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Virginia Mason Medical Center

At the turn of the millennium, Dr. Gary Kaplan, an internal medicine physician, became CEO of Virginia Mason Medical Center in Seattle, Washington. The medical center was facing significant challenges—it was losing money for the first time in its history, staff morale was declining, and area hospitals presented ardent competition. Considerable change was imminent. Within two years, Kaplan had rallied the organization around a new strategic direction, first and foremost to become the quality leader in health care.

What Kaplan and his top administrators lacked was an effective tool to execute their strategy. Soon thereafter, a series of serendipitous events led to the discovery of the Toyota Production System, a manufacturing management method focused on quality and efficiency created by automaker Toyota. Kaplan and Virginia Mason Medical Center became entrenched in a challenge: how to institute a management model previously utilized only in manufacturing into health care.

History of Virginia Mason

In the early 1900s, two doctors shared a vision: a single place where patients could receive comprehensive medical care for virtually any medical problem. In 1920, the doctors founded an 80-bed clinic with six physicians designed to offer a system of integrated health services. They pledged to provide the finest patient care by working collaboratively as a team and sought the best and brightest to join in their mission. In a remarkable coincidence, the daughters of both founders, Drs. Mason and Blackford, were named Virginia, and thus Virginia Mason began.

For decades, the clinic operated as a physician partnership, a legally separate entity from the nonprofit hospital. The partnership distributed operating surplus among the physicians in an annual bonus program. Partners provided the capital and shouldered the debt burden required for clinic growth. In 1986, impelled by a need to expand services and technology, Virginia Mason restructured its organization from a physician partnership into a single nonprofit entity. The medical center sought debt financing and the physicians sold their group practice, becoming employees of Virginia Mason.

Professor Richard M.J. Bohmer and Research Associate Erika M. Ferlins prepared this case. HBS cases are developed solely as the basis for class discussion. Cases are not intended to serve as endorsements, sources of primary data, or illustrations of effective or ineffective management.

When the physicians became employees of the medical center, they no longer carried the debt load nor received a share of the profits. As a 501(c)(3) nonprofit organization, the medical center was run by an internal administration with oversight by a public board, but physicians still wielded important power. Every three years, physicians elected department chairs, and every four years the CEO. Elections did not necessarily mean rampant change at the executive level; Kaplan's predecessor, Roger Lindeman, served as CEO for almost 20 years before his retirement.

In 2005, Virginia Mason Medical Center (VMMC) was a 336-bed center with over 5,000 employees and 9 locations (a main campus and 8 regional clinics). The center included a graduate medical education program and renowned research center, and its 400 physicians practiced in 45 different medical, surgical, and diagnostic fields. When Kaplan first arrived at VMMC in 1978, he described the collaborative team approach to care as "unlike anything I'd ever experienced." Over the years, VMMC retained this unique culture that attracted Kaplan and so many others.

Virginia Mason at the Millennium

In 2000, Lindeman stepped down as CEO, and the physicians at Virginia Mason elected Kaplan as his successor. In November 2000, Kaplan and the board decided to eliminate the electoral process for appointing leaders within VMMC. Instead, the CEO appointed department heads, and the board would assume responsibility for selecting the next CEO.

Daunting challenges faced the leadership team, primarily economic: in 1998 and 1999, the medical center lost money for the first time in its history—double-digit millions, no less—and staff morale was low as a result. Competition was fierce in Seattle; VMMC was located in an area of the city known as "pill hill," which included several hospitals within a one-mile radius.

Before Kaplan assumed the role of CEO, in response to the economic downturn, the medical center had begun trimming costs, for example cutting academic spending for travel time, research and the like. As Kaplan explained, "When academics start going by the wayside, the people you want to retain start questioning whether they want to stay." Within the first six months of Kaplan's tenure, in attempts toward recovery, the medical center sought to consolidate less profitable business lines and grow highly profitable lines. They closed the obstetrics program and several satellite clinics, reduced mental health provider services, renegotiated contracts with payers, and examined productivity by service lines. "However, we just weren't satisfied with the long-term economic sustainability of the traditional management initiatives," explained Kaplan. "We needed more."

Furthermore, the Institute of Medicine (IOM) had recently issued a report on patient safety that jarred the health-care industry when it claimed: "Experts estimate that as many as 98,000 people die in any given year from medical errors that occur in hospitals. . . . Add the financial cost to the human tragedy, and medical error easily rises to the top ranks of urgent, widespread public problems."[1]

The safety challenges facing health care combined with VMMC's financial difficulties were daunting. "I had serious concerns about our long-term survival," recalled Kaplan. "In our current state, we weren't able to evolve in response to the rapidly changing environment. We change or we die. It was as simple as that."

