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# HEALTHCARE BUSINESS INTELLIGENCE

A Guide to Empowering Successful Data  
Reporting and Analytics

**L A U R A B . M A D S E N , M S**

*Foreword by Dr. John Halamka*



# **Healthcare Business Intelligence**



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*A Guide to Empowering  
Successful Data Reporting  
and Analytics*

LAURA B. MADSEN, MS



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To Karl and Nolan





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# Foreword

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**A** year ago, senior managers at my hospital asked me a simple question in anticipation of healthcare reform:

*Can you create the omnibus platform for coordination, population health, and care management that integrates heterogeneous data from large and small affiliated provider organizations, supplying retrospective and prospective analytics to improve quality, safety and efficiency?*

No problem.

Everyone wants to be an accountable care organization, but no one knows how to do it.

I believe there are five tactics necessary for success in a world where reimbursement for quality rather than quantity is our future:

1. Universal adoption of electronic health records
2. Healthcare information exchange
3. Business intelligence/analytics
4. Universal availability of personal health records to patients/families
5. Decision support at the point of care

This book is about how to achieve number 3.

Analyzing data requires much more than technology—it requires an understanding of the very nature of the data and its intended uses. What do I mean?

A few years ago I hired an analyst who looked at one of our data marts and concluded that the average length of stay in the operating room was 127 days! They did not know that length of stay in hospitals is measured in days but in operating rooms it is in minutes.

Another analyst noted that no inpatients over the age of 65 had ever visited our emergency department. They did not realize that Medicare creates a bundled payment for all care delivered in an encounter—there is no separate emergency department charge.

This book provides all the tools necessary to implement successful analytics from an understanding of data quality to getting the project done via appropriate governance. Tactics discussed include the right scope of analytics projects to maximize value while reducing costs and time to deliver useful results. Managing data security, ensuring data integrity, and managing the impact of analytics on culture are key topics that I'm focused on every day. This book shares the details from trenches.

I know you'll find this book to be a helpful reference for your business intelligence journey. It nicely summarizes all the lessons I've learned over the past decade, so you'll have the benefit of best practices without having to repeat our mistakes!

Dr. John Halamka

# Preface

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**T**wenty years ago, I sat in a doctor's office and received a diagnosis that would change my life forever. Although I was fortunate that my diagnosis was chronic but not life-threatening, it took years of suffering before someone could tell me what was wrong. Each doctor I went to see requested the same information, the same replay of history and symptoms, and after three years of begging for relief the paper copy of my medical record came to rival Webster's unabridged dictionary. I didn't know or understand then that most of the inefficiencies within the healthcare system had nothing to do with the capabilities of the care team—and everything to do with sharing data.

Fast-forward to 2006, when my nearly two-year-old nephew sat in the emergency room of Children's Hospital in Minneapolis. He had been sick on and off for about a month, not terribly unusual for a two-year-old, but his regular doctor was concerned enough to send him and his parents to Children's. It was the Tuesday afternoon before Thanksgiving. I had just walked in the door at home when my sister called me and told me that a blood test revealed that my nephew had leukemia. In less than 36 hours, on a holiday week, he received his first treatment. We sat Thanksgiving morning in the waiting room staring at a TV screen that looked more like a report. It had the patient name, location (e.g., prep, recovery) with a green/red symbol to help identify whether he was passing between them. I was struck with the level, ease, and sophistication of the data

that Children's Hospital uses every day to keep their patients and families healthy and well informed. Today, my nephew is a thriving seven-year-old.

There's no doubt that healthcare is deeply personal. The work that I do assists providers in taking better care of people like me and you. Sometimes that means a direct impact to patient care, and sometimes it means that it makes it easier for them to run the business side of providing care. But every day I recognize that the value that data provides means more efficiency, better outcomes, and improved transparency. And we all benefit in the end.

Today, as the arguments for and against universal healthcare continue, we all recognize that the fundamental structure of the U.S. healthcare system is broken. I don't claim that better use and management of data is the panacea, but I do strongly believe that it's as close to a magic bullet as anything else we have in our arsenal.

