



How Toyota Can Save
Your Life... *at the hospital*
By Mark Graban



“The mother of four had gone in for a procedure on a brain aneurysm. But afterward, instead of injecting her with a harmless marker dye, a toxic cleansing solution—chlorohexidine—was injected into her bloodstream. The solutions were both unlabeled and looked the same.” –Seattle, WA

“At the newborn intensive care unit of Methodist Hospital, the staff is blaming the newborn deaths on human error. Somehow the wrong dose of a blood-thinner medication, Heparin, was stocked in a hospital drug cabinet.” –Indianapolis, IN

Mothers killed...babies killed...in the hospital. The place that is supposed to save lives often brings premature death. You have probably read about or seen TV news reports about medical mistakes before. Commonplace 2006 headlines include:

[“Doctors Remove Healthy Kidney from Cancer Patient”](#)

[“Medical Mistake May Have Killed Man”](#)

[“Woman Dies after Medical Mistake at CTSC”](#)

[“Parents Asking Hospital for Answers in Death of Infant”](#)

[“State Confirms Medical Error In Hospital Death of Teen”](#)

The Center for Disease Control estimated, in 1998, that 90,000 are killed and 2,000,000 are injured each year by hospital-caused drug errors and infections. The Institute of Medicine estimated, in 1999, that as many as 98,000 die each year due to preventable medical errors. A 2004 survey by the HealthGrades organization placed the number at 195,000 a year for 2000, 2001, and 2002.

The sheer numbers are appalling. To put medical deaths in perspective, there were almost 17,000 deaths attributed to drunk driving in 2004. Yet we don't have the same public outcry about the deaths caused by hospitals. Anyone care to start Daughters Against Medical Mistakes? Why are we not as outraged about 100,000 deaths in hospitals?

These aren't stories of mysterious diseases that weren't diagnosed, ala the TV show, *House*. These are all 100% absolutely avoidable deaths. The story portrayed in the media usually says that each of these tragic mistakes is somebody's fault.

What we hear in the media are isolated, and sometimes sensationalized, stories of individuals who screw up. What we don't hear about is the systemic nature of these injuries and deaths. It's comforting, in a way, to think that each of these incidents are the result of a "bad nurse" or a careless person. In reality, each of these deaths and medical mistakes is a systemic failure. These were problems that could have occurred, or were bound to occur, anywhere—any given patient, any given caregiver. The idea that medical mistakes, as with plane crashes, are basically random events is very scary.

The closest parallel to medical mistakes is in aviation safety. While news accounts of crashes and near misses are usually blamed on individuals, aviation safety is addressed through many systemic fixes. New technologies are put in place (runway radar systems) so that we don't have to rely on individuals being careful 100% of the time. We put systems in place to prevent accidents, rather than just blaming people after the fact. Pilots are highly skilled, highly trained, and very specialized professionals with a lot of responsibility (as are doctors), yet pilots routinely go through standard pre-flight checklists to make sure nothing is forgotten, regardless of how many thousands of times they've taken off before.

We don't have the same level of standardization and routine in our Operating Rooms or with surgeons. Surgeons are allowed, in many instances, to do things as they please, which opens the door for mistakes or accidents. While the medical world has governing bodies that can make recommendations, we don't have a medical equivalent of the National Transportation Safety Board that would investigate medical mistakes with an eye toward sharing best practices, instituting new practices, with the aim of preventing future mishaps.

It's easy to agree that medical mistakes are a problem that needs solving. What we're hearing far too little about in the media is the solution. So what does Toyota have to do with anything? The solution for healthcare has nothing to do with hybrid ambulances. The solution comes from what would seem like an unlikely source: the management practices and the methods used by Toyota Motor Corporation.

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WHY TOYOTA DOMINATES THE AUTO INDUSTRY

For those unfamiliar with Toyota, the company, you have to look beyond the popular Prius hybrid and the high-tech robotic factories. The Toyota story is not about technology, rather it is about a set of practices called the Toyota Production System and a management system called 'The Toyota Way'. Toyota used its methods, often called "Lean Manufacturing" to propel itself very gradually from post-war ruins to its current position, poised to surpass General Motors as the top automaker in the world in terms of production volume. Toyota surpassed General Motors in quality and reputation many years ago.

Most organizations say their employees are their most important asset. Toyota actually embraces that.