Physician Compact

One of Kaplan's early moves as CEO was the initiation of a physician compact. The concept of a compact was simple: an explicit deal between two parties, in this case the physicians and the VMMC organization. Historically, physicians assumed an *implicit* compact when joining physician practices like VMMC. Kaplan described the old deal:

> The implicit compact was about entitlement, protection, and autonomy. By virtue of joining the group, each physician felt, "I'm entitled to patients, I'm protected from the environment by the administrators, and I can do whatever I want, whenever I want to—I'm a professional." That was the premise upon which I joined this group practice back in the 1970s, and most of my colleagues would say the same.

Kaplan enlisted the help of Jack Silversin, a leading health-care consultant whom Kaplan had heard speak at conventions around the country. Silversin, who worked with VMMC on their compact, generalized Kaplan's observations to the entire industry, "Being a doctor has traditionally meant: be the best doctor you can, however you can. It's difficult to take highly trained professionals and tell them how to do things—that contradicts their professional identity."

The problem with the implicit compact, according to Kaplan, was its inconsistency with where VMMC needed to move in the future in order to address the challenges of the industry. In September 2000, Kaplan organized an off-site retreat for all the medical staff to consider a new compact and asked Silversin to facilitate the discussions. Of the 400 physicians, approximately 230 attended the highly emotional retreat. "Morale was low," recalled Silversin. "Doctors felt a great deal of loss. The discussion of how the implicit compact needed to change triggered a lot of feelings, which in turn allowed most to move forward and engage in creating a different compact."

Upon their return, Kaplan designated a committee, composed primarily of frontline physicians with administrative support, to create an explicit physician's compact. The committee solicited input from the entire organization and went through several iterations before finalizing the compact. This highly collaborative, iterative process took over 12 months. When the physician's compact was completed, leaders and managers created their own compact. The new compact indicated that physicians and the organization had adopted the new goals of the organization: becoming the quality leader by focusing on the patient, working together, and embracing change (see **Exhibit 1** for compact).

To embed the compact into the organization, Kaplan tied its principles into the performance review and incentive compensation system. For example, all physician performance reviews undertaken by the chiefs of service included an evaluation of "group effort," and 10% of the distributed dollars (although not necessarily 10% of an individual physician's compensation) were tied to a physician's group effort and "professional action." Metrics included in the group effort component included relationship with and respect for other members of the care team, embracing evidence-based practice, and participating in organizational change and improvement.

A Strategic Plan

Throughout 2001, board members and executives at VMMC, with input from all levels of the organization, concentrated on creating a strategic plan. The strategic plan focused on putting the patient (the customer) first and created a new vision: to become their industry's quality leader (see **Exhibit 2** for final strategic plan).

VMMC's vision was clear, but it lacked a system to achieve this goal—until a serendipitous meeting led to the discovery of the Toyota Production System (TPS). In early 2001, Virginia Mason president Mike Rona sat on an airplane next to John Black, who brought TPS to the large airplane manufacturer Boeing. Rona was intrigued by TPS and believed it was just the tool for VMMC. "It seemed perfect at every level," remembered Rona. "Why *wouldn't* it work?" He brought the idea back to Kaplan, who was immediately taken with the similarities between VMMC's goals and Toyota's—especially putting the customer first, a focus on quality and safety, and a commitment to employees.

Toyota Production System[2]

In 2004, Japanese automobile maker Toyota surpassed legendary Ford Motors to become the world's second-largest manufacturer of cars and trucks.[3] Toyota consistently ranked high in quality, dependability, and value. Over the years, the Japanese auto giant had transformed the Ford assembly-line system into a manufacturing miracle that had long been hailed as the source of Toyota's consistently outstanding performance: TPS.

TPS evolved in the post-World War II era, when the need for severe cost-cutting in a failing economy challenged Toyota management. It was a time of incredible capital constraint; Toyota could not afford to hold inventory as a buffer to fluctuating demand and product flow. With no spare capital, Toyota had to reduce costs yet meet customer needs. The resulting concept was *heijunka*—leveling production to meet fluctuating demands without holding excess inventory. *Heijunka* became a building block of TPS.

TPS, in essence, reduced cost by thoroughly eliminating *muda,* or waste—waste of overproduction, time, material, space, movement, any activity that consumed resources but added no value to the customer—and improving production flow. Toyota sought the smoothest possible flow of work, accomplished by mapping out work processes, eliminating waste or unnecessary steps, standardizing the process, and using teamwork to identify and address any defects in the flow.

Principles of TPS

The identification of waste was almost more important than the process of eliminating it. TPS provided two guiding principles to facilitate the identification of waste. The first was just-in-time (JIT) production: produce only what and how much was needed, and only when it was needed. Any deviation from true production needs was deemed waste. The second principle was *jidoka*: detect abnormalities in the production process and immediately halt work to respond to these abnormalities *in real time*. Essentially, *jidoka* integrated quality control into the production process.

Standard work—processes streamlined to eliminate non-value-added activities—was a core principle of TPS. Abnormalities were glaringly obvious due to the standardization of work; any aberration would stand in stark contrast to the process and must be dealt with immediately.