There is no better time, as data volumes increase due to regulatory pressures, to take advantage of all we have learned to create strong data management programs in every healthcare organization. The result of this will be a stronger and better health information exchange; a better understanding of members, patients, and behaviors; payment transparency; easier transitions between providers (inpatient to outpatient, or just moving geographically); improved data on drug-drug interactions; the list goes on and on.

In the information technology (IT) industry terminology the term for this type of data management work is *business intelligence* (BI).

This book was born out of my work in healthcare business intelligence, more specifically, my work in creating healthcare BI programs. Almost every organization I have worked with has asked the same questions and expressed similar concerns. Business intelligence is a top-10 trend for just about every chief



information officer (CIO) in the country. Healthcare as an industry is behind in adopting BI, yet no other industry needs it more. The demand for data management expertise in healthcare is increasing at a rapid rate, but the resource pool is limited, especially if you are looking for someone who has built BI programs specifically for healthcare. The lack of industry knowledge and experience jeopardizes healthcare organizations' chances of success in implementing and adopting BI. As a result, many programs fail at things that they shouldn't fail at, or focus on things that are not important.

This book was written with the business leader in mind. You will not find in these pages a detailed method for building out data models (that book has been written well by others). What you will find is a guidebook for creating a BI program that will become a sustaining capability and will provide your organization with significant value. This book differs from the others written about BI. First, it focuses on healthcare, and second, it focuses on the business leader interested in BI.

The following chapters are what I consider the tenets of successful healthcare BI programs. A healthcare BI program can exist without some or all of these, but it may be on shaky ground. The challenges with healthcare BI programs are significant, from the technical to the process. The statistics continue to be disturbing: more than 70 percent of BI programs fail on their first attempt. Many factors are associated with failure for BI programs, but these tenets have been built based on my years of experience in building healthcare BI programs. I know what happens to healthcare BI programs without these tenets; they're on a fast track to disappointment.

So, how can you avoid becoming just another statistic? Use this book as your guide, your cookbook if you will, for creating your program. Why a cookbook? I have been cooking since I could reach a countertop (that's a completely different book) and what I have learned in cooking is that two cooks can follow

the same recipe and have the dish turn out quite differently. That's okay, as long as they have all the right ingredients and a step-by-step process for completion. The same must be true for a healthcare BI program. Your conditions will vary. Your hospital or health plan is not just like any other organization; in order for your healthcare BI program to succeed it must (repeat, *must*) be created, molded, and formed to your organization. The things that work for one hospital may not work for the hospital across the street. That's okay, as long as we all have the same ingredients.

This book gives you the ingredients and, where appropriate, step-by-step process for including key factors. In addition, you will see throughout the book key points highlighted, mini case studies that are meant to provide you with an understanding of what healthcare organizations can achieve when they manage their data as an asset, and sections on how to put all the pieces together.

After reading this book, you will be able to:

- Articulate the best practices of business intelligence and data warehouses for healthcare
- Assess your organization's preparedness to adopt BI
- Create a shared corporate lexicon
- Operationalize a BI program
- Build supporting processes and infrastructures to support a BI program today and in the future
- Present the value proposition and return on investment (ROI) to executives
- Proactively market the BI program to stakeholders

# Acknowledgments

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It is December 2011 and I am about halfway through the content for this book. I am pausing here, at this time and place, to remind myself why I am doing this. I have found it easy in this process to get wrapped up in the length of the chapters or the tone of a sentence. I have found that the more lost I get in these details the less I remember what drives me.

My intention for this book is relatively simple: to start a conversation, to ask why the industry is what it is (or isn't). I do this because of the laser-like focus and incredibly idealist proposition that starting this conversation, pushing the envelope, can drive changes in healthcare. Although I am an idealist, I am also a realistic, so I recognize that this one book about data and reporting will likely not change healthcare in any measureable way. People much smarter than me have been trying to fix the situation for years and haven't been successful, but I am proud to be part of the group that has tried.

In August 2008 I sat down with Tom Niccum, president of Lancet. We had discussed the possibility of my joining Lancet. During this conversation we first discussed the idea of a book. In 2008 the idea of a healthcare BI book was questionable. Healthcare had not adopted BI, and although the elections were looming, none of us knew the degree to which the administration would impact healthcare BI. In other words, in 2008 we didn't have an audience. Fast-forward three years later and our healthcare practice was booming. Healthcare had leap-frogged

ahead in its BI adoption and in a matter of months, a book on healthcare BI seemed like the next right thing to do.

