

The Application of *Lean* in Healthcare

Exploratory Paper

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Abstract

The current healthcare environment poses many challenges to medical group practice managers. Aside from their daily tasks of managing operational issues in their medical practices, healthcare administrators must deal with the burgeoning issues of physician burnout, attracting and keeping talented staff, taking charge of the practice's financial stewardship and ensuring the delivery of quality health care. Healthcare managers are increasingly asked to do more with less. Can *Lean* management systems help practice managers thrive, not only survive, in the current dynamic healthcare environment? This exploratory paper will attempt to answer this question and explore how practice managers can improve patient and employee satisfaction, improve healthcare quality and safety, and lower operating costs by consistently practicing *Lean* principles aimed at creating value and removing waste, surfacing and solving problems, and engaging and empowering employees in continuous improvement.

Keywords: Lean, Toyota Production System, TPS, Continuous Process Improvement, Kaizen, Problem Solving, Coaching, Standardization, Patient Satisfaction, Employee Engagement, 5S, Andon, Kanban, Value Stream Map, Flow, A3 Report, Plan-Do-Study-Act

Introduction

The current healthcare environment poses many challenges to medical group practice managers. Government mandates concerning the meaningful use of Electronic Health Records (EHR) have created mountains of administrative tasks for physicians and managers. Reimbursement trends are changing from “pay for volume” to “pay for value”. Big insurance payors are merging and dictating how medicine should be practiced. Diminishing reimbursement rates coupled with increasing operating costs threaten the survival of practice groups. Healthcare managers are increasingly asked to do more with less. Aside from their daily tasks of managing operational issues of their medical practices, healthcare administrators must deal with the burgeoning issues of physician burnout, attracting and keeping talented staff, taking charge of the practice’s financial stewardship and ensuring the delivery of quality health care.

Quality health care must be safe, patient-centered, effective, efficient, timely and equitable.¹ The US healthcare system is far from being safe, efficient or effective. The Institute of Medicine reported in 2000 that 44,000 - 98,000 patients die each year due to preventable medical errors, costing \$17 - \$29 billion.² A recent article published in the British Medical Journal (BMJ) concluded that medical error was the third leading cause of death in the US.³ Inefficiencies in healthcare resulted in 3 types of waste: administrative, operational and clinical, costing the system \$750 billion.⁴ Research by the Dartmouth Atlas of Health Care found regional variations of more than 200% in Medicare spending.⁵

Wrestling with mounting costs, diminishing reimbursement rates and sub-par patient safety records, healthcare leaders and professionals are truly standing on a burning platform, and change is inevitable. Organizations that can rapidly adapt to the changing landscape of healthcare will have a distinct competitive advantage.

Practice managers need a production system that enables them to thrive, not only survive, in the current dynamic healthcare environment. In recent years, some innovative healthcare leaders have

looked to the manufacturing sector for solutions that can be adapted to the healthcare setting. One such management system is the Toyota Production System (TPS). “The Relentless Pursuit of Perfection”, a slogan from Toyota’s luxury brand Lexus, captures the essence of Toyota’s production management principles, generally known as *Lean*.

Lean (*Lean Thinking*, *Lean Production*, or *Lean Management*) has been around since the early 90s. *Lean* to casual observers would likely evoke images of value-stream maps, the pull system, the andon cord, visual control boards, A3 reports, etc. These are important *Lean* tools to utilize in improvement processes. However, the second pillar of *Lean* – the concept of “Respect for People” - is less understood and often missed in some *Lean* implementations.

This exploratory paper, through a review of the literature, will present a brief overview of *Lean* management, including *Lean* tools and principles; explore how these tools and principles can be applied in healthcare organizations; bring attention to some common *Lean* implementation pitfalls and challenges; present two case studies of *Lean* transformations with inspiring results; and finally draw some conclusions from the material presented. The intent of this paper is to help healthcare managers gain a deeper understanding of *Lean* management principles, and to explore how medical practice groups can improve patient and employee satisfaction, improve healthcare quality and safety, and lower operating costs by consistently practicing *Lean* principles aimed at creating value and removing waste, surfacing and solving problems, engaging and empowering employees in continuous improvement.

Genesis of the Toyota Production System

Three people were instrumental in the early development of Toyota Production System: Sakichi Toyoda, the founder of Toyoda Automatic Loom Works, Ltd; his son Kiichiro Toyoda, founder of Toyota Motor Company; and Taiichi Ohno, widely credited as the architect of the Toyota Production System (TPS).

Sakichi Toyoda

Sakichi Toyoda was a great inventor. In 1890, at age 24, he received his first patent for inventing a wooden hand loom which utilized gravity and a foot pedal and required only one hand to operate. Sakichi's invention increased efficiency and productivity, and it also improved quality by removing unevenness in the woven fabric. Through years of modifications and improvements, Sakichi finally achieved his goal of inventing a fully automatic power loom: the Type-G loom. The Type-G loom would automatically stop operation when an error was detected, hence ensuring quality and reducing waste. Sakichi called this automatic error detection "*Jidoka*" – "automation with a human touch". Automation was no longer a mindless machine operation, it carried built-in intelligence to stop operation at the first sign of a problem arising. Stopping production to fix problems at its root, hence ensuring built-in quality of the product, became the cornerstone of the Toyota Production System.

Kiichiro Toyoda

Kiichiro Toyoda was a genuine engineer. He always liked to gather facts through direct observation on the shop floor rather than relying on reports in the office. Kiichiro's philosophy of *genchi genbutsu* (going to the source, observing the facts, learning by doing) and making continuous improvements formed the foundation and a pillar of TPS. A speech Kiichiro made to his colleagues after design plans for a loom were stolen from Toyoda Loom Works illustrated his way of thinking: "Certainly the thieves may be able to follow the design plans and produce a loom. But we are modifying and improving our looms every day. So by the time the thieves have produced a loom from the plans they stole, we will have already advanced well beyond that point. And because they do not have the expertise gained from the failures it took to produce the original, they will waste a great deal more time than us as they move to improve their loom. We need not be concerned about what happened. We need only continue as always, making our improvements."⁶

Taiichi Ohno

Taiichi Ohno was an iconoclastic engineer who believed inefficiency and waste in the production process were the reasons Toyota's productivity trailed behind that of Ford and GM. Ohno's philosophy of going to the *gemba* (where the work is done) and seeking deeply to understand the situation enabled him to develop an adaptive system. First, a *kanban* (visual board) system was developed to connect different processes with specific information on what to produce and how much. Then, Ohno installed an *andon* (running light) cord along the assembly line which would stop the production line when the cord was pulled. All assembly line workers were instructed and trained to pull the cord whenever they spotted problems; problems were corrected at the root so they never recurred. Ohno also allotted time for *kaizen* (*kai* – change, *zen* – good, *kaizen* – change for the better): team members discussed ways to improve the production process. Slowly, like a jigsaw puzzle, the pieces of the Toyota Production System fell into place.

Lean Tools and Principles

Lean Tools

Many *Lean* tools have been developed to solve problems in the production line. Some common ones are *Andon*, *Kanban*, *5S*, *A3 Report*, and *Value Stream Map*. These tools can also be effectively applied in healthcare.

Andon

A rope hangs over the production line, connected to a visual control board. When operations are normal, a green light shows on the board. When an assembly worker encounters a problem, he pulls the *andon* cord, the assembly line slows down and eventually stops so that the problem can be fixed. The *andon* cord is not only a means to ensure built-in quality, but more importantly an assurance to workers that they have the capability as well as the responsibility to do the job right. As Ohno put it: "To thoroughly eliminate abnormalities, workers should not be afraid to stop the line."⁷ Healthcare

managers can create their patient safety alert systems by modeling the *Andon* system whereby frontline staff can report any patient safety issues and “stop the line” to fix problems and ensure quality.

