are described. Given the complexity of healthcare work systems and processes, the authors emphasize the need for increasing partnerships between the health sciences and human factors and systems engineering to improve patient safety. Those partnerships, they argue, will be able to develop and implement the system redesigns that are necessary to improve healthcare work systems and processes for patient safety.

In Chapter 4, “Aging: Adding Complexity, Requiring Skill,” Christine Cassel, Michelle Johnston-Fleece, and Siddhartha Reddy, of the American Board of Internal Medicine, note that the role of systems in addressing the needs of elderly and chronically ill populations remains a far from universal way of thinking, much less practice, in healthcare. Re-engineering the current fragmented system to align providers, patients and payment models to facilitate proactive management of conditions associated with advanced age and/or one or more chronic diseases – rather than respond to costly consequences of a health care system optimized for acute care conditions – will be a major challenge for all stakeholders. There are, however, promising success stories that are taking place in the United States today that may provide a model for improvement. The authors define the issues faced by the healthcare providers and payers providing care for the elderly and those with chronic conditions, which threaten to overwhelm the financial and human healthcare resources that exist to serve these populations. They define innovative ways of thinking about systems of care, and provide examples of unique systems that have applied theory into practice. These successful leaders may offer lessons in proactively managing complex health

conditions, overcoming communication barriers and using technology to complement the necessary human touch that is essential to healthcare delivery.

Chapter 5, “Palliative & End of Life Care,” by Robert Stroebel and Timothy Moynihan of the Mayo Clinic, indicates that health care provided in the final year of life is typically costly and often delivers unintended outcomes. However, high value can be defined for end of life care. High value clinical practices exist for end of life care and a common set of high value processes can be identified. The current system structure of healthcare delivery does not consistently support those high value processes. An improved organizational schema could foster sustained delivery of high value delivery operations. They conclude that healthcare ecosystem needs to evolve to provide appropriate incentives and support for an appropriately designed care system.

In Chapter 6, “US Healthcare Costs: The Crushing Burden,” Helen Darling of the National Business Group on Health provides an overview of health care costs in the United States, including trends, sources and uses of funds, employers’ role, and factors driving costs. It also reviews what analysts believe are cost drivers especially compared to other countries that have significantly lower health care costs and, often, better health outcomes. *Within* the US, there are also important differences by geography, further demonstrating that higher US costs do not reflect higher quality and greater patient and physician satisfaction. In fact, the opposite is often the case.

## *Section 2: Information*

Chapter 7, “Engineering Information Technology for Actionable Information and Better Health,” by Don Detmer of the American Medical Informatics Association and the University of Virginia, reports that information technology in health care (HIT) is getting a major boost in the United States through the passage of the American Recovery and Reinvestment Act (ARRA) of 2009. The portion of the Act that relates to health information technology (HITECH) seeks to achieve widespread implementation of electronic health records (EHRs) across the land and assure that these EHRs achieve sufficient levels of ‘meaningful use’ to improve care, reduce costs, and result in better outcomes. The author reviews current thinking about how HIT will facilitate collection, dissemination, and evaluation of information throughout the system. Further, it discusses the role and potential for HIT to support a learning organization. Finally, it outlines the current widely identified barriers to progress, e.g., standards development, lack of interoperability and connectivity, and limited decision support that uses evidence-based guidelines created and maintained explicitly to be actionable through computer-based records and systems.

In Chapter 8, “Electronic Health Records,” William Stead of Vanderbilt University asserts that a radical change in technical approach is needed to achieve electronic health records suitable to support an engineered system of healthcare. This chapter suggests a redefinition of interoperable health information. It provides examples of how to break the electronic health record challenge into component parts to match computational technique to the scale of the problem handled by a component.