From the 1980's on, American and global corporations, mostly manufacturing firms, have emulated and copied Toyota's practices. In a time when manufacturing is considered to be a dying industry in the United States, many companies are using 'Lean' to compete effectively in spite of high labor costs compared to "low cost countries" such as China or Mexico. Most successful, among these companies, is Toyota itself. In a time where other companies are rushing to import parts built by cheap Chinese labor, Toyota is building factories in the U.S. and Canada at a rapid pace, showing that lean methods and being close to your customer are effective competitive weapons against cheap labor.

Rather than firing employees for being “too costly,” Toyota invests in its people and has avoided layoffs for over 50 years, in Japan and around the world. Most organizations say their employees are their most important asset. Toyota actually embraces that. At the core of this is the practice of “kaizen,” or continuous improvement.

Toyota’s employees aren’t robots who do what they are told to do by management. It is their job to not only do the work, but to also improve the way their work is done, in small ways each and every day. The involvement and engagement of employees, at all levels, is the way Toyota builds quality vehicles and continually keeps ahead of their rivals. It’s Toyota’s people and management system that make the difference, not having better or more robots than General Motors.

It was GM, ironically enough, and its “Roger and Me” CEO, Roger Smith, who had the vision of the completely robotic “lights out factory.” This was a pipedream that wasted billions of dollars. It was a dream that distracted GM from improving the people side of its management system. Unfortunately, most hospitals are following GM’s path, being seduced by the “siren song” of technology of automation. These “solutions” include automated carts to carry drugs and supplies through the hospital—an expensive and breakdown-prone solution compared to a relatively inexpensive employee who can, unlike a robot, help improve the process.

As the world learned more about Toyota’s management system, they started to understand that, by using Lean methods of “building quality into” the product, quality indeed could be “free.”

Before the publication of the seminal book, *The Machine That Changed the World*, in 1990, the conventional wisdom among many (particular the excuse-making “Big 3” automakers) was that Toyota and the Japanese had to be “dumping” products in an act of unfair competition with the Big 3. Traditional mass production mindsets insisted that higher quality must inherently cost more to produce. Therefore, Toyota must have been illegally selling products at a below-cost price. The Big 3 just couldn’t understand.

In the healthcare world, we are still equating cost and quality, assuming that there must be a positive correlation between the two.

“Mass producers,” (as opposed to “lean producers”) such as the Big 3, relied on “quality control” departments and armies of inspectors to ensure product quality. The GM assembly plant in Detroit was notorious for its vehicles (high-priced Cadillacs!) going to one of two places at the end of the assembly line: “minor repair” or “major repair” ([per a story told by Jim Womack](#)). As Americans and the world learned more about Toyota’s management system, they started to understand that by using Lean methods of “building quality into” the product quality indeed could be “free” (ala the title of Phillip Crosby’s *Quality is Free*).

In the healthcare world, we are still equating cost and quality, assuming that there must be a positive correlation between the two. News reports proclaim breathlessly that, while American healthcare spending is the highest in the world, per capita, that Americans do not enjoy the longest life spans. Spending money hasn’t worked so far. While the United States far outspends other countries (\$4500

per capita, while Switzerland is a distant second at about \$3000 per capita), our life expectancy trails Japan (which spends about \$2000 per capita), Switzerland, and other countries including Canada, France, Luxembourg, and even Malta.

Spending more, whether it's in manufacturing, education, or healthcare does not necessarily lead to higher quality or better results. Over the past five years, American healthcare spending has increased by an average of 9% per year (and some estimates place this number higher). A 1996 Toyota Camry, base model, had a sticker price of \$17,008. A 2006 Camry, LE model, had a sticker price of \$20,375. As with healthcare, we are getting more features and better technology in the 2006 Camry. If Toyota was increasing prices at the same rate as healthcare, a new Camry would cost \$36,939 (the price of a Lexus!!). Toyota, through lean manufacturing, has managed to improve quality and add features without huge price increases. Why can't we expect the same level of improvement and cost containment in the healthcare world?

WHY TRADITIONAL HOSPITAL COST CUTTING DOESN'T WORK

Looking at hospitals, a “lean” view of containing costs has nothing to do with withholding care, reducing services, or laying off employees. Without Lean Thinking, these are precisely the methods that hospitals are using today. Hospitals are closing, services are being cut, and employees are being laid off, but our costs are still rising and quality is not improving fast enough. In my role as a consultant, I have worked with a hospital laboratory department that had suffered through two rounds of layoffs in an effort to contain costs. Their previous consultants came armed with benchmarking data and computers, plotting their layoffs from a distant boardroom. Employees were cut without giving any thought about maintaining quality or avoiding an increasingly stressful workplace that remaining employees might run away from.