Kanban

A *kanban* (tag) is a communication tool to ensure just-in-time production. A *kanban* can be a laminated card, an empty cart or an empty bin which displays the type and quantity of a product to be produced and stocked. Examples of *kanban* in healthcare might be a display board listing patient wait-time to facilitate patient flow, and a two-bin supply *kanban* system to manage medical supplies inventory more efficiently.

5S

5S is a process tool to provide an organized work environment, enable standardized work and help to remove waste. *5S* refers to: *Sort*, *Set in order*, *Shine*, *Standardize* and *Sustain*.

Sort - remove unnecessary materials, tools, equipment and procedures from the workplace.

Set in order – everything has a place and everything is in its place; misplaced items are conspicuous.

Shine – keep everything in original working order; remove any debris and clutter.

Standardize – tasks are highly specified, providing a baseline for the next improvement and new standard.

Sustain – the discipline to maintain what has been achieved through the *5S* cycle.

5S helps establish discipline in healthcare settings by providing a system to improve patient and employee safety while delivering quality care. For example, healthcare managers can apply *5S* in the operating room to organize and sterilize the area and standardize equipment and placement on the surgical tray.

A3 Report

The name *A3 Report* came from the paper (A3, 11”x17”) on which the report is written. It was the largest paper that could fit into a fax machine at the time. A typical *A3 Report* contains 9 elements:

Title, Owner/Date, Background, Current Conditions, Target Conditions, Analysis, Countermeasures, Implementation Plan and Follow Up. The *A3 Report* embodies the Plan-Do-Study-Act (PDSA) Deming Cycle and root-cause analysis. Healthcare managers can conduct *A3* analysis to get to the root-cause of problems they encounter daily and eliminate problems at the root instead of spending time “fighting fires”.

Value Stream Mapping

Value Stream Mapping (VSM) is a method to visualize every step of the material and information flows that contribute to a product completion or service delivery. First, a current “flow” or a current state map is drawn up, then every step of the map is analyzed to determine whether the step adds any value from the customer’s perspective. Any step that does not add value is waste and can be removed. A future state map is then drawn up to guide improvement activities.

John Black, the author of *The Toyota Way to Healthcare Excellence*, talked about the seven flows of medicine:⁸

1. Flow of patients
2. Flow of family
3. Flow of providers
4. Flow of medications
5. Flow of supplies
6. Flow of information
7. Flow of equipment

By eliminating waste, delays and obstacles along these “flows”, practice managers can achieve excellence in the delivery of healthcare services to patients.

Each tool set was a response to a need, based on a thorough understanding of the problem, to solve the problem and obviate its recurrence. Through each problem solving process, employees learned

new knowledge to apply to the next set of problems. A medical practice will have a distinct competitive advantage when its staff acquire the ability to continually develop new countermeasures to new problems. Therefore the key to *Lean* success lies behind the tools that guide managers' thinking: the *Lean* principles.

Lean Principles

TPS, when applied outside of Toyota and its affiliates, is generally called *Lean*, *Lean Management* or *Lean Thinking*. The basic idea of *Lean* is to maximize customer value while minimizing waste. Mark Graban, author of *Lean Hospitals*, defined *Lean* as “a set of concepts, principles and tools used to create and deliver the most value from the customers' perspective while consuming the fewest resources and fully utilizing the knowledge and skills of the people performing the work.”⁹

In the years since the book *The Machine that Changed the World*¹⁰ chronicled the superiority of TPS and *Lean* production, many excellent books have been written about *Lean* management, including *Lean* tools, routine practices, principles, and philosophies, reflecting deeper levels of understanding. These principles are applicable across industries including healthcare organizations of all sizes.¹¹

Early research into *Lean* focused on the value stream and waste reduction. Jim Womack, founder of the Lean Enterprise Institute and Dan Jones, founder of the Lean Enterprise Academy (UK), discussed 5 principles of *Lean: Value, Value Stream, Flow, Pull and Perfection*.¹²

Value is defined as goods and services which the customer desires and is willing to pay for.

The *Value Stream* is the result of analyzing and sorting every action required to complete the product or service into three categories: (1) those that are value adding as perceived by the customer; (2) those that do not add value but are necessary; (3) those that do not add value and can be eliminated.

Immediately remove category 3 actions from the production process, and continually reevaluate category 2 as production techniques improve.

Flow results from focusing on the value stream and removing organizational barriers. Traditional production systems, which favor batch-and-queue processing and create departmental silos, can be eliminated.

Pull means producing only what was ordered, aligning all steps in the production line and supply chain to produce the right amount at the right time at every stage of the production process.

Perfection is the ultimate goal, pursued by repeating the cycle, reevaluating value from the customer's perspective, identifying and removing waste, and pursuing continuous improvement.

Professor Jeffrey Liker, in his international best-seller, *The Toyota Way: 14 Management Principles from the World's Greatest Manufacturer*, posited that the Toyota Way is a combination of 14 management principles and the TPS tool sets. The principles revolve around 4-Ps: *Philosophy, Processes, People, and Problem solving*.¹³

Philosophy. Make decisions based on long-term thinking, even at the expense of short-term losses.

Processes. Create a flow system that surfaces problems, stop to solve problems and ensure built-in quality, establish standard work and continuous improvement, level out the workload and use "pull" to avoid overproduction.

People. Challenge and develop people; grow leaders who understand and live the culture and teach others.

Problem Solving. Go to the source, seek the facts and thoroughly understand the situation; become a learning organization through reflection on problem solving and making continuous improvement.

Harvard professor Steven Spear, author of the Harvard Business Review article "*Fixing Health Care from the Inside, Today*"¹⁴ described the four rules that would guide organizations in their quest for operational excellence:

Rule 1: All work shall be highly specified as to content, sequence, timing and outcome.

Rule 2: Every customer-supplier connection must be direct, and there must be an unambiguous yes-or-no way to send requests and receive responses.

Rule 3: The pathway for every product and service must be simple and direct.

Rule 4: Any improvement must be made in accordance with the scientific method, under the guidance of a teacher, at the lowest possible level in the organization.

Some common themes emerged from these writings: eliminate waste by establishing *flow*, solve problems at the root-cause and develop people to sustain the continuous improvement efforts. Let's examine how these principles help healthcare managers achieve financial and operational excellence.

Lean Management in Healthcare

Lean has been around since the 1990s. A recent survey conducted among the most popular Medical Group Management Association (MGMA) community boards showed that 82% of respondents were personally familiar with *Lean* Management concepts, and 30% reported their organization has started on the *Lean* journey. Of those organizations which had embarked on the *Lean* Journey, 72% were in the early stage of their journey (less than 5 years), and 60% reported they had achieved anticipated results. (Please refer to appendixes A and B for survey questions and results.)

