ANALYTICS in Healthcare and the Life Sciences

Strategies, Implementation Methods, and Best Practices

Edited by Dwight McNeill

Foreword by Thomas H. Davenport

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To all the people pioneering the field of analytics in healthcare.

Contents

Foreword

What's more important to healthcare than analytics? We can use this powerful resource to determine what treatments are most likely to be effective, which care practices are worth the cost, which patients deserve special attention, and which of those patients are likely not to take their medications. In a country—and to a lesser degree, a world—in which we spend too much on healthcare and get too little in return, analytics can help to restore a balance between cost and value. And given all the possible things that we can do with analytics, what could be more important than improving the healthcare of human populations?

For better or worse, however, healthcare is behind other industry sectors in terms of its analytical sophistication. Less charitable observers have told me they think that healthcare is about 25 years behind; I would be more inclined to say five or ten years behind most industries. In any case, healthcare was late to adopt analytics, and late to put in place the data, systems, and skills to use analytics effectively. Other industries have functional silos across which they don't share data and analyses well, but the divide among clinical, operational, and business groups within healthcare organizations leaves other silos behind.

However, when Jack Phillips—the CEO and co-founder with me of the International Institute for Analytics (IIA)—and I began speaking in 2010 with healthcare providers and payers, and life sciences firms, about undertaking sponsored research on healthcare analytics, the responses couldn't have been more encouraging. We discovered a great hunger for information about how to use analytics more effectively in every aspect and segment of the industry.

Perhaps we shouldn't have been surprised by this positive reception, because other actions being taken by healthcare industry members are consistent with a strong interest in analytics. One important signal of interest, for example, is the widespread activity among healthcare providers in installing, replacing, or updating basic transaction systems. You can't do analytics without solid underlying data on patients, care provision processes, and costs, so provider institutions are pouring massive amounts of resources into electronic health

record, billing, and operational management systems. Each of these systems generates new data that only reporting and analysis can make sense of. The key, of course, will be moving beyond the transactional focus to understanding what all the data mean and how analytics on them translate into better patient care.

There is also huge interest across the industry in health data access: patient portals, mobile patient access to records, telemedicine of various types, and the e-patient movement in general. Patients have an interest in seeing their basic transaction information, but they have an even greater interest in analyses and recommendations for personalized care. Only analytics and decision rules can provide this kind of information to caregivers and patients.

Personalized genetic medicine is still on the horizon, but as the cost of sequencing a human genome continues to fall, before long there will be an incredible amount of genetic information available to correlate with disease states and treatment outcomes. Analytics are the only method possible for reducing the mass of data to a comprehensible level, and for understanding the relationships between a particular genome and the care interventions that will improve that patient's health.

Finally, if these indicators weren't enough, there is also a high degree of startup formation in the healthcare big data space—companies dealing with less structured forms of health data. In my hometown of Boston, in particular, there are more than fifty big data startups in a variety of health industry sectors and problem domains. Most of these organizations have venture capital funding; some have already been acquired by larger organizations. Such a big data "gold rush" suggests that there will be many future innovations and potential breakthroughs in the healthcare analytics space.

Healthcare analytics activity also takes place across a variety of sub-sectors within the overall industry, including payers, providers, and life sciences firms. Addressing the content originating in each of these sectors is critical to the focus and value of this book. I've already mentioned that healthcare organizations are siloed with respect to internal functions that generate analytics. However, there is also an extreme lack of integration across sectors. Payers, providers, and life sciences firms don't exchange analytics or even raw data very often.

This situation must change if societies are going to deliver effective and cost-efficient healthcare. Both within and across organizations, the healthcare analytics of the future need to cross boundaries.

There are trends in motion—not only the widespread adoption of electronic medical record systems, but also the "meaningful use" requirements for these systems for reimbursement, and the shift to "accountable care organizations"—that will require greater levels of analytical integration within and across organizations. For the most part, however, the trends have yet to yield dramatic change in analytical integration.