JIT production and *jidoka* reflected key understandings of the production process. First, needs during production would deviate unpredictably from a plan, no matter how detailed that plan was, and second, problems on the shop floor were inevitable. However, Toyota emphasized innovation on the shop floor by frontline workers to solve these problems in real time. The company employed a variety of tools to implement TPS principles.

One such tool to illustrate *jidoka* was the *andon* cord (or switch), which workers activated upon discovery of a problem on the assembly line. If the worker could not fix the problem within the production cycle time, the entire assembly line halted and a senior supervisor joined the problem-solving effort.[4] TPS sent the problem up the hierarchy until someone solved it and the line could begin again. Interestingly, the *andon* cord was considered a temporary fix—a "countermeasure"—

rather than a permanent solution within Toyota.[5] The idea was that tools such as the *andon* cord were not fundamental to the system, because the system was constantly evolving to fit the best approaches to current conditions.

The *andon* cord was an example of yet another key to TPS: *kaizen*, or continuous incremental improvement. Toyota's belief was that progress derived from small incremental improvements, and as such encouraged continuous improvement of its TPS processes through "good thinking" and a commitment to learning. Academics who studied TPS found that Toyota "explicitly teaches people how to improve"[6] through coaching and internal training programs that taught employees how to get to the root of a problem, quickly. Furthermore, Toyota emphasized the role of frontline workers in process improvement; at Toyota, employees generated an average of 999,000 ideas for improvement annually—90% of which were implemented.

Toyota's system was primarily about flow—information flow, physical flow of parts, overall production flow—via standardized processes and continuous improvement. All production lines at Toyota were arranged so that everything flowed along a prespecified, specific path. One academic explained, "Goods and services do not flow to the next available person or machine but to a *specific* person or machine."[7] Anything that hindered the process flow required redesign, and any person in the facility was capable of redesigning any part of the process at any time. TPS emphasized the importance of safety and quality while focusing on the customer to determine value and the operator to detect mistakes, improve efficiency, and develop flow. As TPS principles began to spread, they became known as "lean manufacturing."

The Spread of TPS

Following Toyota's increasing reputation many manufacturing companies, such as General Motors and Dell Computer, began to introduce TPS principles in their own organizations. Curiously, few manufacturers were able to successfully imitate TPS—even though Toyota was candid regarding its practices.[8] Even Toyota was having difficulty maintaining its quality success stories, possibly due to the lack of skilled TPS gurus and training masters. Japanese coordinators were in rare supply, and American Toyota factories found their quality prowess plummeting.[9] The troubles of Toyota and others in instituting and sustaining TPS led experts to question if the system was as robust as had been believed. Others contended that the difficulties stemmed from a lack of understanding. One academic summarized outsiders' troubles replicating TPS:

> Observers confuse the tools and practices they see on their plant visits with the system itself. That makes it impossible for them to resolve an apparent paradox of the system—namely, that activities, connections, and production flows in a Toyota factory are rigidly scripted, yet at the same time Toyota's operations are enormously flexible and adaptable. . . . To understand Toyota's success, you have to unravel the paradox—you have to see that the rigid specification is the very thing that makes the flexibility and creativity possible.[10]

Production Models in Health Care

TPS was not the first production model to be imported into health-care delivery organizations. For the past two decades, hospitals had tried several management models drawn from production industries, including critical pathways, Total Quality Management (TQM), and Six Sigma. Of these TQM was particularly noteworthy. TQM was the combination of a collection of philosophic principles with a discrete set of specific analytic and team tools.[11] The TQM philosophy centered on four key assumptions realized through the use of five specific tactics and a set of specific team and analytic tools (**Table A**).

Table A The Principles, Tactics, and Tools of TQM

Principles	Tactics	Tools
1. The costs of poor quality were greater than the costs of developing systems and processes to guarantee quality. 2. Employees primarily wanted to do good quality work. 3. Quality problems typically crossed functional lines. 4. Quality was primarily the responsibility of senior management.	1. Explicitly define and measure customer requirements. 2. Create supplier partnerships. 3. Use cross-functional teams. 4. Apply the scientific method to improving performance. 5. Use process management heuristics to enhance team effectiveness at process design and improvement.	Control chart Flow diagram Brainstorming sessions Pareto chart Fishbone diagram

Source: J.R. Hackman and R. Wageman, "Total Quality Management: Empirical, conceptual and practical issues," *Administrative Science Quarterly* 40(2) (1995): 309–342.

Initial use of the principles and tools of TQM was restricted to the "hotel functions" of health-care delivery—billing, laboratory turnaround time, patient transport, and so on. However, by the early 1990s TQM was being applied to clinical processes in health care.

