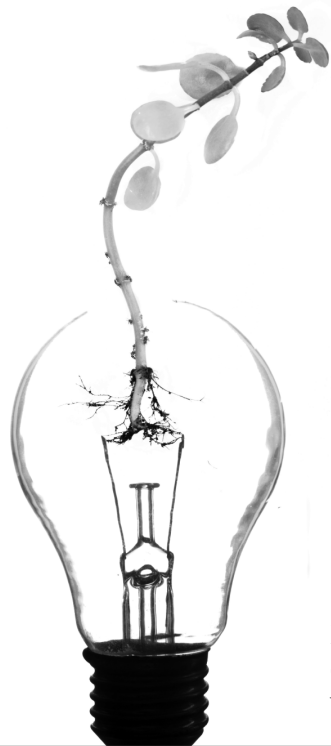


# Advanced Lean Thinking

Proven Methods to Reduce Waste and  
Improve Quality in Health Care



Foreword by  
Gary S. Kaplan, M.D.,  
Virginia Mason Health System

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Printed in the U.S.A. 5 4 3 2 1

ISBN: 978-1-59940-228-4

Library of Congress Control Number: 2008938825

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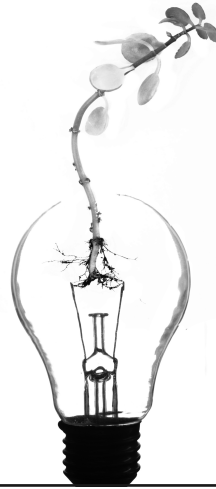
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## FOREWORD

The health care industry is under closer scrutiny than ever before in its history.

Why? Because we aren't meeting the expectations of the public or those paying for the services, including the government and businesses. Our customers are dissatisfied because we aren't able to deliver consistently reliable performance and outcomes; because our charges are high relative to the perception of value received; because the public is expressing unprecedented and justifiable expectations for safer care; and because medical workers' morale has reached new lows due to feeling they are unable to do their best work for their patients.

In addition, many companies are finding that the expense of providing health insurance coverage for their workers is no longer sustainable without risking their ability to be competitive in a global economy. The search for answers to these and other challenges

has been illusory, and the result continues to be widespread frustration with many aspects of the U.S. health care system.

Since 2001, we at Virginia Mason Medical Center have been trying to address these issues with a new and radically different approach to our work. Teams of physicians, nurses, technicians, managers, and front-line staff report weekly on the *kaizen* activities of the past week and the improvements they were able to test and implement in just a few days. The improvements are made in the ambulatory care environment and the hospital environment. They impact primary care, specialty care, and critical care. Most important, they lead to fewer defects, safer care, and higher-quality evidenced-based care for patients every day.

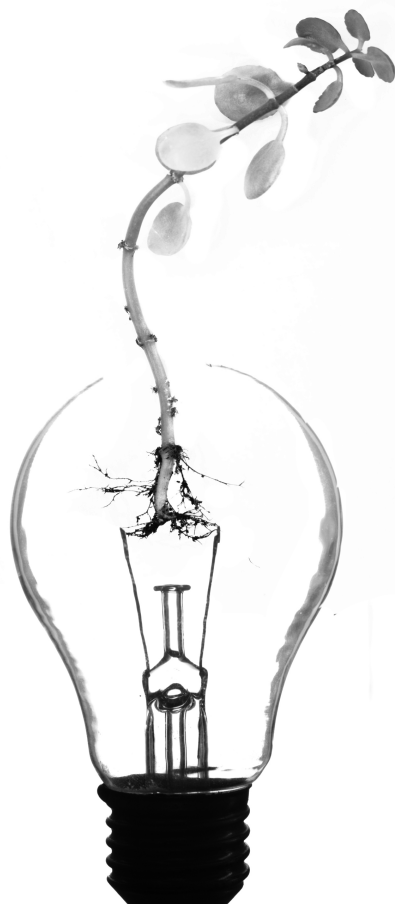
What these improvements all have in common is that they are identified and implemented by front-line staff who know their work best, utilizing the methods and tools of Lean—what we call the Virginia Mason Production System, based on the Toyota Production System. Our staff are discovering what is truly possible for our patients and, in so doing, are creating a less burdensome, waste-free work environment so they can do their very best for our patients.