Although we don't have anything resembling full analytical integration in healthcare, it's useful to think of what it might look like. Within provider organizations, for example, integrated analytical decisions about patient care would address clinical, financial, and quality concerns—all at the same time. Care providers would be able to employ clinical decision support tools to administer the most effective treatment protocols, but would also simultaneously understand the financial implications of different treatment approaches. On patient admission, hospitals would understand how likely they were to improve the patient's condition, what the treatment would be likely to cost, and how likely the patient was to be able to pay for the treatment. On discharge, hospitals would know the likelihood of readmission, and the best combination of home healthcare and other interventions to prevent readmission. Primary care institutions would share a patient's data and analytics—using proper privacy protection, of course—with other institutions and individuals that provide care for the patient.

In terms of planning for new services and facilities, providers would have accurate statistical forecasts of patient demand for existing and planned offerings. They would market those offerings to patients most likely to require them. They would understand the implications of new and enhanced service offerings—and the quality with which they are delivered—for the institution's financial and operational performance.

In such an integrated world, payer organizations would take the lead in disease management programs driven by analytics. They would use data about their customers and claims in order to understand

what genetic, physiological, and behavioral attributes are associated with particular diseases. After informing their customers or members of any diseases they are likely to contract (assuming patients opt into receiving this information), they would also have analytics on which intervention strategies are most likely to yield the desirable behavior change necessary to avert the disease. They would supply these analytics, again with the appropriate levels of privacy, to anyone who cares for the patient.

Payers would also use analytics to identify employers and providers they want to work with, and who would be likely to employ their services. Payers in the U.S. would also have considerable information on consumers (which will become primary health insurance purchasers under U.S. healthcare reform), and would be able to do predictive modeling of which consumers would be most likely to purchase certain types of insurance.

This integrated vision would also encompass life sciences firms—including pharmaceutical and medical device organizations—which would offer predictive models of responses to drugs and devices. With the advent of personalized genetic medicine, life sciences firms would be able to help care providers understand whether particular drugs and treatment protocols would be likely to work on particular individuals. This would also allow an intelligent decision on whether certain medical interventions would be worth the cost. In addition, life sciences firms would have much more effective models of the business value of relationships with physicians (both individually and as members of social and business networks) and provider organizations, and would target marketing and sales resources to the most likely adopters of particular drug and device interventions. Some of the predictive models for physicians would take into account the analytical results from clinical trials and large-scale population studies.

In addition to these integrated analytics initiatives within healthcare organizations, integration would also feature a variety of integration activities for analytics across sub-sectors of healthcare. In this ideal environment, providers, payers, life sciences firms, pharmacy benefit managers, patient registries, and other organizations would share data and analytics with other organizations within their sector and outside of it. Payers, for example, could share analytics about "at

risk" status of their customers with the providers who would treat them for it. All parties would share data and analysis on post-market surveillance of drugs and medical devices.

This is an appealing vision of integration. However, both within and across healthcare industry sectors, analytical integration is still in its infancy. Fortunately, economic and regulatory trends in the industry are beginning to lead to efforts to combine and share data and analytics across organizations and sectors. But for substantial progress to take place, healthcare organizations need to finish implementing basic transaction data systems. They need to create groups whose function it is to integrate and coordinate analytics within and outside the organization. And because these efforts will require investment, advocates for analytical integration need to work closely with senior executives to help them understand the need for and potential of analytics across boundaries.

The integration of chapters in this book is itself a reflection of the integration needed in healthcare analytics. The book is edited by Dwight McNeill, an expert on healthcare analytics and IT, and a personal force for integration. He has been a consultant, entrepreneur, professor, regulator, and large company executive in the healthcare information domain. He has been IIA's lead faculty member for our Healthcare Analytics Research Council for several years.

Dwight and I together have authored about half of the chapters in this book. In addition, there are expert authors from consulting firms, analytics and IT vendors, medical centers, and leading practitioners. It would be difficult to imagine a better group of thinkers to address the integration of healthcare analytics within organizations and across payers, providers, and life sciences organizations.

I am confident that readers of the chapters in this book—both those derived from IIA "research briefs" and from "leading practice briefs," or case studies—will find the blueprint and examples for analytical integration within and across organizations. The healthcare organizations that study these materials, recognize the key issues, and create initiatives to address them will be the pioneers in moving us toward a more analytical future in healthcare.