Chapter 9, “Evidence-Based Medicine,” by Michael McGinnis of the Institute of Medicine, notes that whether for the generation or application of evidence to guide healthcare decisions, the success of evidence-based medicine is grounded in principles common to engineering. In the Learning Healthcare System envisioned by the Institute of Medicine’s (IOM) Roundtable on Evidence-Based Medicine, evidence emerges as a natural by-product of care delivery which is thoroughly documented, pooled for continuous monitoring and analysis, integrated with insights from related studies, and fed back seamlessly to improve the consistency and appropriateness of care decisions by clinicians and their patients. Drawing from lessons shared at the IOM/NAE symposium, *Engineering a Learning Healthcare System*, this

chapter provides an overview of the state-of-play in health care today, some of its key challenges, the vision and features of a learning healthcare system, applicable commonalities and principles from engineering, and potential collaborative opportunities moving forward to the benefit of both fields.

In Chapter 10, “Transforming Healthcare Through Patient Empowerment,” Leslie Lenert of the Centers for Disease Control and Prevention begins with a discussion of the great illusion of American healthcare, namely, that it is an altruistic service not a business. It is easy to see why medical care appears to be altruistic. “Beneficent” payers such as insurance companies, paid by employers, cover much of the costs of care for those with employment related coverage. But healthcare is a business and for every healthcare decision there are at least three perspectives: that of the patient, that of the physician and that of the payer. While physicians are sworn to advance patients’ interests, over all else, the interests of physician and patient are not parallel and often diverge. Sometimes the divergence is due to physicians overestimating the benefit of procedures they offer. Other times it may be due to them underestimating the risk. However, there is no section of the Hippocratic Oath that requires physicians to deliver healthcare to the benefit of payers in the most cost-effective manner. In the current model, physicians largely share decision authority with payers, resulting in a dynamic tension where each tries to limit the financial gain of the other, while trying to do no harm to the patient. This has resulted in a complex, inefficient, and poorly performing healthcare system. This chapter examines the prospects of what would happen if we put patients rather than doctors or insurance companies in charge of decision making using a variety of technologies, strategies and other decision support methods. Results suggest that for many therapies, particularly therapies that have upfront risks for survival and quality of life benefits, allowing patients to lead decision making would lower costs, due to patients’ natural risk aversion. Therapies with few upfront risks are not impacted or might even be used more heavily if patients led decision making. Aligning patient decisions with payers’ values on costs of care may enable approaches that allow individuals to benefit by conserving societal resources.

### *Section 3: Incentives*

In Chapter 11, “Health Economics,” Gail Wilenski of Project Hope notes that health care spending and more importantly, health care spending growth rates, are unsustainable. Past strategies of price controls, reliance on administered pricing for Medicare and the dominance of a la carte fee for service reimbursement have been part of the problem and do not represent promising strategies for the future. Too much time has been spent debating whether Medicare has done better or worse than the private sector since neither represents an acceptable path going forward. Understanding the effects of innovative payment strategies – including those that affect the patient – will be an important part in learning how to “bend the curve”. Making sure that there are strategies to implement the results of successful pilots and demonstrations will also be important.

Chapter 12, “Pay for Value,” by Robert Smoldt of the Mayo Clinic begins by quoting Texas Bix Bender who is not a known health economist. In fact, he’s not an economist at all. He is the author of “Don’t Squat with Yer Spurs On! The Cowboy’s Guide to Life”, and in that book he provides some insight into the issues that affect improving healthcare effectiveness and efficiency. One of his guides to life is as follows: “If you find yourself in a hole, the first thing to do is stop digging.” In healthcare, the author asserts, we find ourselves in a hole. For many years, we have been expounding that our healthcare system does not provide the quality we desire and that it is too expensive. Indeed, back in the 1970’s, President Richard Nixon declared that healthcare in the United States was in a crisis. Since that time, many people have made similar pronouncements. But what have we done? Basically, we have continued to dig, even

though we were finding ourselves in a hole. It is time for a different approach. The author builds upon the early assertion that people do not want the lowest cost, universally available healthcare system. The central issue should really be the creation of a healthcare system that provides the highest value. This chapter outlines a path forward to this goal.