Any mention of applying a management system that grew out of manufacturing setting in healthcare will engender some vociferous opposition. General arguments from those who oppose the use of *Lean* in healthcare are: "We don't make widgets," and "People are not cars." Some even decry the application of *Lean* in healthcare as "cookbook medicine"¹⁵ or "Medical Taylorism."¹⁶

It is true that in healthcare physicians and nurses do not make widgets, and patients are not cars. But healthcare delivery is a process-rich operation and any process can be improved, whether it is in healthcare or manufacturing. John Toussaint, MD, former Chief Executive Officer (CEO) of ThedaCare, argues that the biggest healthcare problem is the lack of standardized processes in

healthcare delivery.¹⁷ A patient's journey through a healthcare organization may entail encounters with a number of different members of the healthcare team: a medical assistant, a nurse, a lab technician, a radiologist, a pharmacist, an attending physician and/or several specialists, all involved in their own set of activities, sometimes unbeknownst to other care team members. Lack of full communication, coordination, and delineation of responsibilities among health care professionals can have serious, even life-threatening consequences. In a MGMA 2015 Annual Conference keynote speech, Harvard professor and surgeon Atul Gawande recounted the case of patient "DS":¹⁸

"DS was involved in a car accident and was badly hurt, broken limbs, a fractured pelvis, collapsed lungs, and a ruptured, hemorrhaging spleen. At the hospital, healthcare professionals heroically jumped in action to fix things and removed the damaged spleen to save DS's life. After a 3-week stay at the Intensive Care Unit (ICU), DS pulled through and was well enough to go home."

Had the story ended there, DS's case would have been hailed as a testament to the marvel of our healthcare system. Unfortunately, the story did not end there:

"Two years later, during a beach vacation, DS came down with an ordinary strep infection, an infection that is normally cleared by his spleen. Because DS did not receive the three vaccines that would guard against streptococcus after his spleen was removed, his body was powerless to fight against the bacteria and developed sepsis. DS survived the ordeal, but lost all his fingers, toes and his nose."

"It's not clear where the breakdown was," Professor Gawande explained. "Some people thought the outpatient physicians would take care of it. Some people thought maybe the ICU would take care of it. The ICU thought maybe the surgeons would take care of it. But it didn't happen."

Unfortunately, the DS case is hardly an isolated incident in our modern healthcare system. In a system that is full of ambiguities and workarounds, cases like the one experienced by DS will continue to happen. Can *Lean* help improve on a care delivery operation that includes complex

activities and connections? The answer is an unequivocal “Yes.” Recall the four rules described by Professor Spear. Healthcare organizations can deliver operational excellence by practicing the four rules to transition from an environment full of ambiguities and workarounds to one that fosters problem solving by staff at all levels of the organization.¹⁴

It has been proven that *Lean* Management is applicable outside of manufacturing, such as in the service industry,¹⁹ the public sector²⁰ and healthcare.¹¹ Let’s examine how the *Lean* Management philosophy of value creation through eliminating waste, surfacing and solving problems, and developing people can enable practice managers to increase operational efficiency, improve quality and provide patient-centered care.

Improve Efficiency by Removing Waste

Inefficiency and waste are pervasive in our healthcare system. Approximately 30% of healthcare spending, about 750 billion dollars, are wasted annually on unnecessary or poorly delivered services and complicated administrative functions that added no value to improving patient health.⁴

Identifying the sources of waste is the first step to removing them. The 8 types of waste in manufacturing identified by Ohno also apply to healthcare:

Waste of Defects

Defective healthcare involves time and effort wasted in doing something incorrectly. Defects can range from a simple clerical error on a claim form that results in a denial of payment by the insurance company to a severe system mix up that causes surgery on the wrong site or even surgery on the wrong patient. All defects contribute to the increased cost of healthcare. For example, an estimated 200,000 Americans contract Central Line-Associated Bloodstream Infections (CLABIs) each year, with an associated cost of \$3,700 to \$29,000 per infection. By adopting the improvement system Perfecting Patient Care (PPC), modeled on Toyota’s problem solving processes, Allegheny General Hospital in Pittsburg reduced CLABIs from 49 cases to 6 cases within the first year.²¹

Waste of Overproduction

Overproduction in healthcare means doing more than what is needed by the patient. Overproduction in healthcare not only increases costs but may also harm patients. Examples of Overproduction in healthcare include duplicating lab and radiology tests, ordering unnecessary tests, and performing surgeries that have little or no value. Consider the case of a Utah resident, “MT”, whose neurosurgeon recommended surgery to fuse his spine to treat his chronic back pain stemming from a car accident twenty years earlier. Instead, MT flew to Virginia Mason Medical Center (VMMC) which was contracted with MT’s employer Walmart as a “center of excellence”. After reviewing MT’s entire medical history, VMMC recommended a nonsurgical approach that included spinal injection, medication for the neuropathic pain and continued back exercises. MT was pain free within a few weeks.²²

Waste of Waiting

In healthcare, when patients have to wait, treatment is delayed, resulting in suboptimal care; when physicians and nurses have to wait, time is wasted, reducing efficiency and operating capacity. Overcrowding in the emergency department (ED) has caused long wait time for patients;²³ to 2 year old baby girl “MJ”, an excessively long wait time in the ED meant delayed treatment that led to partial amputation of her four limbs due to a flesh eating bacteria infection.²⁴ Stanford Hospital and Clinic in California took action to reduce wait time in its ED. By reevaluating the entire ED value stream and redesigning flow, Stanford was able to cut its ED’s median door-to-doctor time from 45 minutes to 18 minutes, and the number of patients who left without being seen dropped from 2 percent to 0.65 percent.²⁵

Waste of Talent

Waste of talent in healthcare means not making efficient or effective use of staff knowledge, skills and professional training. Waste occurs whenever a physician stops to search for patient records, plays phone tag with insurance companies, or spends time to fill out forms that could be completed by

the administrative staff. A recent study showed that physicians spend 49 percent of their time on administrative work and only 27 percent of their time were actually spent on seeing patients.²⁶ A more pernicious form of waste of talent is not developing or engaging employee potential.

Waste of Transport

Waste of transport is excessive or unnecessary movement of patients or medical equipment and supplies. This might happen, for example, if the intake and recovery area is located too far from the operating room (OR), requiring staff to wheel patients a long distance into and out of the OR.

Waste of Inventory

Waste of inventory is having more material or supplies than necessary to do the work. Carrying excess inventory is wasteful since it requires capital, storage and transport, and is subject to spoilage due to expiration dates. Excess inventory could result, for instance, if nurses hoard supplies for fear of supplies running out or having great trouble locating them.

Seattle Children's Hospital staff analyzed their own historical supply usage data and developed their own two-bin *kanban* system (adapted from the TPS model); under their system, supplies were "pulled" by nurses when needed rather than "pushed" by their inventory management department. The system reduced nursing search and travel time by more than 50 percent.²⁷

Waste of Movement

Waste of movement refers to the unnecessary or excess motions and efforts employees have to exert to get the job done. For example, if medical supply items that are typically utilized together are located in different storage areas, staff may be required to travel considerable distances to restock them. A hospital in China, Guangdong Provincial Hospital of Traditional Chinese Medicine (GDHTCM), using the 5S method to streamline and rearrange herb cabinets, was able to reduce pharmacists' daily walking distance by three miles and cut down prescription fill time from 10 minutes to 5 minutes.²⁸

Waste of Excess-processing

Excess-processing in healthcare often involves healthcare information. Examples of excess-processing are making copies of the patient insurance card on each visit even though the patient's insurance company hasn't changed, printing lab reports even though they can be viewed on the EHR system, or an EHR system that requires providers to confirm female-patient pregnancy status each time when ordering separate X-Rays during the same encounter.

Improving Quality and Safety

“Fast, Good or Cheap, pick any two.” This mantra has been repeated many times in business schools and in the literature.²⁹ The basic premise is that producing quality products or services inherently requires extra cost or extra time. However, quality guru Dr. W. Edwards Deming asserted that “Poor quality means high costs.”³⁰ Nowhere is this message more applicable than in the healthcare setting. Examples of increased costs due to poor quality abound: Hospital acquired infections (HAI) contribute \$9.8 billion of extra costs annually;³¹ preventable hospital readmissions within 30 days of discharge cost Medicare \$17 billion per year; avoidable medical errors that cause patients harm cost \$17.1 billion annually.³² The hospital in the baby girl MJ's case paid \$10 million in a settlement with the family.³³ These are just the financial costs due to poor quality; the intangible costs of tarnished reputation, loss of patients' confidence and patients' suffering are incalculable.