—Thomas Davenport, Cofounder and Research Director of the International Institute for Analytics

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Kathleen Aller is the director of data content for McKesson Enterprise Intelligence. Her current interest is the operational and strategic challenges related to automating healthcare quality and operation measures. She has a particular focus on quality eMeasures and on meaningful use measurement for federal electronic health record incentives. She has spoken and written for Healthcare Information and Management Systems Society (HIMSS), Healthcare Financial Management Association (HFMA), and American Medical Informatics Association (AMIA).

John Azzolini has worked in the healthcare field for 30 years as a nurse and healthcare data analyst. In his 18 years at Thomson Reuters, working as both a director of consulting and practice leadership, much of his work has focused on assisting health plans in the assessment of care processes, the creation of metrics that examine the quality of care, employer account reporting, provider profiling, and disease management program evaluation. Mr. Azzolini earned a Master of Business Administration and Master of Public Health from Columbia University and a Bachelor of Nursing from Cornell University.

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leaders and executives on emerging business and technology trends, especially those related to bridging the health and life sciences ecosystems. Prior to joining SAS, he worked at a variety of companies such as GlaxoSmithKline, Quintiles Transnational, and most recently Microsoft where he drove the development and adoption of Microsoft's industry technology strategy and corresponding architecture. He has served as a technology leader in several industry think tank and strategic development initiatives focusing on the future of healthcare and pharmaceutical research.

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Prior to his current role, Kyle served in various executive roles in the healthcare industry. His expertise is centered on the application of advanced business analytics to healthcare business domain problems including healthcare informatics, payment integrity analytics, and healthcare information management. Some of his notable accomplishments include leading the definition, development, and implementation of an award-winning advanced-analytic healthcare fraud detection solution, and leading the development and execution of an advanced healthcare analytics business strategy. He is active with numerous professional organizations, both in the healthcare industry and more broadly focused on the furtherance of analytics as a business asset, and is frequently invited to provide commentary to various industry and media forums on the broader adoption of advanced analytics across the healthcare domain.

Kyle received a PhD in Political Economy from The University of Texas at Dallas in 1996.

Thomas H. Davenport is the cofounder and research director of the International Institute for Analytics, and the President's Distinguished Professor of Information Technology and Management at

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Dave Handelsman is a senior industry consultant in SAS's Health and Life Sciences division. His primary focus is identifying those market opportunities where advanced analytics brings dramatic innovations and improvements to the business and science of the health and life sciences industries. In previous roles within SAS, Handelsman served as the principal product manager for Clinical R&D, where he was responsible for guiding the development and market success of SAS's flagship pharmaceutical solution SAS Drug Development.

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Dwight McNeill, Ph.D., MPH, is a Lecturer at Suffolk University Sawyer Business School, where he teaches population health and health policy. He is President of WayPoint Health Analytics, which provides guidance to organizations on the analytics of population health management, behavior change, and innovation diffusion. He is the author of *A Framework for Applying Analytics in Healthcare: What Can Be Learned from the Best Practices in Retail, Banking, Politics, and Sports* (FT Press 2013) and numerous journal articles including "The Value of Building Sustainable Health Care Systems: Capturing the Benefits of Health Plan Transformation" (Health Affairs).

Over his thirty year career in healthcare, he has held analytics positions in corporations at IBM and GTE; governments at the Agency for Healthcare Research and Quality and the Commonwealth of Massachusetts; analytics companies; and provider settings.

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Pat Saporito's role at SAP is to work closely with current and prospective customers to leverage best practices in business intelligence, their data assets, and SAP Business Objects business analytic solutions to improve business performance. Pat joined SAP Business Objects in 2006 as insurance solutions director within the Enterprise Performance COE. She subsequently has held roles in global consulting helping customers define effective performance analytic solutions and in solution management developing predefined industry applications. She is a recognized insurance and healthcare payer industry analytics thought leader.

Dean Sittig is a professor at the School of Biomedical Informatics at the University of Texas Health Science Center at Houston. His research interests center on the design, development,

implementation, and evaluation of all aspects of clinical information systems. In addition to measuring the impact of clinical information systems on a large scale, he is working to improve our understanding of both the factors that lead to success, as well as the unintended consequences associated with computer-based clinical decision support and provider order entry systems. To this end, he and Hardeep Singh, MD, have proposed a new eight-dimension, sociotechnical model for safe and effective use of health IT.