Despite initial enthusiasm, skepticism about the utility of TQM had grown, as evidence accumulated that the quality of U.S. health care was not improving. Although TQM had been credited with performance improvement in other industries, a national survey of health-care managers found that none could identify a health-care institution that had fundamentally improved its performance using these methods.[12] Moreover, evidence of improvement was particularly lacking in clinical journals.[13]

Explanations for this trend differed. One group of researchers argued that the problem was one of implementation. Some suggested that poor TQM performance resulted from a lack of senior leadership commitment and skill.[14] Others found that lack of physician involvement in hospital governance was associated with lower TQM implementation success (in most hospitals physicians were independent providers, not direct employees).[15,16] One argued that hospitals should begin implementation with administrative rather than clinical projects in order to avoid physician revolt,[17] while others argued that clinical projects early in implementation could produce physician champions.[18] Some researchers contended that while early adopters of TQM customized it to make efficiency gains, later adopters simply implemented normative models of TQM to keep up with the mainstream rather than in a sincere effort to improve.[19] In spite of this controversy, whether an organization implemented some or all of the TQM principles and techniques was not found to predict ultimate performance improvement.[20] Rather, a culture supporting quality improvement work was found to be more important than the use of any specific tools.

In contrast, other researchers proposed that the problem lay not with the implementation of TQM in health care but that TQM was conceptually ill designed for a health-care setting. They argued that TQM, with its emphasis on top management's hierarchical control over work processes and its presumption of rational decision making, was, by definition, not well suited to health-care delivery because these two characteristics were not present in many health-care delivery organizations.[21]

TPS had already been applied in a health-care setting. The University of Pittsburgh Medical Center (UPMC) found in a 2000 study that "the staff was spending more time nursing the system than nursing patients."[22] In other words, nurses did more charting and documenting of their activities than actually performing medical services. In response UPMC tried applying TPS, and early results were encouraging. For example, applying the tenets of TPS resulted in the reduction of patient waiting time, as well as time for patient registration and the assembly of medical charts, and improved the availability of supplies. Hospitals in the Pittsburgh Regional Health-care initiative also reduced rates of nosocomial infection.[23] However, these improvements were isolated in Pittsburgh. The question remained, how well could all health-care institutions integrate TPS principles, so well suited for the manufacturing industry, into the complex and dynamic service industry?

Virginia Mason Production System

TPS appeared to be the method the medical center had been seeking to implement its strategic plan. Other alternatives had failed to gain much support within the center. VMMC had utilized TQM in the 1990s, but the concepts had found little traction inside the action-oriented medical center. VMMC executives felt that TQM tended to emphasize top-down management; one person described TQM as "a bunch of administrative teams meeting, deciding on new processes or better ways of doing things, and handing it down to the rest of us."

Administrators had investigated other options such as Six Sigma, a system favored by production giant General Electric, but were disappointed by Six Sigma's allowance of a defect rate. "Safety and perfection are paramount," explained Virginia Mason Production System (VMPS) administrative director Christina Saint Martin. "Even a small defect rate is not acceptable. We're talking about patients' lives here."

Kaplan and Rona encountered little resistance from the board, whose members were attracted by Toyota's long history of safety, quality, customer and employee satisfaction, and financial success. In 2002, senior executives from VMMC visited Toyota in Japan—a trip that, according to Kaplan, "was all about discovery." Rona remembered his realization: "Manufacturing cars is as complex as health care." Armed with Toyota's principles, leadership at the medical center began to envision VMPS.

No Layoffs

Before initiating VMPS, Kaplan and Rona wanted to engender full commitment from the VMMC workforce. Conventional wisdom, explained Kaplan, professed that in order to improve productivity, you had to cut people. The administration's challenge was to encourage staff to contemplate and change their processes when, as Kaplan put it, "they might improve themselves right out of a job."

VMMC's solution was a no-layoff policy. When units improved efficiency to the point that they were overstaffed, the medical center redeployed people to other areas. Staffers would receive education and training to equip them for new positions. Kaplan described some of the challenges:

> It requires rigor around attrition and hiring. When 78% of your costs are labor, and you want to reduce your labor costs, you have to have fewer people. In a no-layoff environment, the only way to accomplish lower labor costs is not to hire replacements when people leave. It's a real challenge given technical skill sets. For example, when a certified ultrasound technician leaves and you have no one else, we're either out of business or we hire someone. You can't redeploy an operating room nurse and make her into an ultrasound technician. One great example of redeployment was in the audiology department—we did a workshop and

discovered we had two and a half too many audiologists. These are highly trained professionals with advanced degrees! We ended up redeploying one of our best audiologists to a project manager in the operating room, with equal pay, and she's very happy there.

Strategies of VMPS

VMPS depended on the use of specific methods as mechanisms for action. These activities were borrowed from TPS and tailored to fit the health-care model. As legendary TPS guru Taiichi Ohno once said, "You can't improve a process until you have a process."[24]

Value-stream mapping The main vehicle for VMPS was value-stream mapping, a lean manufacturing method of visually mapping the flow of information and materials through all production steps. In essence, value-stream mapping was a simple flow chart with associated medical-center metrics. Kaplan saw the value-stream map as the foundation of VMPS. "Understanding the work is critical," he said. "Unless you understand the steps, you cannot see the waste, you cannot see the opportunity, you cannot see the defects." At VMMC, early value-stream mapping encompassed patient check-in and visits, flow of equipment, and inventory (see **Exhibit 3**). Eventually, all departments within the medical center had engaged in value-stream mapping.