Medical errors cannot be explained as the result of a few “bad apples” in the system. Avoidable errors are usually caused by bad processes or bad systems. Good people in a bad system will produce bad results.³⁴ Simply telling medical staff to try harder or to be more careful will not solve the central quality and safety issues. These issues can only be tackled by establishing good processes that encourage cohesive and collaborative team work, apply standard work and foster problem solving capabilities.

To improve quality and safety, healthcare professionals must break down their departmental silos and work collaboratively as a team to provide integrated care to patients. Standardized work in the form

of a checklist can also help professionals improve quality in healthcare settings. Checklists have long been recognized as a critical safety device in aviation; they can also work in healthcare to reduce surgical deaths, complications, infections and unplanned reoperations. In fact, checklists need not be forced upon frontline employees from upper management; research has shown that simply having frontline staff make their own checklists for daily work activities can improve the consistency of care to patients.³⁵

Improve Patient and Employee Satisfaction

A number of factors influence patients' satisfaction with their healthcare providers. Aside from clinical outcomes, patients' interactions with physicians, nurses, technicians, nurse aids and housekeepers, -- whether they were treated with courtesy, empathy, compassion, and dignity -- greatly influence their experience.

One of the two pillars of TPS is "Respect for People". "People" includes customers, employees, vendors and shareholders. It is important not only to respect the customers by providing them the value they desire, it is also important to respect employees by engaging them as valued participants in the mission to improve customer value. In healthcare currently, much emphasis is given to providing patient-centered care and improving the patient experience. Engaging and empowering employees is the best way for management to achieve these goals. Practice managers must change from being problem-solvers to becoming teachers and mentors, encouraging and developing their employees to discover solutions to problems.

While caring for others, healthcare professionals must care for themselves as well. Physician burnout is a growing concern in healthcare. Factors contributing to physician burnout include misalignment between physician expectations and those of the organization in areas such as degree of autonomy and workload. A positive and supportive culture can prevent and eliminate physician burnout.

Healthcare leaders can create such a culture through *kaizen* events, engaging a multidisciplinary team

of employees in all levels of the service line, including physicians, to redesign their own work and improve quality, safety, and financial performance, through value stream mapping (VSM), removing waste of excess-processing, waste of movement, and waste of waiting to increase operational efficiency and reduce physician workload.

Lean Implementation Challenges and Pitfalls

It has been demonstrated that *Lean* management principles can be successfully applied in healthcare settings to improve the quality and safety of healthcare delivery, reduce overall healthcare costs and improve patient experience.¹¹ However, not every *Lean* implementation is a success.³⁶⁻³⁸ When *Lean* implementation fails to generate intended effects, in *Lean* terms, a defect is being produced and someone must pull the *andon* cord, conduct a root cause analysis and put in countermeasures that will bring the organization back on course in their *Lean* journey. Understanding the problem is the first step to solving the problem, so it is instructive to analyze failed *Lean* implementation cases and learn what caused these failures. Many factors may contribute to limit *Lean*'s effectiveness or even doom the effort altogether; chief among them are: lacking upper management support, narrow focus on cost reduction, and lacking an improvement culture.

Lacking Management Support

Lean is not a quality improvement program or an initiative; it is an operating system, a foundation upon which every activity of an organization is built. When *Lean* is brought in as an improvement project or an add-on to the organization's existing improvement programs, it will be treated as another management "fad of the month" by people in all levels of the organization. In the healthcare environment, improvement activities are often inter-departmental. For example, improvement efforts to reduce ED overcrowding might require a workflow change in in-patient service, patient discharge procedures, and even housekeeping. Without a coalition of management support, change is difficult to achieve, and any small improvements made along the way are often unsustainable.³⁹ Successful *Lean*

transformation must be a top-down and bottom-up effort throughout the organization.⁴⁰ Management commitment and support for *Lean* efforts must be active and visible. An important element of *Lean* success is that all executives, including the CEO, practice the “gemba walk”, which is “go and see, ask questions and show respect”, in order to understand operations at the frontline. Virginia Mason Medical Center requires its leadership to undergo formal training in their *Lean* management system, which they have named the Virginia Mason Production System (VMPS). All organization leaders are expected to apply what they’ve learned, coach others and support their teams as part of their daily management routine.⁴¹

Lean management principles also require leaders to change from being problem solvers to become teachers and coaches. This is a paradigm shift for those leaders who attained their current positions by demonstrating their personal resourcefulness and by solving problems along the way. In a *Lean* culture, a leader’s effectiveness is judged by how well he coaches his team members to solve problems, to learn from their own problem solving activities and to become coaches themselves. Therefore, management must take a long-term view to evaluate *Lean* effectiveness in their organization; a myopic focus on the financial benefits of *Lean* efforts based on short-term return-on-investment analysis will necessarily ignore the potentials of a well trained workforce and doom the transformation effort.⁴²

Narrow Focus on Cost Reduction

“Lean and mean,” a negative connotation that is often associated with *Lean* efforts, adds to the myth that *Lean* is solely an efficiency program. Many *Lean* efforts failed precisely because management mistakenly thought *Lean* was a set of cost cutting tools to increase efficiency. Stories abound of *Lean* consultants descending onto the nursing area unannounced with stopwatches and clipboards in hand to measure how nurses spent every second of their time;⁴³ management cutting staff to dangerous levels, and then telling them they were empowered to make improvements. This is not empowerment, it is abandonment.

Doctors and nurses chose their careers to help the poor and care for the sick. The goal of cost cutting does not resonate with healthcare professionals. Efficiency can be achieved only through iterative and small incremental improvement efforts from frontline healthcare professionals. Any effort to cut costs by promulgating a set of standard procedures conceived by some “efficiency experts” will backfire.¹⁶

A central tenet of *Lean* is waste removal through continuous improvement efforts by the frontline staff. If frontline staff perceive that management is only interested in cost reduction and profit maximization, improvement ideas from employees will dry up for fear of improving themselves out of their jobs, and the *Lean* effort will stall. It is paramount that organizations clearly communicate to employees that improved efficiency will not cost them their jobs. It is management’s responsibility to grow the business so that excess capacity can be absorbed.

Lacking an Improvement Culture

Many organizations adopted elements of *Lean* by using value stream mapping (VSM) to increase efficiency and reduce costs, and using standardization as a backstop to prevent improvement efforts from backsliding. These organizations may have achieved isolated success in their improvement efforts, but they found *Lean* transformation too arduous to implement throughout their organization, and they ultimately scaled back or even abandoned their *Lean* efforts. Standardization should not be used as a control mechanism to ensure employee compliance; rather, it is a baseline for ongoing improvements. Simply duplicating *Lean* tools in one’s own organization does not automatically establish the continuous improvement culture, and the organization might even become rigid and stagnant. To achieve lasting success in a *Lean* transformation, a practice manager must create a positive and supportive organizational culture that motivates team members to solve problems, help each other and continuously improve.⁴⁴

By meeting challenges and avoiding common *Lean* implementation pitfalls, organizations on their *Lean* journey are well positioned to transform the healthcare industry with dramatic results.

Lean Transformation Case Studies

Change is never easy; culture change is even harder. To sustain a *Lean* journey, a continuous improvement mindset must be deeply embedded in an organization's culture. Pioneers such as Virginia Mason Medical Center (VMMC) and ThedaCare are transforming healthcare everyday through the consistent practice of their *Lean* systems.