David Wiggin is the Program Director, Healthcare and Life Sciences, for Teradata Corporation. His responsibilities include industry strategy, marketing, offer development, and field enablement and support. Prior to joining Teradata, David was with Thomson Reuters for 25 years supporting employer, health plan, provider, and government markets. He has worked in a variety of roles, including product management, product development, project management, data warehousing, operations management, and systems architecture. David has experience with both the business and IT dimensions of the healthcare industry and has held executive and management positions at Stern Stewart & Co. and Exxon Corporation.

Jesus Zarate, Col, USAF, MSC; Air Force Medical Service CIO.

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Introduction

Dwight McNeill

There has never been a better window of opportunity for analytics to strut its stuff and contribute to dramatic improvements in clinical and business outcomes in the healthcare industry.

- The opportunities are mind-boggling. Clinical outcomes are the worst when compared to peer, wealthy countries. Efficiency is the worst among all industries with at least a third of the healthcare industry's output considered waste. The likelihood of getting the right care at the right time remains just above the probability of a coin toss. Customer engagement ranks among the lowest of all industries.
- The drivers for change are strong and convergent. These include sweeping changes in the financing, payment, and delivery of healthcare resulting from the Affordable Care Act as well as from hypercompetitive market pressures to markedly reduce costs, increase market share, and increase revenues.
- The analytic workbench is chock full of statistical tools, methods, and theories to collect, organize, and understand data and to influence decision making.
- The explosion of "big" data and the technology to harness it more quickly and cheaply provide greenfield opportunities for new discoveries and applications, such as genomics.

Yet, despite these convergent forces, the funding and utility of analytics in healthcare have been low. The irony is that healthcare is built on strong analytic pillars in its extensive research on the causes and treatments of diseases, but this culture and expertise have not

spilled over into the delivery of care. Indeed only a dozen or so of the best providers and payers approach the full optimization of analytics.

There are many rationales for this. Among them are

- Improving clinical outcomes and efficiency does not necessarily make good business sense. After all, the healthcare industry is profitable, and the pursuit of social (health) goals is not always aligned with the pursuit of profits.[1] If the industry does not want to change, there is little call for the analytics to support it.
- There are strong beliefs that the industry data are underdigitized, and business cannot benefit from analytics until the data are complete, clean, and perfectly integrated.
- Medical care is delivered by highly trained, autonomous, and intuitive-thinking professionals (doctors) who may eschew data-driven decision making.
- Technology is a two-edged sword. On the one hand it offers awesome capabilities to process data. On the other hand, it may blind analysts from seeing all that is necessary to make change happen through analytics for their industry. The field needs to look inward and transform itself to be more results oriented.
- Finally, the (new and improved) discipline of analytics is relatively young, unknown, and yet to prove itself.

The primary purpose of this book is to address the last bullet point. The book provides the most comprehensive review of the current state of the science and practice of analytics in healthcare to date. The book is divided into a journey of five parts, the four Parts and the Conclusion. For a simple guide on navigating the book see Figure I.1.

Part I, "An Overview of Analytics in Healthcare and Life Sciences," provides an overview of the analytics landscape in the healthcare and life sciences ecosystem and includes chapters on payers, providers, and life science companies. Tom Davenport and Marica Testa, in Chapter 1, "An Overview of Provider, Payer, and Life Sciences Analytics," conclude that despite the many obstacles, "healthcare organizations have little choice but to embrace analytics. Their extensive use is the only way patients will receive effective care at an affordable cost." Although the maturity level of analytics is low across the

ecosystem, many opportunities are outlined in the chapters. For providers, these include meaningful use, accountable care, regulatory compliance, clinical decision support, and more. For payers, these include actively improving the health of their members to be more competitive in the new era of the business to consumer model. And for life science companies, the focus is on research discovery, clinical trials, manufacturing, and sales and marketing. Increasingly the focus will be on personalized medicine to tailor individual treatment programs and on cost-effectiveness analysis to determine the value of therapeutics.