In Chapter 13, “Reform Incentives To Create A Demand For Health System Reengineering,” Alain Enthoven of Stanford University, makes the argument that America needs a far more efficient health care financing and delivery system than the one we have. Our present system is a serious threat to public finances and is pricing itself out of reach. At the root of the problem are incentives and organization. The present fragmented fee-for-service small practice model is filled with cost-increasing incentives. There are some relatively efficient organized delivery systems, mostly based on large multi-specialty group practices. Unfortunately, most consumers are not offered the opportunity to save money and get better care by choosing such a system. This situation presents great opportunities for improvement in performance by re-engineering the system. However, for this to happen, incentives must be fundamentally changed so that everyone is cost conscious and care is organized in accountable care systems seeking improvement.

#### *Section 4: Engineering Approaches*

Chapter 14, “Systems Engineering and Management,” by William Rouse of Georgia Tech and Dale Compton of Purdue University offers a systems view of healthcare delivery and outlines a wide range of concepts, principles, models, methods and tools from systems engineering and management that can enable the transformation of the dysfunctional “as is” healthcare system to an agreed-upon “to be” system that will provide quality, affordable care for everyone. Topics discussed include systems definition, design, analysis, and control, as well as the data and information needed to support these functions. Barriers to implementation are also considered.

In Chapter 15, “Operations Research,” William Pierskalla of the University of California at Los Angeles begins by noting that in *Evita*, Andrew Lloyd Webber and Tim Rice wrote: *Politics, the Art of the Possible*. Those in the operations research community postulate: *Operations Research, the Science of Better* – (i.e. better processes, better systems and better decisions). Using their own and other scientific, engineering, mathematical, and social sciences methodologies, operations researchers help decision makers make better decisions; decisions leading to improvements: greater quality, lower costs, greater revenues, better access, better scheduling, lower risks, more satisfaction – with the goal of always striving for the best or optimal decisions.

Chapter 16, “Engineering Healthcare as a Service System,” by James Tien and Pascal Goldschmidt-Clermont of the University of Miami, argues that engineering has and will continue to have a critical impact on healthcare. They propose that the application of technology-based techniques to biological problems can be defined to be technobiology applications. This chapter is primarily focused on applying the technobiology approach of systems engineering to the development of a healthcare service system that is both integrated and adaptive. In general, healthcare services are carried out with knowledge-intensive agents or components which work together as providers and consumers to create or co-produce value. Indeed, the engineering design of a healthcare system must recognize the fact that it is actually a complex integration of human-centered activities that is increasingly dependent on information technology and knowledge. Like any service system, healthcare can be considered to be a combination or recombination of three essential components – people (characterized by behaviors, values, knowledge, etc.), processes (characterized by collaboration, customization, etc.) and products (characterized by software, hardware,



infrastructures, etc.). Thus, a healthcare system is an integrated and adaptive set of people, processes and products. It is, in essence, a system of systems with objectives to enhance efficiency (leading to greater interdependency) and effectiveness (leading to improved health). Integration occurs over the physical, temporal, organizational and functional dimensions, while adaptation occurs over the monitoring, feedback, cybernetic and learning dimensions. In sum, such service systems as healthcare are indeed complex, especially due to the uncertainties associated with the human-centered aspects of these systems. Moreover, the system complexities can only be dealt with by using methods that enhance system integration and adaptation.

In Chapter 17, “Process Engineering: A Necessary Step to a Better Public Health System,” David Ross of Emory University notes that with its primary focus on community health, the public health system focuses on intervention and prevention of disease and injury to protect entire populations. As a federation of city, county and state entities operating independently under a complicated array of local, state and federal laws, public health can best be understood as a complex adaptive system. The dynamic nature of this system and the need for public health agencies to relate and respond to numerous stimuli in terms of new regulations, changing health status, emerging threats and shifting policy, can mask the commonality of underlying business processes performed within the public health sector. Heightened demand for interoperable, adaptive information systems across the broader U.S. health system necessitates the recognition of this commonality and highlights the need for comprehensive analysis and understanding of these core business processes. In turn, this analysis paves the way for public health to apply proven systems engineering techniques to streamline, automate and facilitate those processes. Here, we look at the nature of the public health system and the evolution of a purpose-built methodology for process engineering within public health. The authors present a case study based on the application of the methodology to develop requirements for public health laboratory information management systems.