Virginia Mason Medical Center ^{11,45}

Virginia Mason Medical Center (VMMC) is an integrated health care system based in Seattle that serves the Pacific Northwest. VMMC includes a 336-bed hospital, nine locations, 470 physicians and 5,000 employees. When Dr. Gary S. Kaplan took over as Chief Executive Officer (CEO) of VMMC in 2000, the institution was facing challenging economic times. The institution had suffered financial losses in the previous two years for the first time in its history, threatening the institution's long term survival. "We change or we die" declared the new CEO during a board meeting. The board of directors decided a new strategic planning process was necessary. While developing the strategy, the question "Who is your customer?" revealed that the system had been built around doctors, nurses and managers, but not the patients. The board developed a new strategic plan that put patients on top supported by four pillars: people, quality, service and innovation. Then they created "compacts" for leaders, the board of directors, and physicians that specifically spelled out expectations and responsibilities for each.

In 2002, the entire VMMC executive team flew to Japan to observe how *Lean* management really worked, and each team member worked on a production line in the Hitachi Air Conditioning plant to experience *Lean* in action. Upon their return to the U.S., the executive team committed to a new management system called the Virginia Mason Production System (VMPS), modeled from the Toyota Production System, focusing on six areas in pursuit of the "Perfect Patient Experience":

1. Adopting "Patient First" – the patient's needs drive all processes.

2. Creating an environment for continuous improvement, with the pledge of “No-Layoff” due to improved efficiency.
3. Implementing the Patient Safety Alert (PSA) system, modeled from the *andon* cord, to drive down defects.
4. Engaging all employees in Rapid Process Improvement Workshops (RPIW) to solve problems.
5. Achieving operational efficiency and financial stability through eliminating waste.
6. Transforming Leaders into teachers and coaches.

VMMC’s *Lean* journey was not without challenges. The challenge of redesigning the spine clinic tested VMMC’s commitment to the pursuit of the “Perfect Patient Experience”.

VMMC team members drew a detailed value stream map revealing what happened to typical back pain patients. It showed patients had to wait weeks for an appointment with a physician, would then undergo an MRI, then face another wait for MRI results, followed by more waiting to see the physical therapist. Since over 80% of the back pain cases were uncomplicated, an expensive MRI scan with healthy margins to VMMC contributed little or no value to most patients. The whole value stream showed that 90 percent of the healthcare team’s work added no value to the patient. This might have been fine in the old days, but it was not acceptable under VMMC’s new management philosophy. Applying VMPS, the VMMC team set up a new spine clinic offering same day service. A patient with back pain would be seen first by a physical therapist for initial workup and evaluation; a physician would then join the discussion to differentiate between the complicated cases and cases of common back pain. Patients with uncomplicated back pain got physical therapy immediately; patients with complicated back pain would undergo further testing. This new process provided patients with timely treatment, greatly improved patient satisfaction, and reduced overall health care costs. Better, faster, and more affordable healthcare was made possible by applying VMPS. Although VMMC did suffer initial revenue losses due to reduced MRI volume, the success of the new spine clinic attracted large

employers such as Starbucks, Walmart and Lowe's to recognize VMMC as a provider of choice, and volume was doubled in one year. Patient MT, the Walmart employee who suffered from chronic back pain (described earlier), was one of the beneficiaries of the new spine clinic.

VMMC's success in applying VMPS did not go unnoticed. In 2006, Dr. Gary Kaplan was invited by the Northeast region of Britain's National Health Service (NHS) to share VMMC's experience. In 2009, an eight-person team from a leading hospital in Japan flew to VMMC to observe VMPS in action.

In 2008, the Virginal Mason Institute was founded not only to provide continual training to employees, but to also spread their knowledge throughout the industry.

The adoption of VMPS has led to industry-wide recognition of VMMC's accomplishments:

- VMMC Named Top Hospital of the Decade by Leapfrog Group
- VMMC Named One of America's 50 Best Hospitals by Healthgrades
- Dr. Gary Kaplan named recipient of the Harry J. Harwick Lifetime Achievement Award by Medical Group Management Association

By 2013 VMMC had achieved significant results by consistently applying VMPS:⁴⁶

- Over 40,000 Patient Safety Alerts reported
- 74% reduction in Liability Premium from 2004
- Registered nurse available for direct patient care 90% of the time
- Surgery center throughput increased 60% without facility expansion

[ThedaCare](#)^{11,47}

ThedaCare, Inc. is a healthcare delivery system based in northeast Wisconsin, with seven hospitals, 35 clinics, and 6,800 employees, and is a member of the Mayo Clinic Care Network. In 2000, ThedaCare was already recognized for delivering quality healthcare; the National Committee for

Quality Assurance (NCQA), which accredits healthcare and health plan providers in the US, ranked the ThedaCare health maintenance organization as best in the nation based on their Health Effectiveness Data Information Sets (HEDIS) scores. However, the leadership at ThedaCare was not satisfied with doing well “comparatively.” After years of efforts to improve clinical performance without a systematic method, ThedaCare CEO Dr. John Toussaint determined that the organization needed a structured improvement system. The ThedaCare leadership team commenced a search for a system that they could fully embrace, and they found it in a most unlikely setting – the shop floor of an Ariens Inc. snow blower factory in Wisconsin. Ariens, Inc. had gone through a successful *Lean* transformation just a few years earlier. After a few visits, ThedaCare leaders were so impressed by the factory’s workflow and their employee engagement that they decided that *Lean* would be the management system to guide ThedaCare’s continuous improvement efforts – the ThedaCare Improvement System (TIS).

ThedaCare established a “True North”⁴⁷ - a set of metrics around patient satisfaction, patient safety, employee engagement, productivity and financial stewardship- that guided every *kaizen* event.

ThedaCare leadership recognized that much of the waste within an organization was due to unresolved root causes of problems. The same problems kept recurring, requiring staff to spend time “putting out fires,” or creating temporary fixes and workarounds. ThedaCare engaged employees by adopting the “Model Cell” approach (also known as “inch wide and mile deep”⁴⁸) in which members from cross-functional areas came together to form a team working on a specific problem; the team would analyze the root cause, using the Plan-Do-Study-Act (PDSA) scientific method to solve the problem. Learning and knowledge gained from the model cell was then shared throughout the organization, creating momentum for further improvement activities in other areas. In 2008, the ThedaCare Board created a nonprofit organization called ThedaCare Center for Healthcare Value (recently renamed Catalysis) to spread the word about *Lean* healthcare and to provide resources for other hospitals who were struggling to remove waste and improve quality at their organizations.

Results of TIS by 2011⁴⁹

- Achieved bottom-line savings of \$25 million by 2009 with no-layoff philosophy intact.
- Improvement on bedside care and medication reconciliation resulted in reduction from 1.25 defects to zero defect per chart, reduction in length-of-stay by 16.4%, and reduction of cost per case by 22%.
- Improvement work on Code ST-segment Elevation Myocardial Infarction (STEMI) cut the average time to intervention from 91 minutes to 40 minutes, while the industry standard was 120 minutes and benchmark was 90 minutes.
- Improvement work on the coronary bypass grafting process reduced mortality rates from 2% to zero, and reduced length-of-stay by 21%.
- Improvement work on radiation oncology increased productivity by 30% and increased gross revenue by 24%.

Conclusion

The current healthcare environment poses many challenges to practice managers. Change is inevitable. Those who choose to continue conducting business as usual will be left behind. However, change is never easy; it is even more difficult in a healthcare delivery setting characterized by departmental silos and individual heroics. Many *Lean* implementations started out strong, but then gradually lost steam and finally faded away after a few years. To sustain the *Lean* transformation effort, organizations must have consistent senior management support, avoid using *Lean* solely as a cost cutting tool, develop people into problem solvers, and become a learning organization.