Joint Commission Resources (JCR) continues to make a substantial contribution to spreading these methods throughout our industry. The following pages provide the reader with a wealth of knowledge, outlining in detail the tools and methods of Lean and their applications. These tools have been shown to work in every industry in which they have been applied and are now being used successfully in health care. These chapters are invaluable for those who are focused on quality improvement within their organizations and for those who are looking for ways to make care safer and more reliable. Examples from organizations across the country provide practical applications and inspiration.

Unfortunately, learning the tools of Lean is not enough. To truly transform health care and embrace the potential for “zero-defect” care, leaders must also be willing to challenge our old ways of thinking about how we deliver care. We must embrace the power of care delivery teams and not rely on the imperative of the autonomous physician as the key to safer care. We must deliver evidence-based care to every patient whenever possible, and we must develop zero tolerance for the waste that is omnipresent in our processes. Leaders must be willing to take tough stands, challenge the status quo, and take their responsibility as stewards of precious resources seriously.

The time is now for courageous leadership in health care to rise to the challenge. Our patients and our staff are counting on us to lead. Only with strong leadership will we be able to realize the benefits of Lean tools and create a better health care environment for our patients, our people, and our communities. As our *sensei* Chihiro Nakao, a pioneer of Lean manufacturing, has told us, “It is your destiny to be a leader.” Readers of this book will find new hope and new ideas and might even be inspired to become the leaders we need to truly keep our promise to our patients.

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# INTRODUCTION

This book is a follow-up to *Doing More with Less*, the 2006 publication of Joint Commission Resources. In order to use the tools in this sequel, a basic familiarity with Lean is required. This edition will provide more in-depth detail for five particular tools: value stream mapping, 5S events, *kaizen* events, error proofing, and Six Sigma. This book also includes seven case studies that provide greater insights into the use of the Lean tools presented here, Lean thinking in general, related Lean tools, and associated quality improvement tools. The last of these case studies also serves as a springboard for implementing Lean in your own health care organization.

### Lean and Health Care

Although Lean developed initially in the 1930s as a response to the needs to eliminate waste and improve quality in manufacturing, since the 1980s, Lean thinking (or Lean) has been expanded and adapted to meet the needs of the health care industry. Health care as an industry has experienced significant challenges in providing quality services while enduring great cost pressures. In response, many organizations are looking for improved ways to address these challenges. Lean benefits include the following:

- Valuing diversity by including all stakeholders in problem solving
- Sharing information among employees, which boosts cross-functional understanding and process awareness and in turn decreases rework
- Illuminating where waste occurs in order to promote immediate implementation of solutions
- Paralleling the patient experience
- Giving employees a greater feeling of empowerment and control as they move toward looking clearly at the simple but often overlooked things that impact daily working life
- Fostering team spirit

It is said that using Lean promotes the development of a “community of scientists,”<sup>1,2</sup> whose daily life at work comes to include simple but effective experiments that add to overall improvements over time, in small ways and large. Employees do not wait for reports or directives to look for ways to improve systems and processes. All work becomes highly specific regarding its content, sequence, timing, and outcome.<sup>1</sup> Administrators, once distanced from work on the front line (or *gemba*, in Japanese), come to appreciate what their staff and workers experience. Lean thinking means that all staff share a common goal and a common sense of what an ideal system would be like.

Lean is the evolution of the Toyota Production System (TPS) as well as other quality improvement approaches. As Lean began to move from company to company, it also migrated from industry to industry. Any business in any industry can benefit from the adoption of Lean concepts and methodologies. Although there is no single business or health care organization that is a model for Lean, certain institutions have a clear start and have tracked outstanding benefits from using Lean. Some of these institutions have contributed the case studies that we present in Part 2.

### Waste and Variation in Health Care

Lean thinkers and experts are most recognized for their mission to declare war on waste in the workplace. According to the Institute of Medicine, 30 to 40 cents of every dollar spent on health



care is for costs associated with overuse, misuse, underuse, duplication, system failure, unnecessary repetition, poor communication, and inefficiency, all of which can be described as “waste.”<sup>3</sup>

*Waste* is defined as anything that does not add value to a product or service from the viewpoint of the customer. In health care, the primary customer is the patient and the patient’s family.

More specifically, waste (or *muda*, in Japanese) may occur in time, space, cost, energy, or errors. Any time a process exists, there is potential for waste, or *non-value-added activities*. In a health care setting, for instance, value would include comfort, compassion, competence, and the achievement of desired outcomes. Classifying process steps as either value-added or non-value-added from the patient’s perspective is the first step in exposing and eliminating that waste. In Lean thinking, non-value-added work is also subclassified; that is, some of this work may not be considered of value by the patient, but it is required nonetheless. This type of work is referred to as “non-value-added essential.”