Chapter 18, “Engineering Responses to Pandemics,” by Richard Larson and Karima Nigmatulina of MIT, focuses on pandemic influenza and approaches the planning for and response to such a major worldwide health event as a complex engineering systems problem. Action-oriented analysis of pandemics requires a broad inclusion of academic disciplines since no one specialty can cover a significant fraction of the problem. Numerous research papers and action plans have treated pandemics as purely medical happenings, focusing on hospitals, health care professionals, creation and distribution of vaccines and anti-virals, etc. But human behavior with regard to hygiene and social distancing constitutes a first-order partial brake or control of the spread and intensity of infection. Such behavioral options are “non-pharmaceutical interventions.” The chapter employs simple mathematical models to study alternative controls of infection, addressing a well-known parameter in epidemiology,  $R_0$ , the “reproductive number,” defined as the mean number of new infections generated by an index case. Values of  $R_0$  greater than 1.0 usually indicate that the infection begins with exponential growth, the generation-to-generation growth rate being  $R_0$ .  $R_0$  is broken down into constituent parts related to the frequency and intensity of human contacts, both partially under our control. It is suggested that any numerical value for  $R_0$  has little meaning outside the social context to which it pertains. Difference equation models are then employed to study the effects of heterogeneity of population social contact rates, the analysis showing that the disease tends to be driven by high frequency individuals. Related analyses show the futility of trying geographically to isolate the disease. Finally, the models are operated under a variety of assumptions related to social distancing and changes in hygienic behavior. The results are promising in terms of potentially reducing the total impact of the pandemic.

In Chapter 19, “Understanding and Enhancing the Dental Delivery System,” Paul Griffin of Penn State reports that dental decay is the most prevalent chronic disease among both children and adults in the

U.S. The Surgeon General's Report on Oral Health found that there had been marked improvement in oral health in many Americans over the last 50 years and that good oral health could be achieved by all Americans largely due to the presence of safe and effective interventions to prevent and control oral disease. However, recent national data suggest that several disparities in dental care exist. This chapter presents a model of the dental health system as well as key differences with the general medical health system. The author further discusses the major issues that the dental care delivery system will have to address in order to ensure that all Americans have access to effective interventions to prevent and control disease in an environment of decreasing supply of dentists per capita and potentially increasing demand. Strategies and policies to address these emerging issues in the context of this model are then discussed. This chapter concludes with suggestions on how engineering techniques could be used to improve the system.

### *Section 5: Perspectives*

Chapter 20, "Integrated Health Systems," by Stephen Shortell and Rodney McCurdy of the University of California at Berkeley, argue that before meaningful gains in improving the value of health care in the US can be achieved, the fragmented nature in which health care is financed and delivered must be addressed. One type of healthcare organization, the Integrated Delivery System (IDS), is poised to play a pivotal role in reform efforts. What are these systems? What is the current evidence regarding their performance? What are the current barriers to their establishment and how can these barriers be removed? This chapter addresses these important questions. Although there are many types of IDS' in the US healthcare landscape, the chapter begins by identifying the necessary healthcare components that encompass an IDS and discusses the levels of integration that are important to improving health care quality and value. Next, it explores the recent evidence regarding IDS performance which while generally positive is less than what it could be if there was greater focus on clinical integration. To highlight, the chapter discusses the efficacy of system engineering initiatives in two examples of large, fully integrated systems: Kaiser-Permanente and the Veterans Health Administration. The evidence here is strong that the impact of system engineering methods is enhanced through the integration of processes, goals and outcomes. Reforms necessary to encourage the development of IDS' include: 1) the development of payment mechanisms designed to increase greater inter-dependency of hospitals and physicians; 2) the modification or removal of several regulatory barriers to greater clinical integration; and 3) the establishment of a more robust data collection and reporting system to increase transparency and accountability. The chapter concludes with a framework for considering these reforms across strategic, structural, cultural, and technical dimensions.