Organizational culture change takes time to achieve and great effort to sustain. Katsuaki Watanabe, former CEO of Toyota Motor Company, once said in an interview with Harvard Business Review, “When 70 years of very small improvements accumulate, they become a revolution.”⁵⁰

Lean is not a quick fix; *Lean* is not a toolkit or an improvement project. *Lean* must be deeply embedded in a culture that embraces organizational learning, continuous improvement and “respect for people”. Among health care providers, trailblazers such as Virginia Mason Medical Center and ThedaCare have been consistently and deliberately practicing *Lean* thinking in their daily management and operations since 2002. Today, 16 years later, they have achieved amazing results, proving that *Lean* thinking is applicable in health care. Healthcare managers who aspiring to emulate the success of VMMC and ThedaCare will encounter many obstacles and challenges in their *Lean* journeys. However, by making small improvement after small improvement, solving one problem after another, conducting *kaizen* events, and developing staff members to become coaches, these managers are gradually and steadily transforming their practice groups to meet new challenges.

Appendix A

MGMA-ACMPE Fellowship Paper Survey

Lean is a set of management principles derived from the Toyota Production System (TPS). Lean is best known for some of its tools such as Value Stream Mapping (VSM), Kaizen Events, A3 Analysis...

1) Are you familiar with Lean management principles?

- a) Yes
- b) No

2) Has your organization started on the Lean journey?

- a) Yes
- b) No

IF Yes:

3) The level at which Lean is applied at your organization:

- a) Individual initiatives, using Lean tools
- b) At a departmental level, using Lean as projects
- c) As a business strategy, upper management is visibly involved

4) What metrics are tracked to evaluate Lean's effectiveness in your organization?

- a) Productivity/Service Capacity
- b) Quality/Safety
- c) Efficiency/Financial
- d) All of the above

5) How long has your organization been on the Lean journey?

- a) Less than 5 years
- b) 5 – 10 years
- c) 10 – 15 years
- d) Over 15 years

6) Has your organization achieved its anticipated results?

- a) Yes
- b) No

7) Based on your organization's Lean implementation experience, you agree with which of the following statements:

- a) Lean is not applicable in Healthcare, because people are not cars.
 - b) Lean provides some useful tools in some healthcare settings
 - c) Lean is part of our organizational culture.
 - d) None of the above. (Your own assessment below)
-

8) What is the size of your organization?

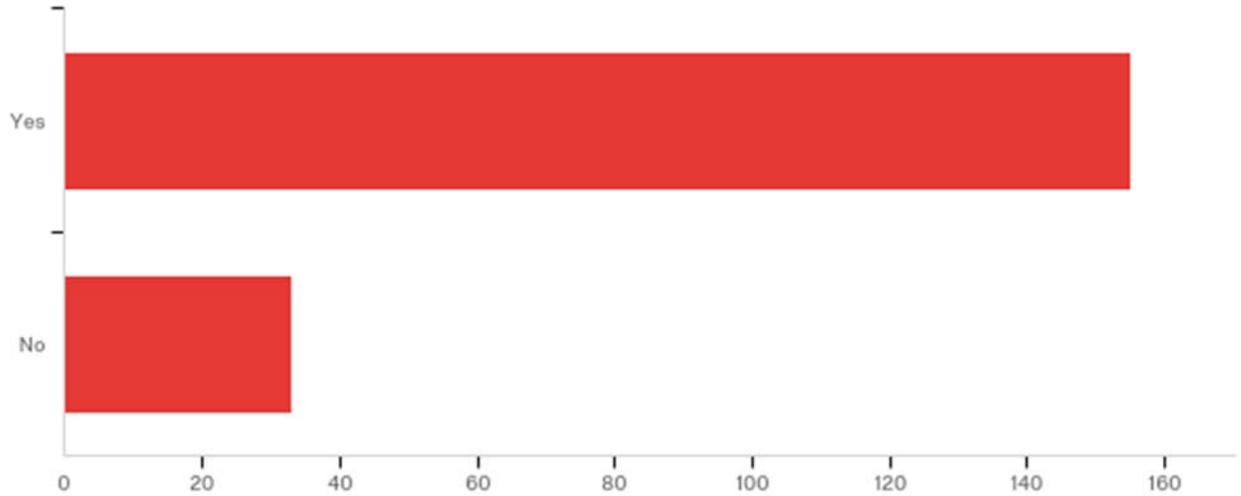
- a) Individual provider practice
- b) Provider group practice
- c) Hospital
- d) Healthcare system

Survey Report

ACMPE Fellowship Professional Paper Survey - Lean Management

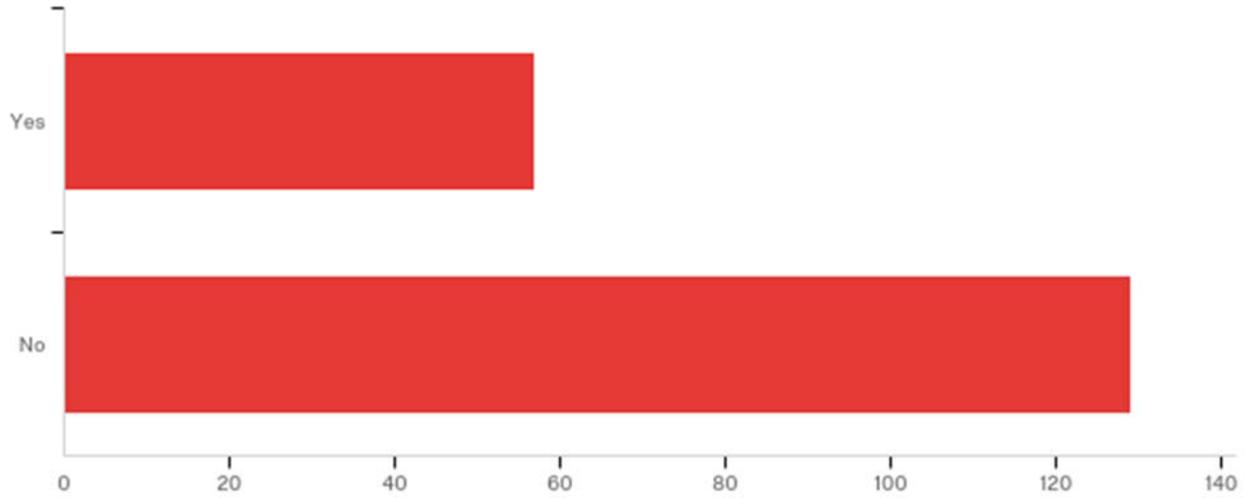
January 10th 2018, 7:02 am MST

Q1 - Are you familiar with Lean management principles?