The proportion of waste in health care has been estimated in a range from 30% to 60%.<sup>4</sup> By one estimate, only about 10% of work performed is considered value-added.<sup>5</sup> Waste can include—but is not limited to—waiting; barriers to flow; handoff breakdowns; errors and mistakes; correcting, revising, or reevaluating; inaccurate information; inaccessible information (for example, when a patient’s history is unavailable); shortage or lack of tools or equipment; incorrect or inappropriate equipment; inefficient motions, such as unproductive walking time; unnecessary movement; inaccessible tools or supplies; and inflexible processes (inability to quickly improvise).

A report by the Murphy Leadership Institute<sup>6</sup> posts the following top 10 most wasteful activities in health care organizations:

1. Completing multiple forms for the same task
2. Inefficient shift-to-shift ratios
3. Staff interruptions
4. Hunting for equipment
5. Unavailable or delayed medication administration
6. Long-lasting meetings
7. Searching for or correcting misplaced records
8. Unnecessary or redundant communications
9. Waiting for physician availability
10. Waiting for the delivery of an item from another department

A more inclusive list of wastes is shown in Table 1-1.

Waste arises for any number of reasons. As workers get better at “seeing” the workplace and closely observing the ongoing processes surrounding them, they improve the depth with which they can discern waste. For instance, to the Lean-untrained eye, a busy staff means efficient work. However, if what the staff is doing is not adding value, this “busy-ness” is merely waste masquerading as work.

One huge source of waste is work-arounds, which typically increase the risk for error and reduce the precision of systems that are inherent in quality. A *work-around* is any activity that is implemented to “get around” a problem. Work-arounds may meet a person’s immediate needs, but they do not resolve the ambiguities that result in a complex system. People who work at the same tasks, week after week, month after month, and even year after year become used to the work-arounds they have put in place as stopgaps.

**TABLE 1-1. Example of Wastes and Variations**

<p><b>Delays or waiting</b></p>	<p>Waiting for people (physicians, nurses)          Waiting for bed assignments, treatment, equipment, tests, signatures, approval, supplies, or information          Specimens waiting in batches for testing          Patients waiting due to physician lateness or schedule exceeding capacity          Delay in admission to or from emergency department          Delays in testing, treatment, or discharge          Delay in patient lab test results</p>
<p><b>Overproduction and overuse</b></p>	<p>Unnecessary services, such as preparing drug mixtures in anticipation of patient needs          Costly tests, such as MRI, CT scans, when not evidence based          “Just in case” blood tubes drawn from patients but not used          Delays in medical interviews and treatment          Medications given to patient/resident early to suit staff schedules          Testing ahead of time to suit lab schedule</p>
<p><b>Motion</b></p>	<p>Excess movement of people, equipment, paper information, or electronic exchanges; especially the wasteful searching for materials and supplies          Excess transport of equipment, specimens, or samples          Long walks between departments or areas, for example, from medical clinic to chemotherapy          Searching for patients          Searching for meds          Searching for charts          Gathering tools and equipment          Gathering supplies          Handling paperwork</p>
<p><b>Extra Processing</b></p>	<p>Excessive effort, that is, more than is required or requested          Ordering more diagnostic tests than needed or required          Non-value-added steps in processes          Work-arounds          Excessive paperwork          Repetitive work          Using an intravenous line when oral medication would suffice          Time/date stamps on labels that are not used          Time spent creating a schedule that is not followed          Multiple bed moves          Multiple testing          Retesting          Unnecessary procedures</p>

**TABLE 1-1. Example of Wastes and Variations, *continued***

<p><b>Inventory</b></p>	<p>More inventory on hand than is required to meet customer needs at moment                  Work piles or Work in Progress (WIP), such as lab specimens awaiting analysis, dictation awaiting transcription, or paperwork in process                  Supplies that are kept on hand and take up space                  Expired test reagents and medications                  Bed assignment and patients in beds                  Pharmacy stock                  Lab supplies                  Samples                  Specimens awaiting analysis</p>
<p><b>Defects, mistakes, or adverse events</b></p>	<p>Wrong patient                  Missing information                  Work output that contains errors or lacks something necessary for the next step in the process (for example, incomplete discharge orders)                  Medication errors, including wrong medication and wrong dosage                  Wrong-site surgery                  Poor labeling                  Poor packaging                  Poor storage                  Multiple sticks for blood draws                  Misdiagnosis and diagnostic delay                  Wrong procedure                  Blood redraws                  Poor clinical outcomes (preventable)                  Medication orders not kept up to date after patient is transferred (handoffs)</p>
<p><b>Transportation</b></p>	<p>Moving patients for testing                  Moving patients for treatment                  Moving patients                  Moving samples and specimens                  Disorderly schedule for picking up equipment</p>
<p><b>Human potential<sup>7</sup></b></p>	<p>Employee ideas not listened to                  Employees or patients/families not allowed to contribute                  Intimidating employees or professional students<sup>8-13</sup>                  People not acknowledged for contributions and ideas                  Wasted time and faulty organization systems reduced amount of direct patient care time                  Not highest and best use of talent (for example, registered nurses performing nonclinical tasks)                  Low staff job satisfaction, leading to greater turnover rates</p>