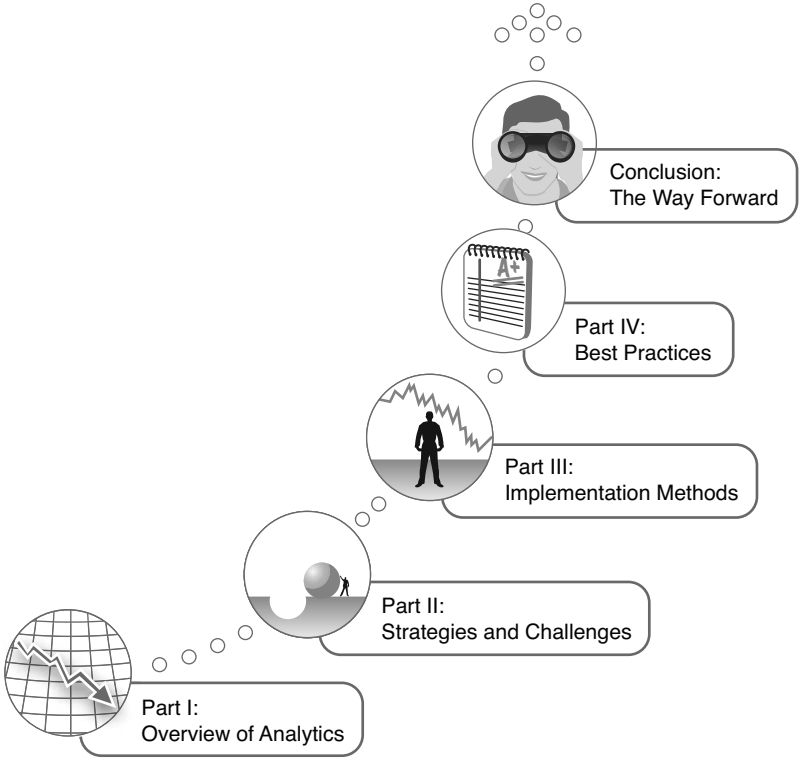

Figure I.1 Navigating the five parts of *Analytics in Healthcare and the Life Sciences*

Part II, "Strategies, Frameworks, and Challenges for Health Analytics," includes six chapters that provide some fundamental answers as well as a reference library of terms and concepts to those wanting

to get into the new game of health analytics. It provides a mapping of healthcare analytics "DNA" and addresses the following important questions:

- What is health analytics and what is its scope and various options?
- What is its value to the business and how is it determined?
- What are the different types of analytics and ways to perform them?
- What are some examples of analytics "secret sauce" for supporting clinical and business outcomes?
- What are the privacy concerns that arise with big (personal) data and the use of advanced analytics and how can these be built into data security and privacy practices?

Part III, "Healthcare Analytics Implementation Methods," looks at implementation methods, or solutions. It provides a workbench of analytics methods that address some of the most vexing issues in healthcare, including

- **Using the EHR—**The electronic health records (EHR) can support meaningful results in three important healthcare reform areas, including insurance reforms (especially health insurance exchanges), Centers for Medicare and Medicaid Services (CMS) Innovations (especially Accountable Care Organizations), and Health Information Technology (HIT) (especially meaningful use). Chapter 12, "Meaningful Use and the Role of Analytics: Complying with Regulatory Imperatives," by Deborah Bulger and Kathleen Aller makes the case that building the infrastructure for meaningful use has much more value than just a compliance issue and can be the backbone to a new approach to managing care.
- **Improving the delivery of care—**In Chapter 13, "Advancing Health Provider Clinical Quality Analytics," Glenn Gutwillig and Dan Gaines focus on measuring, monitoring, and improving providers' adherence to established clinical standards. They assert that clinical quality analytics must measure a health provider's compliance to established clinical standards of care as

well as analyze the relationship between compliance and clinical outcomes.