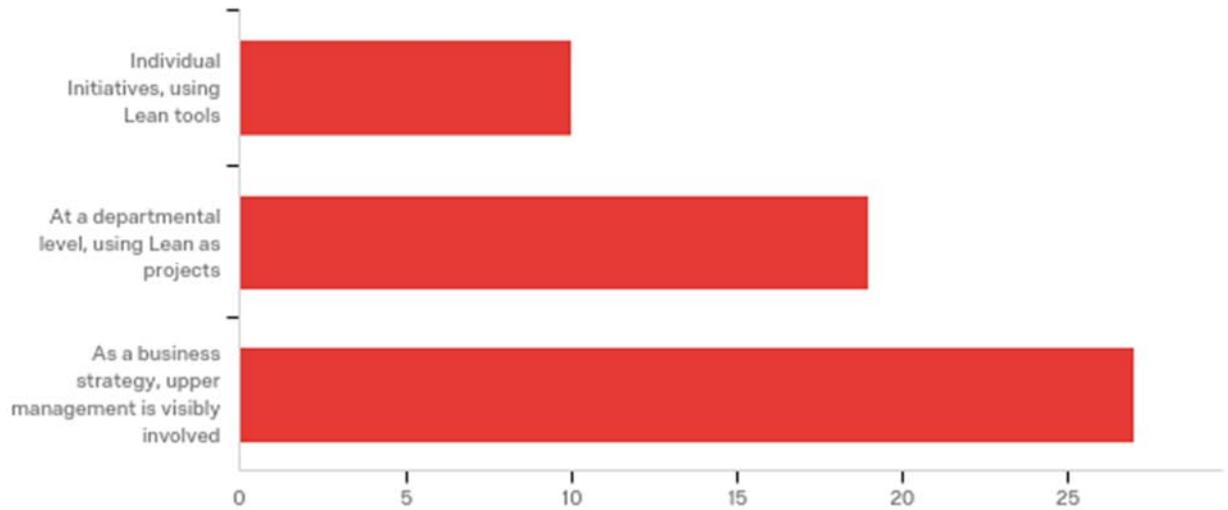
#	Answer	%	Count
1	Yes	82.45%	155
2	No	17.55%	33
	Total	100%	188

Q2 - Has your organization started on the Lean journey?



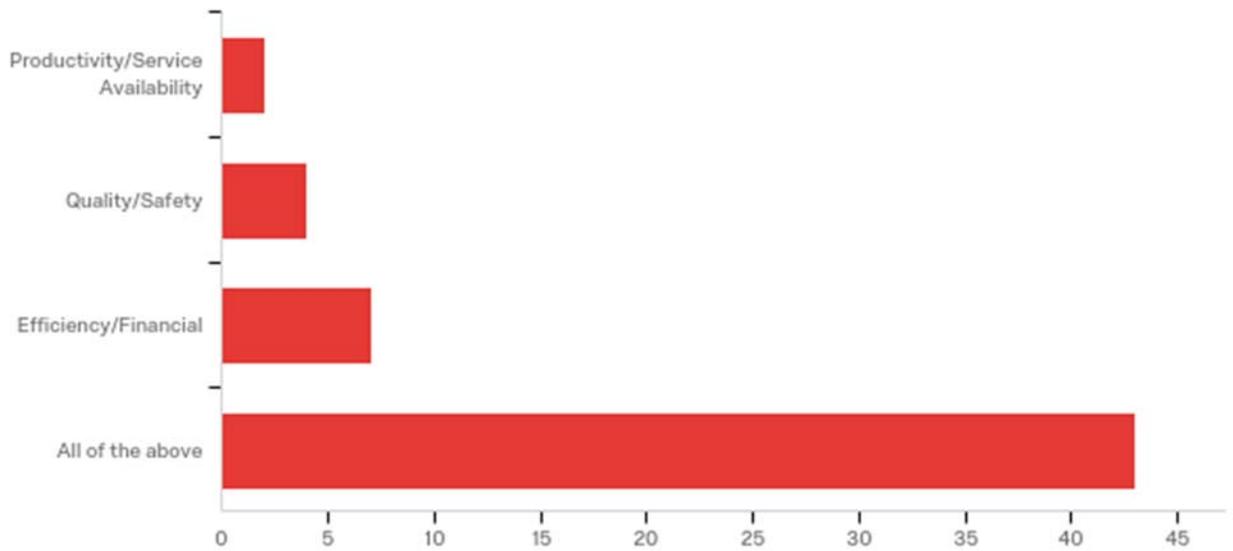
#	Answer	%	Count
1	Yes	30.65%	57
2	No	69.35%	129
	Total	100%	186

Q3 - The level at which Lean is applied at your organization:



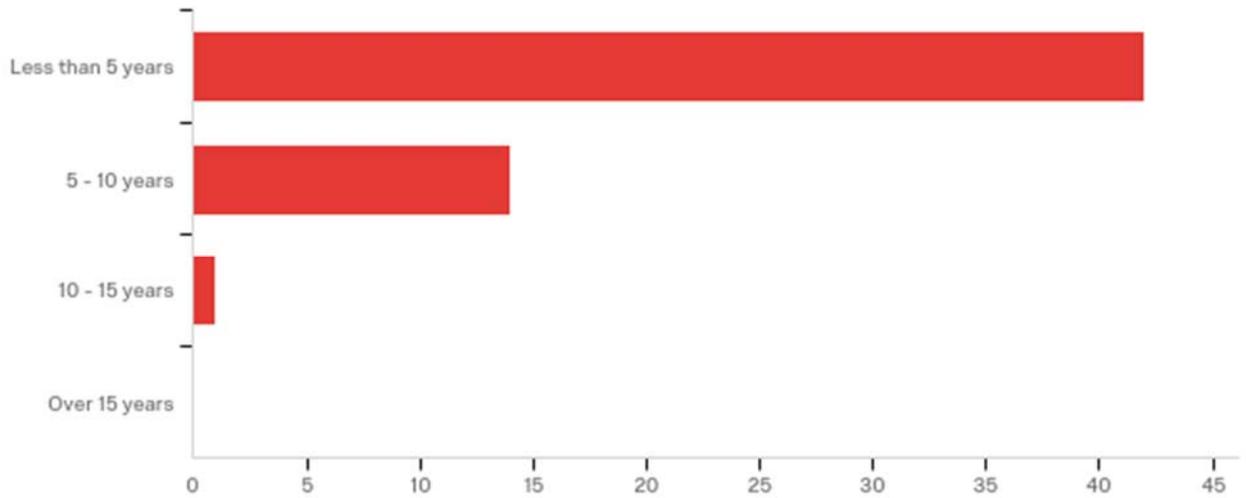
#	Answer	%	Count
1	Individual Initiatives, using Lean tools	17.86%	10
2	At a departmental level, using Lean as projects	33.93%	19
3	As a business strategy, upper management is visibly involved	48.21%	27
	Total	100%	56

Q4 - What metrics are tracked to evaluate Lean’s effectiveness in your organization?



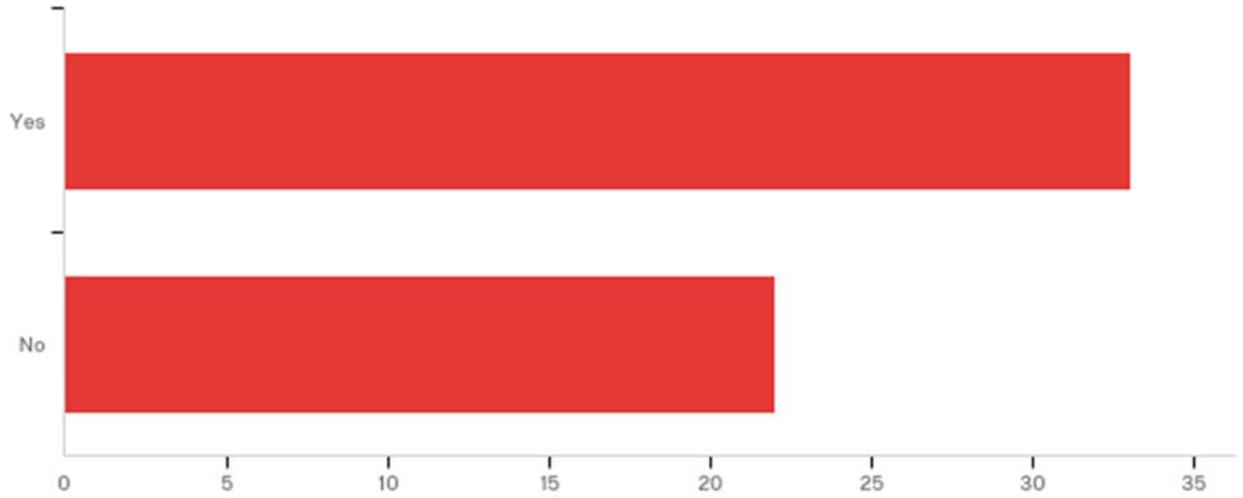
#	Answer	%	Count
1	Productivity/Service Availability	3.57%	2
2	Quality/Safety	7.14%	4
3	Efficiency/Financial	12.50%	7
4	All of the above	76.79%	43
	Total	100%	56

Q5 - How long has your organization been on the Lean journey?