A big thanks to Tom for starting the conversation and re-visiting it until the timing was right. I owe a debt of gratitude to Nancy Dowling, my editor-on-the-side, who kept the quality of my work high. Diane Fiderlein, dear friend and colleague, whose thoroughness and knowledge guided the book from good to great. So many others at Lancet participated in their own time (and some company time) to help make this book a reality. Big thanks go to Paul Sorenson for adding intellectual vigor, and Michael Reid and Neil Schafer for great conversations about architecture and the resultant graphics. I also have to thank all the founders of Lancet for their support and faith: Chris Holtan, Jaime Plante, Rick Thorp, and particularly Randy Mattran, who continues to always expect the absolute best from me; damn that's frustrating! I would be remiss if I didn't mention the Lancet DesignHaus, a team of wildly talented artists who have dedicated themselves to the cause of visualizing data. In their free time they designed all the graphics for this book; Jennifer Maanhardt, Chris Peters, and Mike Erickson—thanks for making my notes and bad sketches look great.

I owe a debt of gratitude to the organizations that agreed to include their case studies in this book. These organizations, and the work that they do in healthcare BI, have continued to inspire not only me but all of our peers too. It's incredibly exciting to be in this industry, and I have these pioneering organizations to thank.

Finally, I have to acknowledge my family. My parents and grandmother, who constantly encouraged me in my incessant need for information and understanding, even at age five. My siblings, whose struggles and experiences with healthcare are detailed in these pages, and most of all, my husband and son. There are no words to thank them for the support that they provide and the patience that they exhibit after my endless

## *Acknowledgments*

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hours on the road learning the ins and outs of my industry and then the hours locked in my office writing this book. My appreciation is diminished only by my love for you both.

No matter whose name appears as the “author” it takes a team of people to get a book to its finished state. I am humbled and incredibly fortunate to be able to work with all of you, so I thank you.



# Healthcare Business Intelligence





## Business Intelligence

### *An Introduction*

**W**hen I tell people what I do for a living they respond one of two ways. First, “Business intelligence, isn’t that an oxymoron?” Oh, first time I have heard that! So funny. The second response is: “What?” Complete with a blank stare on their face.

I almost always qualify it with something like “You know, reporting and analytics.” That usually seals the deal. It’s not completely accurate but in these instances I am okay with good enough.

Many definitions of business intelligence (BI) exist; the most well-known is “The right information to the right person at the right time in the right way.” This is my least favorite because it implies a factor of luck. Perhaps the oldest was written by H. P. Luhn in 1958: “The objective of the system is to supply suitable information to support specific activities carried out by individuals, groups, departments, divisions, or even larger units. . . . To that end, the system concerns itself with the admission of acquisition of new information, its dissemination, storage, retrieval, and transmittal to the action points it serves.” The one I use most often is: *BI is the integration of data from disparate source systems to optimize business usage and understanding through a user-friendly interface.*

Data warehousing is a companion phrase to BI. The well-documented best practice for BI is to create a data warehouse. A data warehouse is exactly what it sounds like, a place where a lot of data resides. Good data warehouses have a strong organization system, like the card catalogs from libraries of the past. Without that strong organization system, healthcare companies find themselves digging through their data warehouse for data, not an optimized method for certain. To be clear, business intelligence is not an IT (information technology) activity. But it does require support from your IT group for the more technical aspects of data warehousing. We address more of these in Chapter 5.

The truth is that simple definitions don't really do business intelligence justice. True BI, good BI, is an enablement mechanism to provide IT leaders and hospital executives the best information possible to improve their ability to make informed decisions. BI helps organizations go from management by instinct to management by data. BI isn't just a capability, although certainly it provides capabilities; when done well BI can become the life-blood of your organization, providing your organization with key performance indicators that help manage revenue cycle management, quality and safety indicators, or outcomes associated with diabetes management, to name a few. Few healthcare organizations treat BI as life-blood. But as you will see throughout these pages, when they do, the results are nothing short of stellar.