An example of the evolution of value-stream mapping was in the oncology unit. After value-stream mapping such activities as patient check-in and laboratory processes, the oncology unit decided to track a patient with breast cancer from the point of diagnosis through to the completion of treatment. The resulting value-stream map (see the current value-stream map, **Exhibit 4**) followed the patient from the moment a provider revealed a positive biopsy through the various departments available to each patient, cancer conferences during which specialists discussed the diagnosis and treatment selection possibilities, and treatment options available. In the future value-stream map (see **Exhibit 4**), the oncology unit hoped to include standard work around patient follow-up. Patients could choose which provider(s) they wished to follow up with—for example, their primary-care physician or oncologist—with the knowledge that their follow-up process would not differ between providers.

RPIW Value-stream mapping was the first step in a rapid process improvement workshop (RPIW), a five-day event designed to eliminate waste, improve processes, and increase both efficiency and productivity in the participating unit. RPIW teams defined the existing process and set targets for the new process before spending over two days observing, measuring, and brainstorming on the existing process. On the fourth day, the team established new or improved existing standard work and on the fifth day "reported out" to the organization.

RPIWs measured specific targets such as staff walking distance, inventory turns, and quality for specific tasks, such as ambulatory specialty scheduling, inpatient incomplete chart processing, or rehab medicine patient flow. There were specific, standard tools utilized in each RPIW, such as a target progress report, to track these metrics (see **Exhibit 5**). In the early days of VMPS, RPIWs were used mainly for designing standard processes, to tackle the "low-hanging fruit," as one employee put it. As VMPS evolved, RPIWs improved the existing standard processes and were tailored to align with organizational goals. From 2002 to 2005, VMMC participated in over 350 RPIWs, often completing multiple RPIWs on the same topic within the same unit for the sake of continuous improvement (see **Exhibit 6** for list of RPIWs by year).

Actionable items typically resulted from RPIWs. For example, the hematology and oncology department discovered during an RPIW that 49% of their patients were not roomed by their scheduled appointment time. The ensuing resolution was an entirely new patient rooming process, complete with a visual control board to monitor patient, room, and provider status.

5S Organization of physical space was an essential component of VMPS. 5S, a visual system for organizing the workplace, stood for sort, simplify, sweep, standardize, and self-discipline. In VMPS, a clean and orderly space enhanced quality and productivity because less time was wasted searching for tools and problems were more salient (see **Exhibit 7** for examples of 5S).

3P 3P—production, preparation, process—was an improvement strategy used to radically redesign space according to flow. At VMMC they designated the "seven flows of medicine": patients, providers, medications, supplies, equipment, information, and instruments. By utilizing 3P, unit providers and staffers examined ways to improve service delivery, introduce new services, and complement process design changes. 3Ps throughout the medical center resulted in over 10 million of saved capital budgeted dollars.

For example, in the hematology and oncology unit, patients, doctors, and nurses all collaborated with architects to redesign the physical layout of treatment rooms, provider offices, and the waiting room. The final product was a circular unit, with treatment rooms on the outside where patients could enjoy scenic views and exam rooms, provider offices, nurses stations, and administration arranged to maximize communication while reducing travel time. In the same amount of space, they increased the number of patient visits a day from 120 to 188—a 57% increase—and reduced patient travel per visit from 1,600 feet to 375 feet—a 76% decrease. Furthermore, they built a pharmacy on-site and an improved lab delivery system, which reduced the wait times from 2 hours to 20–30 minutes and 20 minutes to 1 minute, respectively. Every detail was considered according to 3P. For example, the unit contained three medication refrigerators; in all three refrigerators, medicines were located in the exact same spots.

Everyday lean Yet another VMPS tool was the "everyday lean idea system." Everyday lean encouraged all employees, at every level within the organization, to creatively change the approach to their jobs in order to reduce waste and add value for patients. Embracing the concept of *kaizen*, employees were encouraged to identify areas for improvement, innovate solutions, test solutions on a small scale, and measure the effects. The everyday lean idea form standardized the process of submitting proposals and implementing successful solutions. VMMC held monthly contests to recognize the top three employee ideas. Judges reviewed ideas based on applicability, ease of implementation, and how well the standard process was followed. Between June and September 2005, employees suggested 87 lean ideas, 80% of which were implemented. (See **Exhibit 8** for the winning everyday lean worksheet from August 2005.)

Patient safety alert system The patient safety alert (PSA) system was a direct result of a factory visit to Japan and seeing the *andon* cord in action. The key concept behind "stopping the line" at Toyota was that a mistake could be corrected in real time. As a matter of fact, it was easier to fix a mistake the moment it occurred than to send it further down the line. Safety improvements depended on the notion that every frontline worker was expected to detect and prevent defects.