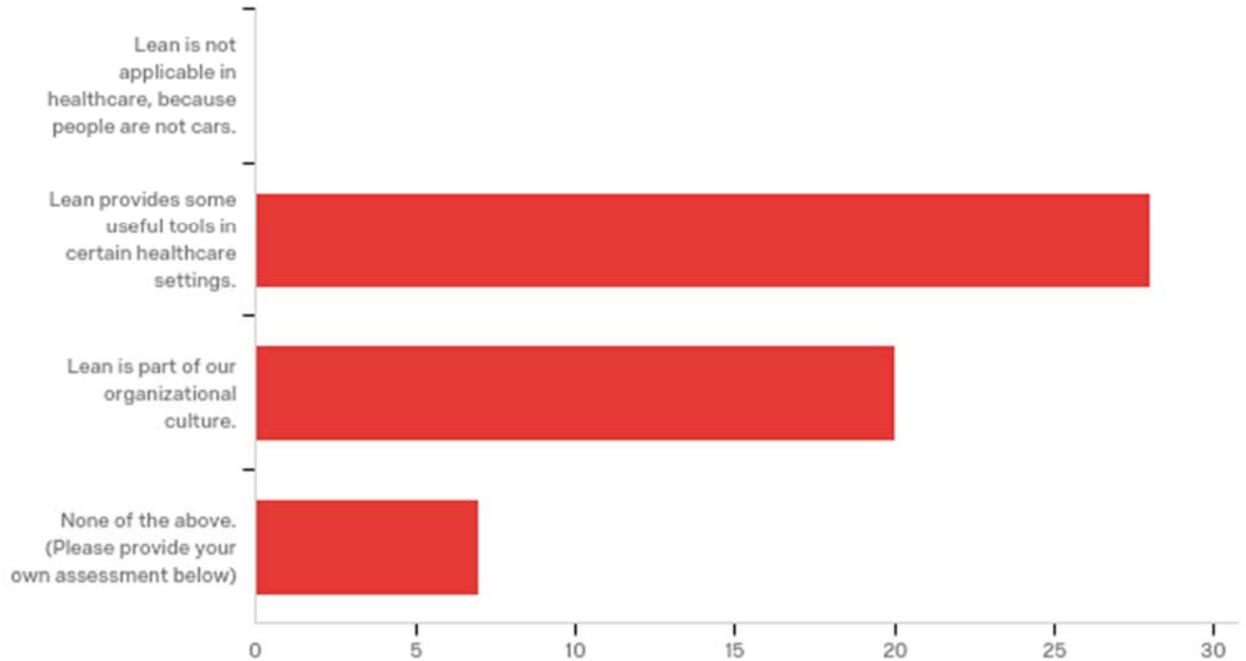
#	Answer	%	Count
1	Less than 5 years	73.68%	42
2	5 - 10 years	24.56%	14
3	10 - 15 years	1.75%	1
4	Over 15 years	0.00%	0
	Total	100%	57

Q6 - Has your organization achieved its anticipated results?



#	Answer	%	Count
1	Yes	60.00%	33
2	No	40.00%	22
	Total	100%	55

Q7 - Based on your organization’s Lean implementation experience, which of the following do you agree with?



#	Answer	%	Count
1	Lean is not applicable in healthcare, because people are not cars.	0.00%	0
2	Lean provides some useful tools in certain healthcare settings.	50.91%	28
3	Lean is part of our organizational culture.	36.36%	20
4	None of the above. (Please provide your own assessment below)	12.73%	7
	Total	100%	55

Q7_4_TEXT - None of the above. (Please provide your own assessment below)

None of the above. (Please provide your own assessment below) - Text

Lean study and exams/proficiency tests are encouraged and often in our girls. There are three levels of organization exams to take. We have done several projects to achieve higher goals relative to efficiency

It takes time, energy, consistency and accountability standards to develop a LEAN culture. We have had some success but we are not yet adept at using LEAN in all areas.

LEAN is becoming part of our organizational culture.

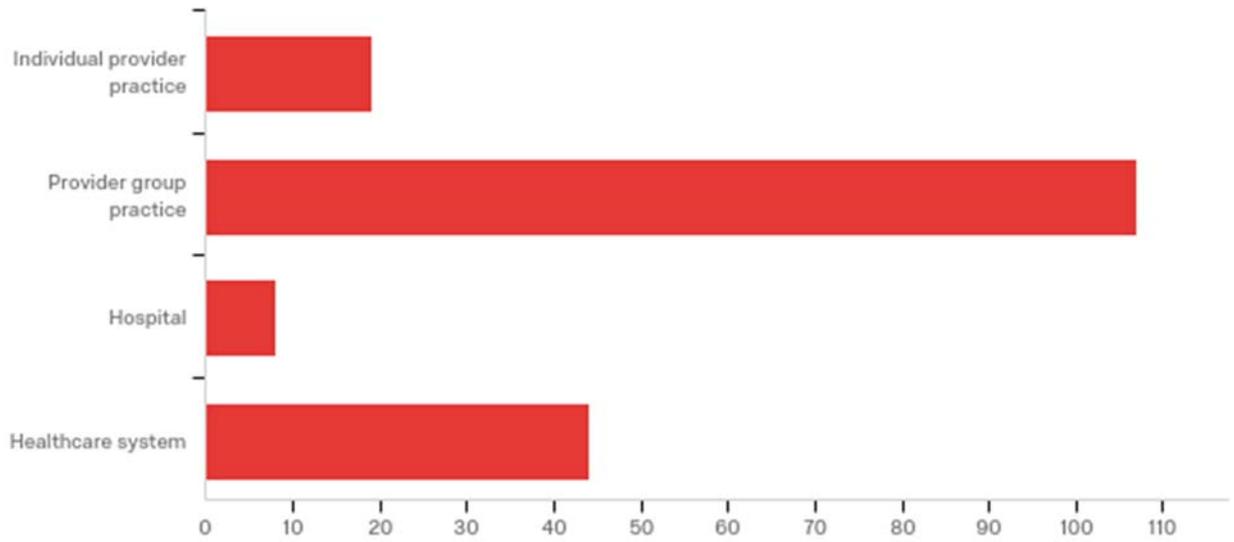
We had to streamline our practice protocols when we implemented EHR. We had to become highly efficient when ObamaCare became a reality and reimbursements fell and deductibles rose. It has been more challenging in the past 5 years than any other time in my 26 years as an office manager.

Lean is part of the org culture but there are so many people still being trained, it has not been rolled out everywhere.

Lean is applicable in healthcare. Efficiencies are created.

Not everyone agrees with this statement, but I believe that will change with time.

Q8 - What is the size of your organization?



#	Answer	%	Count
1	Individual provider practice	10.67%	19
2	Provider group practice	60.11%	107
3	Hospital	4.49%	8
4	Healthcare system	24.72%	44
	Total	100%	178

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