Hospitals have to find new ways of cutting costs other than firing employees. Being short-staffed means that hospitals have to close down beds (reducing the amount of care they can provide to the community). Stressed out and overworked employees are naturally more likely to make mistakes or to leave their medical field, exacerbating the employee shortages and the overwork. The healthcare world needs to see that the best way of reducing costs is to improve quality and to prevent patient injury and patient deaths.

Traditional cost cutting doesn't work. Likewise, throwing money at the problem isn't likely to help. I recently listened to an audio session run by the Institute for Healthcare Improvement called "Hospital Emergency Care—The Breaking Point." The session recommended seven initiatives for improving emergency medicine. Six of the seven recommendations called for spending more money, money that can't be counted on when healthcare spending is already at a breaking point of its own.

The seventh recommended initiative called for process improvements and lean initiatives. That's the power of the lean methodology—the ability to improve service and quality, while simultaneously reducing costs and not requiring additional spending.

APPLYING LEAN AND TOYOTA METHODS TO HEALTHCARE

So healthcare is too expensive, costs are rising, life expectancies trail other countries, and people are getting hurt and killed by medical errors. Not real encouraging. The good news is that the proven lean methodology of the Toyota Production System is successfully being applied at hospitals across North America and around the world. Some leading examples to search for include Virginia Mason Medical Center, in Seattle, and ThedaCare, a health system based in Wisconsin.

What are some of the common themes across these “lean healthcare” initiatives?

- Reducing Waste
- Standard Work
- Error Proofing

Waste

One of the two pillars of the Toyota Production System is the idea of continuous improvement through the elimination of waste. Waste is defined in the lean world as any activity that does not provide value to the customer or activities that are not done right the first time.

It is important to define “waste” in terms of the customer. Otherwise, it is very easy to want to justify value in things “we’ve always done this way.” In the manufacturing world, the customer is easy to define—it is the purchaser or the user of the physical product that is being produced. As the buyer of a car, you value the time being spent assembling the car, since a perfectly built car is what you are paying for. Time spent on waste (such as fixing defects or searching for parts) is not valued by the customer and does nothing to produce or improve the product.

In healthcare, waste can be evaluated from two perspectives: the employee and the patient. In analyzing the “current state” of a workplace, lean thinkers will observe employees and document their activities. At a world-renowned cancer treatment center, I observed nurses providing outpatient chemotherapy treatment to patients. The nurses were spending only 30% of their time working directly with patients, providing “value added” care. The rest of their time was waste: walking, searching for supplies and medications, and solving problems (“defects”) in the process. This non-value added time caused patients to wait, adding waste from their perspective. During the patient’s visit at the center, over 75% of their time was spent waiting, from arrival to the start of treatment.

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Most of this waiting time was due to poor scheduling, things not going right (such as getting drugs from the pharmacy), or other types of waste in the system.

In the treatment center, one of the constraints limiting the number of patients who could be treated was nurse availability. Nurses were scheduled at a given ratio, since a nurse can only perform so much activity in a given time (they certainly can't be in two places at a time) and can therefore only care for so many patients at a given time. Without lean, we take all of the nurse activity as required and unfixable, including the 70% waste.

With lean, improvement teams identify and focus on reducing waste. By reducing waste, and only by reducing waste, can nurses be expected to care for more patients simultaneously. Lean does not focus on doing the value added work more quickly; it focuses on reducing waste so employees can spend more time on value added work. The value added work is usually what's rewarding—caring for patients—and the reason that people went to school and the reason they come to work.

One key concept of lean thinking is that we don't overburden employees or ask them to do more work than physically possible. Toyota doesn't ask an assembly line worker to do 60 seconds worth of work in a 45 second cycle. It is through careful analysis of the work and an understanding of what's involved in a job that leads to proper staffing levels. Having an overburdened staff is bad for morale, quality, and efficiency, no matter what the workplace is. Now, in a hospital setting, the work is less

predictable and less repeatable than in an assembly line. But, that doesn't mean we can't analyze the work, looking for waste, and making sure we have a proper balance of workload and staff.

People often think that "lean" means getting rid of employees and making them figure out how to get by. That was the traditional cost-cutting approach that didn't work. When you just arbitrarily cut staff (even if it's based on industry benchmark data), employees will reduce work on their own to fit into their workday. The risk is that they are forced to cut corners on the value added activity rather than reducing waste.

If we focus on reducing waste in a hospital, we can prevent and reduce defects in the system, which frees up time to care for and be responsive to patients.