- **Medical errors—**Medical errors continue to be seemingly intractable to improvement. In Chapter 14, "Improving Patient Safety Using Clinical Analytics," Dean Sittig and Stephan Kudyba concentrate on the detection of errors and discuss the use of "triggers," or automated algorithms, to identify abnormal patterns in laboratory test results, clinical workflows, or patient encounters.
- **Social media—**The use of social media to improve health is just emerging. Healthcare is following industries that have used social media for marketing, sentiment analysis, and brand management. Chapter 16, "Measuring the Impact of Social Media in Healthcare," by David Wiggin provides an overview of current and emerging uses of social media to improve health and proposes an analytical model to measure its impact. He suggests that the best source of data may come directly from people through surveys rather than what can be "scraped" from websites. This is different, and potentially much more valuable, than the usual "scraping" of websites for social media data.
- **Population health—**One aspect of managing population health is to find high cost/clinical need people so that appropriately tailored programs can be offered to them. In Chapter 15, "Using Advanced Analytics to Take Action for Health Plan Members' Health," Kudyba, Perry, and Azzolini detail the difficulty of developing, implementing, and managing population-based care programs. They present a conceptual framework, based on "hot spotting" techniques, that defines the information requirements, analyses, and reporting that will lead to actionable results.

Part IV, "Best Practices in Healthcare Analytics Across the Ecosystem," includes eight case studies of leading organizations in healthcare analytics. These are bellwether organizations that represent the best of the art and science of analytics as of 2012. The case studies are inclusive of the settings where analytics is practiced including providers, payers, and a life sciences company and includes both the public and private sectors. The lineup includes Partners HealthCare System,

Catholic Healthcare Initiatives, Veterans Health Administration, Air Force Medical Services, HealthEast Care System, Aetna, EMC, and Merck. The chapters address the "whats" (the domains of the content such as business, clinical, and marketing) and "hows" of analytics to support organizational strategies and goals (including how it is organized, how it adds value, and its technical challenges). The common characteristics of these high performing companies are the early adoption and use of EHRs, leadership that clearly articulates organizational mission and goals, the use of clinical warehouses to address organizational needs such as research, the application of analytics to improve business and finance functions, and insights into how to operationalize analytics within organizations for optimal results.

Finally, a conclusion, "Healthcare Analytics: The Way Forward," addresses the future of analytics in healthcare. It starts off by acknowledging that healthcare has great challenges and that the potential of analytics to address them has been underrated. Analytics is poised to make a difference, but there is a blockage that must be addressed. The conclusion addresses some untapped opportunities including issues related to the big data "gold rush" and the need to appreciate "small" data, new computing technologies such as NoSCL and the seductive trap of technology, and the overlooked science of making change happen and getting innovations adopted in organizations. McNeill suggests that analysts must keep their eyes on the prize of improving outcomes, and it has less to do with the tools and technology and more to do with the sociology of making change happen through communications among people. He concludes with the observation that the field of analytics is undergoing an identity crisis, the role definition needs work, a Chief of Analytics may not be the savior, and what is needed is for analysts to "be the change" they want to see in the organization and the world.

Note

1. Eduardo Porter, "Healthcare and Profits, a Poor Mix," *The New York Times*, January 8, 2013.

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1

An Overview of Provider, Payer, and Life Sciences Analytics

Thomas H. Davenport and Marcia A. Testa

The healthcare industry is being transformed continually by the biological and medical sciences, which hold considerable potential to drive change and improve health outcomes. However, healthcare in industrialized economies is now poised on the edge of an analytics-driven transformation. The field of analytics involves "the extensive use of data, statistical and quantitative analysis, explanatory and predictive models, and fact-based management to drive decisions and actions."[1] Analytics often uses historical data to model future trends, to evaluate decisions, and to measure performance to improve business processes and outcomes. Powerful analytical tools for changing healthcare include data, statistical methods and analyses, and rigorous, quantitative approaches to decision making about patients and their care. These analytical tools are at the heart of "evidence-based medicine."

Analytics promises not only to aid healthcare providers in offering better care, but also more cost-effective healthcare. Several textbooks have been written on the cost-effectiveness of health and medicine, and health economics and the methods described can be used in healthcare decision making.[2, 3, 4] Moreover, as healthcare spending rose dramatically during the 1970s and 1980s in the United States, an increased focus on "market-driven" healthcare developed.[5] Today, as the amount spent on healthcare has risen to nearly 20% of GDP in the United States, analytic techniques can be used to direct limited resources to areas where they can provide the greatest improvement in health outcomes.