## **What BI Isn't**

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BI isn't reporting, it isn't analytics, it isn't data warehousing, and it isn't dashboards. All of these things individually do not make a BI program, but put them together and that is exactly what BI is. Business intelligence enables all of these. BI is greater than the sum of its parts. You may question why BI enables

data warehousing, but the truth is that you don't need a data warehouse if you don't intend to analyze data or report from it. BI is an industry and a skill set, but BI isn't the group you go to that will provide you the knowledge or intelligence about your organization. Good BI means putting valuable information at the fingertips of many businesspeople, not just a lucky few.

### **Is It Really Worth It?**

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I received a call one early January day. For consultants, those are the calls that are the most intriguing, because usually it means that someone really needs help, contemplated their next steps over the winter holiday, and waited until the new budget year to make the call. This call came the first business day back from break, and the caller was a director of IT. She was looking for an “objective” voice that had knowledge of both tools and BI programs. Two days later I was sitting in her office learning all the details. The most important question she asked me was: “Does anyone really do this? It seems so complicated and hard to find the right resources, is it really worth it?”

The answer is yes; many organizations have done BI and done it well. They have found the proverbial gold at the end of the rainbow, where all the work they did brings them the value from the data that they needed.

### **Do You Need BI?**

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If your organization uses data to make decisions then the answer is yes. If your organization *wants* to use data to make decisions then the answer is yes. If your plan is to hire a team of really smart analysts then the answer is no, because BI is

meant to deliver information to a broad audience. The degree to which you have to invest and create your BI program is what should vary.

“Do you need BI?” is a great question, and one every person who is in charge of a BI initiative should ask themselves often, and here’s why:

- If you don’t, someone else will, usually around budget time.
- If you aren’t asking then you probably aren’t thinking about how to make your program the most relevant for your organization.
- These programs are expensive; between tools, resources, and time they cost money. You have to make sure that you are providing the value that matches the investment. If you aren’t, then what are you doing?

Ask yourself these questions at least twice a year, and depending on how your organization is structured, have a prepared statement or a PowerPoint ready when these questions are posed to you by someone else.

## Healthcare Information Environment

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To “do BI” you will have to organize your data for usage. Odds are, as you read this, your hospital or clinic has data stored somewhere. That data comes from a transactional system like an electronic health record (EHR) or a financial system. The data on its own is not user-friendly for the majority of businesspeople. If the goal of BI is to put better information into many businesspeople’s hands you must take the time to organize your data to ensure that it’s easy to use and provides the most value. That is where a traditional data warehouse comes in.

When working in healthcare I do make a few modifications to the traditional data structures you see in other books on the

topic. For example, the analytics sandbox and audit control sections are critical to healthcare organizations, but maybe not as necessary for retail. Each of them provides a method to allow your more sophisticated analysts access to the data that is granular. The analytic sandbox provides your analysts a “play space” to create predictive models that can help you adjust staffing in your emergency department without an impact to regulatory reporting. The audit control environment (ACE) provides a one-stop-shop for both internal and external auditors to see the data and the path the data took to validate your approach for anything from JCAHO (the Joint Commission for the Accreditation of Healthcare Organizations) reviews to medical records reviews for public health documentation.

The first thing you should know about your data environment is that it is unique to your organization and should be created based on the needs and wants of your hospital or health plan. As you construct your information environment, important key criteria need to be kept in mind. These environments are built to optimize stability and data usage for your organization. Some methods of shortcutting the process exist, but few deliver the capabilities that are promised during the sales cycle. We review these methods in Chapter 5, but for now let’s look at the baseline healthcare information environment that I recommend.

Let’s start at the beginning, or in this case, on the left side of Figure 1.1. The source systems in healthcare do vary, but they generally follow two categories: Clinical and Financial. In theory, anything that has data can be a source (e.g., Excel), but as you consider what you bring into your data warehouse you need to ask yourself a basic question: “Yes, you can, but *should* you?” Every industry is buckling under the weight of data, prompting interest in “the Cloud.” But not all data is equal, only data that provide valuable insights should be stored in your data warehouse.