Reducing waste can save lives by increasing the capacity of a hospital and its departments. I observed one hospital in a major city as they were shutting down inpatient rooms due to nurse shortages. With all of the waste in the current system, the hospital needed to maintain a 6:1 nurse to patient ratio to ensure quality of care. If the hospital were using lean methods and reducing waste, this ratio could be increased without jeopardizing patient care or stressing out employees. By keeping more rooms open, fewer patients would be "boarded" (kept in the ER hallways waiting for a room) and fewer ambulances would be turned away (the practice called "diversion").

If we focus on reducing waste in a hospital, we can prevent and reduce defects in the system, which frees up time to care for and be responsive to patients. Reducing waste reduces cost, which allows hospitals to care for more patients or to invest in new technologies and methods. Reducing waste reduces the stress on employees, which makes it easier for them to do the right things and to avoid often-fatal mistakes that come from being overworked and overburdened.

Standard Work

Another major foundation of the Toyota Production system is “Standard Work.” In most non-lean environments, we observe and hear about employees each doing things their own way, because no standard has been identified or because there is no oversight to make sure standards are followed. This was true at a General Motors factory I worked in during the mid-1990’s and it’s true in every hospital this author has observed. The lack of Standard Work leads to waste.

It is an old Industrial Engineering belief (dating back to the early 20th century and Frederick Taylor) that there is always “one best way” of doing any task. In the Toyota system, this standard work is defined and improved upon by the workforce (as opposed to the old Taylorist notion that management were the only ones smart enough to define the standard work). This requires consensus, a leadership drive to convince the workforce that standardizing methods is the best way to ensure patient safety and efficiency.

Hospitals and individual doctors still operate in their own way, regardless of what is considered “best practice” and what is proven scientifically.

One simple practice that is not universally practiced is the notion of “prophylactic antibiotics.” National guidelines recommend that surgical patients be given antibiotics before and after their procedures. Surgical site infections occur in roughly 2% of the 30 million procedures performed

in the US each year. Many of these infections can be prevented with cheap antibiotics, but studies show that some patients are given antibiotics too soon before the procedure or are continued too long after the procedure. One study showed that only [slightly more than half](#) of patients received the proper drugs at the proper timing. Some studies show that infection rates are 2x to 6x higher when antibiotics are not given properly. Part of the problem is a lack of standard work in the operating room setting and a lack of accountability (and management oversight).

Another recommended practice is marking the site of a surgery to prevent a “wrong site surgery,” where, for example, the left knee is operated on instead of the right (correct) knee. USA Today reported that “wrong site” surgeries occur in roughly 1 out of 100,000 operations, which is a rate of roughly 300 errors per year. The same newspaper reported this year that many surgeons either refuse to follow the standard or they make tiny [“passive-aggressive marks”](#) that follow the guideline by the letter, but are not useful for preventing surgical errors. This resistance to a standard practices comes partly from arrogance (surgeons think it’s always the other doctor that will make an error) and from a lack of supervision on the hospital’s part. The supervisory relationship is complicated by the fact that most surgeons are independent contractors, not hospital employees. Since hospitals rely on surgeons to bring in patients (and, thereby, revenue), many hospitals do not want to risk angering a surgeon or losing their business.

Simple handwashing is another common “standard work” practice that isn’t followed. Shockingly enough, only [57% of physicians](#) washed their hands between patients in one study (another study put this number at [an even lower 32%](#)). Since hospital-acquired infections are a leading cause of preventable patient deaths, it’s unconscionable that more doctors wouldn’t take the time for simple life-saving steps. Patient safety advocates call for patients to buy a giant “Costco” -sized bottle of hand sanitizer to keep by their bedsides to make sure they see every caregiver clean their hands before coming near them. Some hospitals have started an “Ask Me” campaign for caregivers to wear buttons inviting patients to ask them if they’ve washed their hands. As a patient, you would have

taken that as a given!! Physicians aren't directly paid for hand-washing time—maybe that's something that we should change.

It is clear, in healthcare, that the lack of Standard Work leads to preventable errors. Healthcare administrators are not doing enough to hold healthcare employees accountable for following standard practices, whether it is nurses administering drugs, technicians working in a lab, or physicians washing their hands between patients.

Error Proofing and Patient Safety

In the earlier section, we saw how a lack of Standard Work and medical errors are closely tied. With the lean approach, it is management's job to set up the system in a way that makes it hard for errors to occur. Asking people to "be careful" is not enough—it is not an effective way to prevent errors and patient injuries or death.