Analytics in healthcare is an issue for several sectors of the healthcare industry involving patients, providers, payers, and the healthcare technology industries (see Figure 1.1). As shown, the patient is the ultimate consumer within the healthcare system. This system consists of several sectors, including providers of care; entities such as employers and government that contribute through subsidized health insurance; and life science industries, such as pharmaceutical and medical device companies.

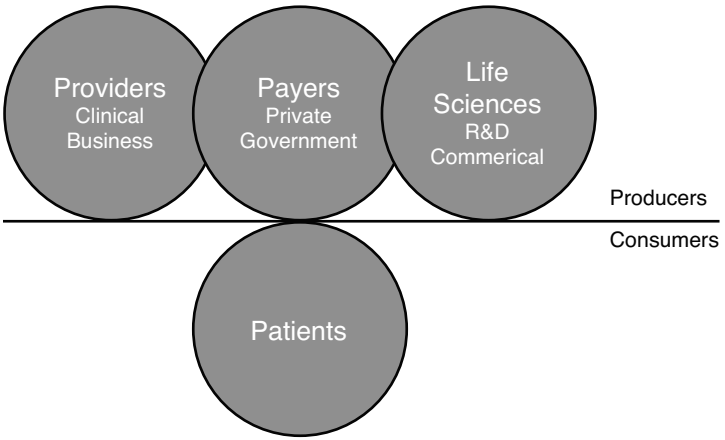

Figure 1.1 The healthcare analytics environment

Provider Analytics

A key domain for the application of analytics is in healthcare provider organizations—hospitals, group practices, and individual physicians' offices. Analytics is not yet widely used in this context, but a new data foundation for analytics is being laid with widespread investments—and government subsidies—in electronic medical records and health outcomes data. As data about patients and their care proliferate, it will soon become feasible to determine which treatments are most cost-effective, and which providers do best at offering them. However, to maximize their usefulness, analytics will have to be employed in provider organizations for both clinical and business purposes and to understand the relationships between them.

Tom Davenport and Jeffrey Miller in Chapter 2, "An Overview of Analytics in Healthcare Providers," make the case that analytics for healthcare providers is poised to take off with the widespread digitization of the sector. They describe the current maturity level of provider analytics as low and describe current analytical applications along the continuum of descriptive, predictive, and prescriptive for both clinical and financial business purposes. And they address future areas for analytics contributions including meaningful use, accountable care organizations, taming the complexity of the clinical domain, increased regulatory requirements, and patient information privacy issues.

Payer Analytics

Payers for healthcare, including both governments and private health insurance firms, have had access to structured data in the form of claims databases. These are more amenable to analysis than the data collected by providers, who have relied largely on unstructured medical chart records. However, historically payers focused on collecting data that ensure efficiencies in billing and accounting, rather than healthcare processes and outcomes. Even with limited administrative databases, payers have, at times, been able to establish that some treatments are more effective and cost-effective than others, and these insights have sometimes led to changes in payment structures. Payers are now beginning to make inroads into analytics-based disease management by redesigning their information databases to include electronic medical records. However, there is much more to be done in developing medical information databases and systems and employing analyses within payer organizations. In addition, at some point, payers are likely to have to share their results with providers, and even patients, if systemic behavior change is to result.

Kyle Cheek in Chapter 3, "An Overview of Analytics in Healthcare Payers," concentrates on analytics as a value driver to improve the business of health insurance and the health of its members. He provides a framework of the types of analytics that can add value, and he reviews the current state, which he describes as "analytical sycophancy." He concludes with paths to maturity and best practice examples from leading organizations.

Life Sciences Analytics

Life sciences companies, which provide the drugs and medical devices that have dramatically changed healthcare over the past several decades, have also employed analytics much more than providers. However, their analytical environment is also changing dramatically. On the R&D and clinical side, analytics will be reshaped by the advent of personalized medicine—the rise of treatments tailored to individual patient genomes, proteomes, and metabolic attributes. This is an enormous (and expensive) analytical challenge that no drug company has yet mastered. On the commercial analytics side, there is new data as well—from marketing drugs directly to consumers, rather than through physicians—and new urgency to rein in costs by increasing marketing and sales effectiveness.