In VMPS, the PSA process was a commitment by all employees to "pull the cord" when any safety hazard or mistake was identified. The process notified senior leaders, who immediately addressed the root cause of the problem on-site. "It was a major shock to our organization that we would be willing to respond 24/7," Kaplan recalled, "until we understood the root cause and how to avoid the mistake in the future." For example, in the dermatology unit, a medical assistant prepared two syringes for a surgical patient. When the physician injected the first syringe, the patient reported discomfort and a lack of numbness in the surgical site. The physician, suspecting that the medication mix in the syringe was incorrect, aborted the procedure, informed the patient of the error, called the pharmacy for advice, and sent the patient to observation.

Next, the dermatologist notified senior leadership, including the chief of medicine, the vice president of quality and compliance, and the CEO. A buddy system was immediately initiated to verify the appropriate mixing of other medications in the unit, and an evaluation team of half a dozen employees began to analyze the process defects that caused the error. Over the course of approximately 10 days, the team identified process weaknesses, and the dermatology unit made improvements to address those weaknesses. VMMC experienced an average of 32 PSAs per month, and each issue could take from 48 hours to two weeks to resolve. Kaplan gave this example of a PSA:

> A retained sponge—a retained instrument is a recognized medical error—when that was identified, we took that surgeon, the whole team, and the procedure offline until we understood the root cause of that problem. That is tough to do—it is productive time, it is economics, it is reputation, it is a lot of things, and so the onus was on us. And that root cause analysis was complete in 48 hours.

In further patient safety efforts, VMMC instituted a medical emergency team (MET), composed of a hospitalist, critical-care nurse, and respiratory therapist. The MET responded to calls on any hospital floor and assisted in the evaluation, assessment, and management of patients in an effort to improve patients' status, reduce critical-care unit admissions, support and educate floor staff in real time, and prevent emergency situations.

Bundles In 2004, VMMC consulted best practices from medical literature and publications by the Institute for Health-care Improvement (IHI) and instituted "bundles" into VMPS. Best practices, or evidence-based interventions, were discovered through robust scientific experimentation and widely agreed to be the preferred method. Bundles at VMMC included specific steps to prevent ventilator-acquired pneumonia, surgical-site infection, and central-line infection and to improve myocardial infarction care.

For example, ventilators were known to occasionally induce pneumonia in patients. Various factors were identified as increasing the risk of ventilator-acquired pneumonia (VAP), and the VMPS bundles aimed to eliminate those factors.[25] According to the IHI, the four practices known to dramatically reduce incidences of VAP were elevation of the head of the bed between 30 and 45 degrees, daily sedation and assessment of readiness to extubate, peptic ulcer disease prophylaxis, and deep venous thrombosis prophylaxis. In the critical care unit at VMMC, nurses employed standard work such as checklists to ensure that each patient received the appropriate bundled care. Dr. Mike Westley, section head of critical care, explained:

> We use the principles of VMPS to reliably get evidence-based [VAP] bundles to every patient. It's about self-checks, successive checks, redundancy and documentation; for example, with bed elevation we don't leave it up to one person. The respiratory therapists check it every three hours, nurses check it every two hours, and we document it. Nurses have told me, if we don't document it, we don't do it. Documentation is both a prompt and a self-check. Successive checks occur at handoffs when nurses ask each other, "Did you do x, y, and z for every patient on a ventilator?" and having to document it makes it so.

In 2002, VMMC experienced 34 cases of VAP, at an estimated total cost to the medical center of $500,000. By 2005, the projected cases had been reduced to only one, at a $15,000 cost to VMMC.[26]

Yet another example was inserting a central line—an intravenous catheter placed in the blood vessels leading to the heart—which often resulted in potentially fatal infections. IHI released best practices for inserting a central line, a bundle that included five key components. Providers at VMMC collaboratively improved the process even further and instituted it as standard work within the medical center.

VMPS Infrastructure

To support the massive undertaking of implementing VMPS, the medical center created an infrastructure designed around VMPS operations and *kaizen* promotion offices (KPOs). As implied by *kaizen*, the Japanese word for continuous and incremental improvement, KPOs were responsible for overseeing, leading, and coaching units through RPIWs, as well as facilitating everyday lean.

The first generation of VMPS infrastructure designated only one KPO responsible for the organization and implementation of all RPIWs and VMPS tools. As a result, early RPIWs often included overambitious targets or attempts to tackle too many targets in one workshop. In short, the KPO found itself stretched too thin.

As VMPS evolved, so did the infrastructure. In early 2005 the medical center expanded to three KPOs—corporate, hospital, and clinic—each with six full-time staffers. The increase in KPO support resulted in RPIW goals that were better aligned with organizational goals, the creation and tracking of explicit measurable targets, and accountability for implementation and sustained results.

The two operations managers were VMPS specialists and oversaw the training and education of all 5,000 VMMC employees. Educational courses included an introduction to VMPS and everyday lean and "how-to" courses on value-stream mapping and mistake proofing. The operations managers also facilitated the planning and development of RPIWs, oversaw data collection and analyses, and provided support for 3P redesign.