That point can't be emphasized enough. To improve quality and patient care, to prevent errors, we need to look at why errors could happen. It is not enough to remove all "bad" or careless employees from the system, as we all have careless moments, even the most careful of us in the world. As Dr. Atul Gawande wrote in his book, *Complications: A Surgeon's Notes on an Imperfect Science*, the point of error proofing is to prevent good doctors from making mistakes.

As a starting point, hospitals need to join up in a concerted effort to analyze past errors. A simple analysis tool from the lean toolkit is a method called "The 5 Whys." Looking at an error, we ask "why did this occur?" or "why could this have occurred?" until we get to a "root cause" of the error. Upon identifying this error, we look for systemic changes that can be put in place through Standard Work. What can be done to prevent the error from happening other than telling people to "be careful?" Do we need standard checklists to make sure steps are not forgotten? Do we need to

The following quote sums up the same thinking behind the Toyota Production System:

"Human error is inevitable. We can never eliminate it...We can eliminate problems in the system that make it more likely to happen."
~Liam Donaldson, WHO World Health Alliance for Patient Safety

Healthcare operates in a highly litigious environment where there are financial or legal incentives to cover up and hide problems.

change the packaging or storage of drugs to make sure similar looking drugs are not mistakenly substituted for another.

Much of the “problem solving” in the healthcare world seems to be reactive. A more complete approach would be to use proactive problem solving methods adapted from the Lean and Six Sigma methodologies. An approach called “Failure Modes Effects Analysis” (or [FMEA](#)) takes a proactive look at things that *could* go wrong in a process. FMEA’s look at three factors: the chances of an error occurring, the chances that the error is not detected, and the impact or harm that would be caused by an error. Hospitals should use FMEA to anticipate errors that could injure or kill patients. FMEA gives us a method for prioritizing risks and solutions that should be put in place.

In one recent case, a nurse mistakenly administered an overdose quantity of a drug to a patient, resulting in death. The nurse and the supervising physician were both fired, but the hospital also took the step of instituting process changes to prevent future errors. It is a shame that the hospital had not turned on these “error proofing” features of the automated drug dispensing systems earlier. If the hospital had been proactive, the death could have been prevented.

Once a certain type of error occurs at a hospital, such as mistaking the drug heparin for insulin, there is no excuse for that error occurring again at that hospital, yet alone any other. Unfortunately, the healthcare world operates in a highly litigious environment where there are financial or legal

incentives to cover up and hide the cause of problems. It is easier to let an individual take the fall and let the public believe that the problem has been solved because the person at fault was fired or prosecuted. We need to encourage more openness and cooperation so that every hospital can learn from a single mistake that occurs anywhere. We need to share our proactive problem solving efforts so that all hospitals can prevent the same systemic errors without having to duplicate analysis efforts across the country.

In the manufacturing world, health and safety professionals recognize the “safety pyramid,” the idea that for each fatal accident, there will be several injuries, many more near misses, and an incalculable number of unsafe conditions or practices that could have led to near misses, injuries, or deaths. Rather than waiting for a death or injury to occur, management and administration must proactively look for unsafe conditions at the bottom of the pyramid.

Too often, near misses get covered up and hidden, as workers fear punishment more than value the preventative nature of improving the system. We have to set up a system where employees are encouraged to bring near misses to the attention of administration so problems can be prevented, rather than being hidden or covered up. Hospital administrators need to get their heads out of the sand. Ignoring the possibility of errors that are likely to occur makes them fully responsible when foreseeable and preventable errors do occur.

CONCLUSION

After my first 18 months working in healthcare, I have been surprised by the lack of controls and the lack of systems that would prevent errors, injuries, and deaths from occurring. For all of the technical advances in medical care, it is unfortunate that medical processes have not kept up. For every new life-saving technology, there is a systemic problem still waiting to injure or kill a patient.

It is encouraging to see many in the healthcare world looking to adopt best practices from outside of the industry, including lean and Six Sigma methods. But, the progress is not happening fast enough. We need to promote the further adoption of these methods with the goal of saving lives and saving healthcare from further explosive growth in costs.

Some in healthcare cringe at the thought of adopting lean methods and say, “we don’t want assembly line medicine.” The negative connotations of this phrase imply that assembly lines are only concerned with speed and efficiency. That is true if we are talking about traditional “mass producers.” I would be afraid of “General Motors assembly line medicine” (or Ford, or Chrysler, or BMW, or many others). But, “Toyota assembly line medicine” can save many lives and is something I would welcome.

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