Dave Handelson in Chapter 4, "Surveying the Analytical Landscape in Life Sciences Organizations," starts off with the contextual reality that it is no longer "business as usual" in the life sciences industries, which has resulted in a heightened focus on analytics. He describes the potential analytical contributions related to the primary business functions, including research discovery, clinical trials, manufacturing, and sales and marketing. He notes that healthcare reform and the emphasis on cost containment place more reliance on analytics that includes new reimbursement strategies and the need to use comparative effectiveness results in assessing the value of therapies.

Patients Analytics

Patients are, of course, the ultimate consumers of healthcare and will need also to become better informed consumers of analytics—at least to some degree. They will need analytics to decide which providers are most effective, whether the chosen treatment will work, and in some payment structures, whether they are getting the best price possible. These consumer roles are consistent with the "consumer health informatics" and "Health 2.0" (use of web-based and e-technology tools by patients and physicians to promote healthcare and education) concepts. Of course, complex biostatistics and the results of comparative effectiveness studies are unlikely to be understood by most patients and will have to be simplified to be helpful.

Collaboration Across Sectors

Each of the sectors that participate in healthcare progressively adds analytical capability, although at different rates. For true progress, analytics must be employed collaboratively across the various sectors of the healthcare system. Providers, payers, and pharmaceutical firms must share data and analyses on patients, protocols, and pricing—with each other and with patients—and all with data security and privacy. For example, members of each sector had data that might have identified much earlier that COX-2 drugs (Vioxx, Celebrex, and Bextra) were potentially associated with greater risk of heart disease.

Barriers to Analytics

Healthcare organizations desiring to gain more analytical expertise face a variety of challenges. Providers—other than the wealthiest academic medical centers—have historically lacked the data, money, and skilled people for analytical projects and models. Even when they are able to implement such systems, they may face difficulties integrating analytics into daily clinical practice and objections from clinical personnel in using analytical decision-making approaches. Payers typically have more data than providers or patients, but as noted above the data are related to processes and payments (administrative databases) rather than health outcomes (research databases). Moreover, many payers do not now have cultures and processes that employ analytical decision making.

Life sciences firms have long had analytical cultures at the core of their research and clinical processes, but this doesn't ensure their ongoing business success. Clinical trials are becoming increasingly complex and clinical research more difficult to undertake given the restrictions imposed by Institutional Review Boards, ethics committees, and liability concerns. Drug development partnerships make analytics an interorganizational issue. And the decline of margins in an increasingly strained industry makes it more difficult to afford extensive analytics.

While statistical analyses have been used in research, analytics has not historically been core to the commercial side of life sciences industries, particularly in the relationship with physicians' practice patterns. Life sciences firms must normally buy physician prescribing data from a third-party source, and the data typically arrive in standard tables and reports rather than in formats suitable for further analysis. The firms increasingly need to target particular physicians, provider institutions, and buying groups, but most do not have the data or information to do so effectively.

Despite these obstacles, healthcare organizations have little choice but to embrace analytics. Their extensive use is the only way patients will receive effective care at an affordable cost.

Notes

1. Thomas H. Davenport, Jeanne G. Harris, *Competing on Analytics* (Boston, MA: Harvard Business Press, 2007) p. 7.
2. Marthe R. Gold, Joanna E. Siegel, Louise B. Russell, and Milton C. Weinstein, *Cost-Effectiveness in Health and Medicine* (New York, NY: Oxford University Press, 1996).
3. Rexford E. Santerre and Stephen P. Neun, *Health Economics: Theories, Insights, and Industry Studies*, 5th Edition (Mason, OH: South-Western Cengage Learning, 2010).
4. Sherman Folland, Allen Goodman, and Miron Stano, *The Economics of Health and Healthcare*, 6th Edition (Upper Saddle River, NJ: Prentice Hall, 2009).
5. Regina E. Herzlinger, *Market Driven Healthcare: Who Wins, Who Loses in the Transformation of America's Largest Service Industry* (Cambridge, MA: Basic Books, A Member of the Perseus Books Group, 1997).

Index

A

B

C

D

E

F

G

H

I

J–K

L

M

N

O

P

Q

R

S

T

U–V

W