Furthermore, VMMC funded two trips annually to Toyota's head office and factories in Japan. On these trips, VMMC employees, from senior executives to physicians to nurses, observed and worked on the shop floor at Hitachi in a *Gemba Kaizen* (continuous improvement workshop). Kaplan led every trip to Japan and told this story about a reluctant physician participant:

> When I asked one of our surgeons to go to Japan in 2003, he refused. A year later he changed his mind because he'd heard that it was value-added time. So he is on the assembly line in Japan, and I send the team out to get measurements of their workers so that we can plot the work and find the waste. And he came running back and said, "I can't get any measurements. I can't clock it." I asked, "Why not?" And he answered, "Because the operator does it differently every single time. There is no standard work!" And there was the teaching point right there: because this person did it differently each time, the surgeon couldn't possibly measure the work; if you can't measure it, you can't improve it. That was very powerful.

Overall, VMMC dedicated 20 full-time employees (18 KPO staffers plus two central operations managers) to the planning, implementation, and maintenance of VMPS. These employees were redeployed from their previous roles within the medical center. Overall, the financial commitment to VMPS was large, but administrators justified the expense as "avoided costs." In other words, the administration felt that financial gains through improved efficiency outweighed the labor expense. In the first two years of VMPS, the medical center's margins improved significantly. When the KPO split into three separate units, RPIWs and everday lean ideas yielded higher efficiency improvements. It appeared that the human capital was a worthwhile investment.

Zero Defects

One important goal of TPS was "mistake-proofing" standard processes, or investigating the root cause of mistakes and immediately instituting countermeasures to avoid repeating those mistakes. VMMC's goal was to achieve zero defects—anything that could cause harm if not corrected or an avoidable mistake. "No one should die because of something we could prevent," explained Dr. James Bender, the medical director of hospital services.

However, almost three years into VMPS, VMMC experienced what in health care was known as a sentinel event—an avoidable mistake that becomes a turning point for the organization. In 2004, a patient in the interventional radiology department received an injection of chlorhexidine (an antiseptic solution) instead of a nontoxic image dye used to view the arteries. Both solutions looked exactly the same and were sitting unlabeled on the same tray. The patient died as a result of this tragic mistake, and the organization was shocked.

In the spirit of transparency, believing that highlighting the event could prevent its recurrence, the administration quickly sent out a center-wide memo explaining the situation and within hours had posted an apology. Kaplan recalled the reaction of the director of the pulmonary function lab, a 20-year veteran of VMMC: "She stopped me in the hallway and said, 'It's so sad and so ironic that at this time in our history, when we're required to focus relentlessly on safety, such a tragedy can still occur. No matter how much we do, it's still a journey.'"

"We don't make cars, we treat patients"

Enthusiasm and support for VMPS was not universal within VMMC. Many physicians and nurses issued a common cry: "We don't make cars, we treat patients!" Toyota Camrys, explained disinclined providers, cannot be compared to patients with unique diseases and complex emotions. Many doctors and nurses contested that they did not work on a production line, so it was impossible to transfer TPS principles to the medical center. How can providers standardize care, they argued, when each patient is different?

Furthermore, after their experiences with TQM, many employees were skeptical about the benefits of yet another management-imposed system. Some physicians also felt that standardization threatened their ability to perform such core competencies as diagnosis and treatment selection. They maintained that standardization would stifle their autonomy and clinical creativity. Kaplan disagreed, saying, "Thanks to the elimination of waste, VMPS frees up more time to spend with patients, families, or on pursuing academic endeavors."

In the early days of VMPS, there was some staff and physician attrition; 10 physicians left the medical center. "People left because they knew they wouldn't fit into the new culture, or they weren't comfortable with VMPS, or they just didn't like the change," explained a KPO specialist. "There were certain expectations in our new culture, and some people just couldn't adjust." Kaplan agreed, "One of the hardest things for me to realize was that not everyone wanted or was able to come with us on this journey. I recognized that you have to say good-bye, and this is a good thing. You can't keep everyone happy."

Conclusion

VMPS resulted in significant improvements within the medical center. A total of 275 RPIWs from 2002 to 2004 reduced staff walking distance within the medical center by 38%, or 34 miles, and the travel distance of parts by a whopping 77%, or 70 miles. Inventory was cut in half. Lead time within the medical center decreased by 708 days (53%), which translated to over two years. There was a 44% gain in productivity, the equivalent of 77 full-time employees redeployed within the medical center.[a] Additionally, 3P efforts saved between $12 million and $15 million in budgeted capital. Not only did 3P reduce the utilized number of square feet by 24%, but also, thanks to the redesign of several units, planned additions and relocations were no longer necessary (see **Exhibit 9**).