### Lean Concept

#### WASTE IN A WORK-AROUND

At one hospital, nurses needed keys to adjust doses of patient-controlled anesthesia (PCA) pumps.<sup>15</sup> Security considerations dictated that each unit would be issued just a few set of keys. As a work-around, nurses spent an inordinate amount of time tracking down one of the sets of keys. When a focus was put on this issue and the amount of time was calculated, nurses discovered that on each shift they searched for keys an average of 23 times, wasting 49 minutes in the process. Their solution was to revise the pharmacy mandate: Nurses now each had their own key, which they signed in and out only at the beginning and end of their shift. This practice satisfied the need for security; when it was then deployed throughout the hospital, time spent searching for keys was reduced to almost zero, and time saved totaled 2,900 nurse-hours per year.

Although people have the best intentions, when they are in the midst of their workday and they see a problem, inefficiency, barrier, or irritation, their customary tendency is to perform the work-around rather than do what is necessary to solve the problem. In less-than-ideal environments, the “normalization of deviance” can occur.<sup>14</sup> That is, when individuals ignore or minimize a problem and grow tolerant of things and circumstances that are not quite ideal—or, worse, are ineffective or wasteful—then the “deviant” behavior becomes the norm.

Work-arounds are not tolerated in Lean, and in fact, when converting to Lean, acknowledging when something is waste is perhaps the biggest obstacle to overcome. Instead of forgetting to solve a problem and forming a stopgap measure to work around it, everyone is embraced as a

part of seeing and solving. Doing the work is interwoven with the process of seeing it as it is and venturing to do it better not someday, not when it is convenient, but as an integral part of the work itself.

Non-value-added activities increase costs, time, and resources without directly satisfying the customer. Such activities generally show that there is a problem within a process. Often the “pacemaker” process is the most downstream process, but it can be any process that sets the pace for the entire stream. In other words, work flow can go only as fast as its slowest component. The pacemaker process is therefore a critical place for intervention with Lean thinking.

*Value-added activities* are those activities that change the form, fit, or function of a product or transaction in order to satisfy customers and directly fill a need. Complex processes involved in health care provide never-ending opportunities to eliminate waste and variation. What sets apart companies using Lean thinking is not the solutions they create but their ability to master the process.

Variation is also an enemy of quality and safety. When processes vary, the stage is set for outcomes that also vary. In clinical practice, evidence-based data serve to provide a burning platform, a foundational impetus from which strategies are set.

## How Lean Works for Health Care

Although Lean is simple in its precepts, it is not always easy to implement in health care. Barriers include the natural human desire to cling to the familiar, the fear of change, and a lack of understanding of how Lean works. In addition, although Lean health care strives to be patient-centric and to always serve the patient, some aspects of health care may be necessary for delivering care and yet not represent services or products the patient might inherently value. Staff must be won over to Lean thinking to best serve patients as well as other stakeholders. Overcoming this cultural inertia involves hands-on leadership at all levels. Leaders

must become teachers and be visible on the front line. As part of a Lean transformation, leadership styles will also require “modernization.” The more educated, “psyched,” and inspired the staff are led to be, the better the process works.

Lean is a compilation of world-class practices that can improve a health care organization through an evidence-based methodology. Lean is also a management system whose purpose is to eliminate all waste or non-value-added elements by means of daily, hourly, or momentary review. In addition, Lean is about respect for all the people in the organization. Making sure the organization has eliminated waste in its processes sends the message to each worker that “we value you” and “we want to make the work you do as waste free as possible.” Lean is not intended to eliminate people but rather to use them more wisely. It is based on reducing costs rather than raising prices or reducing services.