In Chapter 21, "Academic Health Centers," Fred Sanfilippo of Emory University discusses how Academic Health Centers (AHCs) are composed of academic, hospital, and clinical practice components that play a key role in healthcare delivery by their special ability to identify and implement improvements in outcomes, safety, cost-benefit, and satisfaction. They do this by utilizing a wide range of academic and clinical health professionals and disciplines to provide cutting-edge, highly specialized patient care as well as disproportionate uncompensated care in communities nationwide; to identify the effectiveness of different diagnostic and therapeutic approaches through clinical research; to foster new discoveries in biomedical science and technology and their clinical application; and to educate future generations of health professionals who apply these improvements. As the traditional homes of innovation in health and healthcare through research, and as the major sites of implementing change through education, AHCs have been at the forefront of improving healthcare. To successfully improve the effectiveness and

efficiency of healthcare delivery, it is critical that AHCs continue to serve as uniquely integrated models for improving quality and value through novel approaches in education, research, and service.

Chapter 22, “Government, Health And System Transformation,” by Jonathan Perlin and Kelvin Baggett of the Hospital Corporation of America, begins by noting that all levels of government have an economic and social interest in health. In the United States, Federal, State and local government are involved in the development of health policy, funding health care, and maintaining or improving public health. Federal, State and most municipalities also engage in delivery of health services. As with the private sector, government is grappling with accelerating health care costs, increasing service demands generated by an aging and more chronically ill society, and accumulating evidence that American health outcomes are not commensurate with the resources invested. Unlike the private sector, attempts to improve value in health care – whether through legislation in Congress or regulation or program design in the Executive branch – are subject to the full intensity of the partisan political process. In order to engage effectively with government in health system transformation, an understanding of both the civic processes and the political dynamics is necessary. This chapter provides an overview of the major governmental roles in health care as formally structured and identifies points of influence in the political process.

### *Sections 6: Conclusions*

In Chapter 23, “Barriers to Change in Engineering the System of Health Care Delivery,” Jon Saxton and Michael Johns of Emory University argue that significant reform of the health care system sufficient to achieve universal coverage, a value-driven system and administrative simplification faces enormous barriers at the level of our societal ecosystem – barriers as large as any that can be faced in public policy. These barriers exist within the health system itself as a complex adaptive system, and are structured by our economic, legal, cultural and political systems. Because there are so many barriers, significant reform is a relatively rare occurrence. Yet it does happen and there are some important examples of major health care reforms. There are a number of lessons to be learned from the successful enactment of the Medicare and Medicaid programs that appear relevant to current and future reform efforts. First, a necessary condition for achieving significant reform is the existence of large and sufficiently enduring social forces sufficient to disrupt legislative and policy stasis and drive the necessary political solutions. Second, public sentiment and electoral “mandates” might be necessary to significant reform, but they are not sufficient. Third, assuming the theoretical capacity to manage the constellation of systemic, economic, legal, cultural and legislative barriers, there remains a political “tipping point” political threshold must be crossed and translated into a Congressional super-majority in order to enact significant nationwide reform.

Chapter 24, “Prospects for Change,” by Denis Cortese of Mayo Clinic and William Rouse of Georgia Tech addresses the prospects for change in health care delivery. The focus is on value – high quality, affordable care for everyone. They consider three domains that participate in the flow of value and the nature of the interfaces among these domains. They also discuss strategic priorities that should align in various ways with these domains. Finally, they address the business transformations needed to enable the provision of value by enterprises that are viable and successful.

## **6. Conclusions**

This summary of the chapters in this book presents a panorama of important issues, roles of information and incentives, engineering approaches, the perspectives of major stakeholder organizations in healthcare

delivery, and barriers and prospects for change. This panorama is sufficiently rich to preclude a succinct summary of the nature of the system and needed changes. We leave these ideas and insights to the authors that follow.

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