Lean thinking is based on a philosophy that includes the steps of stabilizing, standardizing, and simplifying work processes, regardless of the health care setting:

- *Stabilize:* It is critical that excess movement of work and process variation be removed first. It is difficult to apply Lean when variation exists.
- *Standardize:* Once an area or process has been stabilized, formal standards via work rules, charts, and visual controls can be used to further eliminate variation.
- *Simplify:* As an organization stabilizes and standardizes process, it then can balance the work load among staff to ensure effective and efficient service is provided to the patient.

One of the practices that is integral to Lean and that can help organizations follow the aforementioned steps is the technique of visual aids or controls. This technique uses a visual communication system to control and standardize a process. Examples include checklists, task lists, posted displays of process steps, posted warnings and alerts, story or sign boards, value stream maps, *kanbans* (signal cards), indicators, or color codes. Using these indicators and controls provides the benefit of reducing confusion and stress, encouraging process standardization, and reducing errors.

For example, in 2004, Lean management led to \$7.5 million in savings in Park Nicollet Health Services, St. Louis Park, Minnesota.<sup>16</sup> Average patient waiting time at the St. Louis Park Urgent Care facility was reduced from 122 minutes to 52 minutes. The number of phone calls answered within 30 seconds was increased by 560%. The cycle time between when a request for a prescription refill was made to when the pharmacy received authorization was reduced by 79%. The number of medications prepared but not needed was reduced by 30%. After analyzing the variation in surgical instrument preferences and the agreement on standardization of instruments, 40,000 fewer surgical instruments were processed each month.

## The Case for Lean in Health Care

Lean practices help a health care organization run as a successful business, focusing on achieving a positive return on investment (ROI) by eliminating, or at least minimizing, non-value-added activities. Such practices might include the following<sup>17</sup>:

- Improving employee retention
- Reducing adverse events
- Reducing admission rate, resulting in more bed turns and increasing, by means of new and expanded services, the opportunity to fill beds

- Reducing length of stay
- Better leveraging available resources
- Improving employee and physician satisfaction and physician/nurse relations
- Increasing nurses' direct patient care time, which will result in improved patient perception of care

Lean thinking contributes to cost savings, increased quality and safety, and increased patient perception of care and staff satisfaction. Although almost all health care organizations employ some form of quality improvement, health care organizations that use Lean have a competitive advantage as an employer because Lean is built on the participation of all employees, allowing them to contribute their ideas, solutions, and creativity.

Although the advantages of using Lean seem self-evident, persuading the organization to adopt Lean practices requires enrolling everyone into the proposed benefits. (See Chapter 12.)

There are two ways of looking at implementing Lean practices into a health care organization. Some observers say that converting to Lean is so challenging that it requires leadership's review of the entire organization—that beginning with one department may be self-defeating because all departments overlap, and one department will differ so radically that improving overall functionality will never stand up. Others say that those who begin too big may end up with a lack of focus and are doomed to fail. The key is to implement Lean while continuing to emphasize current priorities, in the process adjusting focuses and projects over time. As Lean thinking and projects increase, organizations can continue to assess, reassess, and plan for including more and more of the organization into Lean.

To be the advocate or ambassador, or eventually the bona fide champion, for Lean takes commitment on an individual as well as team level. But as Lean experts and those well experienced in its benefits will testify, Lean has individual and personal benefits, too. Personal spaces begin to shine and show order, and in these settings, productivity and satisfaction increase. Creative signals and visual controls are used to lighten, brighten, and clarify. Searching and hunting decrease. Time is freed up for what is valuable to the patient, the staff member, and the organization as a whole. Those who take on Lean fully and passionately see many benefits. As you get more familiar with Lean and its tools, discuss them with others in small and large forums to hear and share your stories. And be sure to have fun!

### About This Book

Although we focus on just five tools in this book, Lean is not simply a toolbox but an overall organization perspective. It is true that some organizations “cherry-pick” their Lean tools, but adhering to a total Lean management philosophy means implementing Lean steps throughout the organization as its overall strategy for quality and safety. Selecting Lean tools first and then as an afterthought deciding what you need to accomplish with them is putting the cart before the horse.

A Lean culture must be the foundation upon which the tools are used and the benefits accumulated. As you proceed with Lean thinking and working, search for ways to change your organization's culture in addition to seeking any quick, measurable results. Leaders must be informed, vocal champions for “going Lean.” A changed culture assures success. All involved, from staff to vendors to top organization management, are allies in this crusade.

## Part 1: The Lean Toolbox

Each of the chapters in Part 1 is organized as an easy-to-read guide. The *At a Glance* feature presents the tool description, purpose, responsible staff members, duration, and process steps. A number of related Lean and other quality improvement tools have been integrated throughout the book and highlighted as “tool tutors” to provide examples and explanations. These related tools and concepts, which operate hand in glove with the five Lean tools detailed in Part 1, appear in boxes labeled as follows:

- *Tool Connections* explain related Lean and performance improvement tools.
- *Lean Concepts* define foundational concepts for thinking Lean.
- *Tool Tangents* highlight short examples of a Lean tool or concept in action.

The following five chapters appear in Part 1:

- Chapter 1: Value Stream Mapping
- Chapter 2: 5S Event
- Chapter 3: *Kaizen* Event
- Chapter 4: Error Proofing
- Chapter 5: Six Sigma

## Part 2: Lean Applications

Part 2 highlights seven case studies of health care organizations that have begun to implement Lean. They provide insight into how Lean tools are used or adapted to varying settings. The *Case At a Glance* feature includes the organization, Lean project, tools used, and primary outcome. Those features are described in further detail in the study itself. The case studies in Part 2 highlight the following Lean tools and settings:

- Various Lean tools in the hospital setting
- *Kaizen* in two ambulatory care settings
- *Kaizen* in the home health care setting
- A3 in the behavioral health care setting
- Process mapping in the laboratory setting
- Use of key leadership concepts to integrate Lean into the health care culture

The following chart summarizes which tools are used in which case studies.

Tool/Concept	Chapter Case Studies
Value stream mapping	6, 7, 8, 9
5S	8, 9
<i>Kaizen</i> events	6, 8, 9, 10, 12
Error proofing	7
Six Sigma	7, 12

Chapter 12, “How to Make Lean Work for Your Organization,” provides a review of one organization’s overall foray into Lean thinking. Cancer Treatment Centers of America is one of only a handful of organizations in the United States that have taken Lean on as an institutional foundation and have based their strategic plan around Lean philosophies and methods.

A reference list at the end of the book identifies all the resources used in preparing this book. Finally, a glossary includes definitions of Lean and related tools as well as other concepts that are integral to Lean management.

### Terms Used Throughout

Lean operates with one clear focus: the customer. Depending on the health care setting, the customer might alternately be called a patient, client, or resident. In most cases we have used the term *patient* to serve overall. Although Lean's operating principles, specifically as they are rooted in the TPS, have Japanese roots, we have included only the Japanese terms that are used frequently in Lean.

### Acknowledgments

We would like to thank the individuals, institutions, and organizations that contributed information for this book. We are especially grateful to the many people who contributed their time and information to construct the case studies provided in Part 2 as well as the project example in Chapter 5, "Six Sigma." They are listed here:

- Tricia Brown, Vice President, Corporate Affairs; Irene Magee, Vice President and Director of the Medical Equipment Division; Northeast Health, Troy, New York
- Herb De Barba, Vice President for Lean Six Sigma at Cancer Treatment Centers of America, Midwestern Regional Medical Center, Zion, Illinois
- Trent Gordon, F.A.C.H.E., Business Development and Planning; Don Calcagno, Vice President of Performance Improvement; Advocate Good Shepherd Hospital, Barrington, Illinois
- Pam Guler, M.H.A., Administrative Fellow, Six Sigma Black Belt; Lisa Johnson, M.S., M.S.N., R.N.-C.N.A.A., CNO, Vice President Patient Services; Morton Plant Mease Health Care, Clearwater, Florida
- Wayne Ketron, Executive Director Performance Improvement and Safety, Six Sigma Master Black Belt, Wellmont Health System, Kingsport, Tennessee; Terry Eads, Director Quality Accreditation and Risk Management, Wellmont Bristol Regional Medical Center, Bristol, Tennessee
- Sandra Kiesel, Principal, Go Lean, Lake Orion, Michigan
- Paul Melinkovich, M.D.; Patricia Gabow, CEO; Denver Community Health Services, Denver, Colorado
- Bev Moncy, Senior Consulting Manager; Tom McFadden, Consulting; Karie Coonrod, Consultant; GE Healthcare
- Jan Pringle, Ph.D., Director, Program Evaluation and Research Unit, School of Pharmacy, University of Pittsburgh
- Charleen Tachibana, R.N., Senior Vice President, Hospital Administrator, and Chief Nursing Officer; Cathie Furman, R.N., M.H.A., Vice President of Quality and Compliance; Alisha Mark, Media Relations Manager; Virginia Mason Medical Center, Seattle, Washington



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