It appeared that the importation of TPS into VMMC was a successful cost-saving and quality-improving effort. Word of VMMC's success spread, and beginning in 2004, hospitals from California to the Midwest to New York were engaging in value-stream mapping and "lean" workshops to reduce waste and improve hospital operations.[27] Furthermore, VMPS was changing the landscape of health-care delivery. As Kaplan stated, "We are changing what it means to be a manager, to be a leader, to be a doctor, in many respects." Not only was VMMC changing the role of the doctor, but it was also transforming the relationship between hospitals and physicians. A Japanese *sensei* once likened physicians to race-car drivers and hospitals to pit crews. Was that an accurate characterization of the relationship? Would VMPS last, or was it destined for a fate similar to TQM? And, perhaps most importantly, could it be replicated in other health-care delivery organizations?

[a] This productivity gain represents the consolidated rollup of the incremental gains of removing non-value-added activities from one or more people. Approximately 20 full-time employees were completely redeployed outside of their process or department.

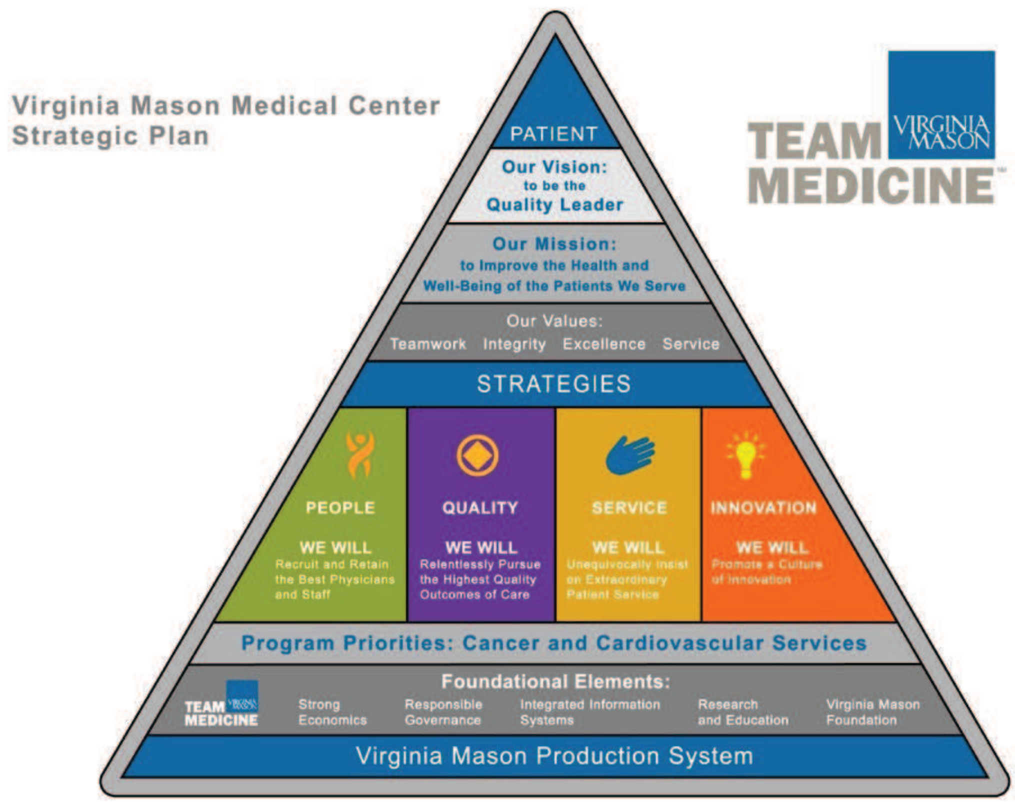
Exhibit 1 Compact

Virginia Mason Medical Center Physician Compact

Organization's Responsibilities	Physician's Responsibilities
Foster Excellence • Recruit and train superior physicians and staff • Support career development and professional satisfaction • Acknowledge contributions to patient care and the organization • Create opportunities to participate in or support research	*Focus on Patients* • Practice state-of-the-art, quality medicine • Encourage patient involvement in care and treatment decisions • Achieve and maintain optimal patient access • Insist on seamless service
Listen and Communicate • Share information regarding strategic intent, organizational priorities and business decisions • Offer opportunities for constructive dialogue • Provide regular, written evaluation and feedback	*Collaborate on Care Delivery* • Include staff, physicians, and management on team • Treat all members with respect • Demonstrate the highest levels of ethical and professional conduct • Behave in a manner consistent with group goals • Participate in or support teaching
Educate • Support and facilitate teaching, GME and CME • Provide information and tools necessary to improve practice	*Listen and Communicate* • Communicate clinical information in clear, timely manner • Request information, resources needed to provide care consistent with VM goals • Provide and accept feedback
Reward • Provide clear compensation with internal and market consistency, aligned with organizational goals • Create an environment that supports teams and individuals	*Take Ownership* • Implement VM-accepted clinical standards of care • Participate in and support group decisions • Focus on the economic aspects of our practice
Lead • Manage and lead organization with integrity and accountability	*Change* • Embrace innovation and continuous improvement • Participate in necessary organizational change

Source: Reproduced by casewriters from Virginia Mason Medical Center internal document, 2001.

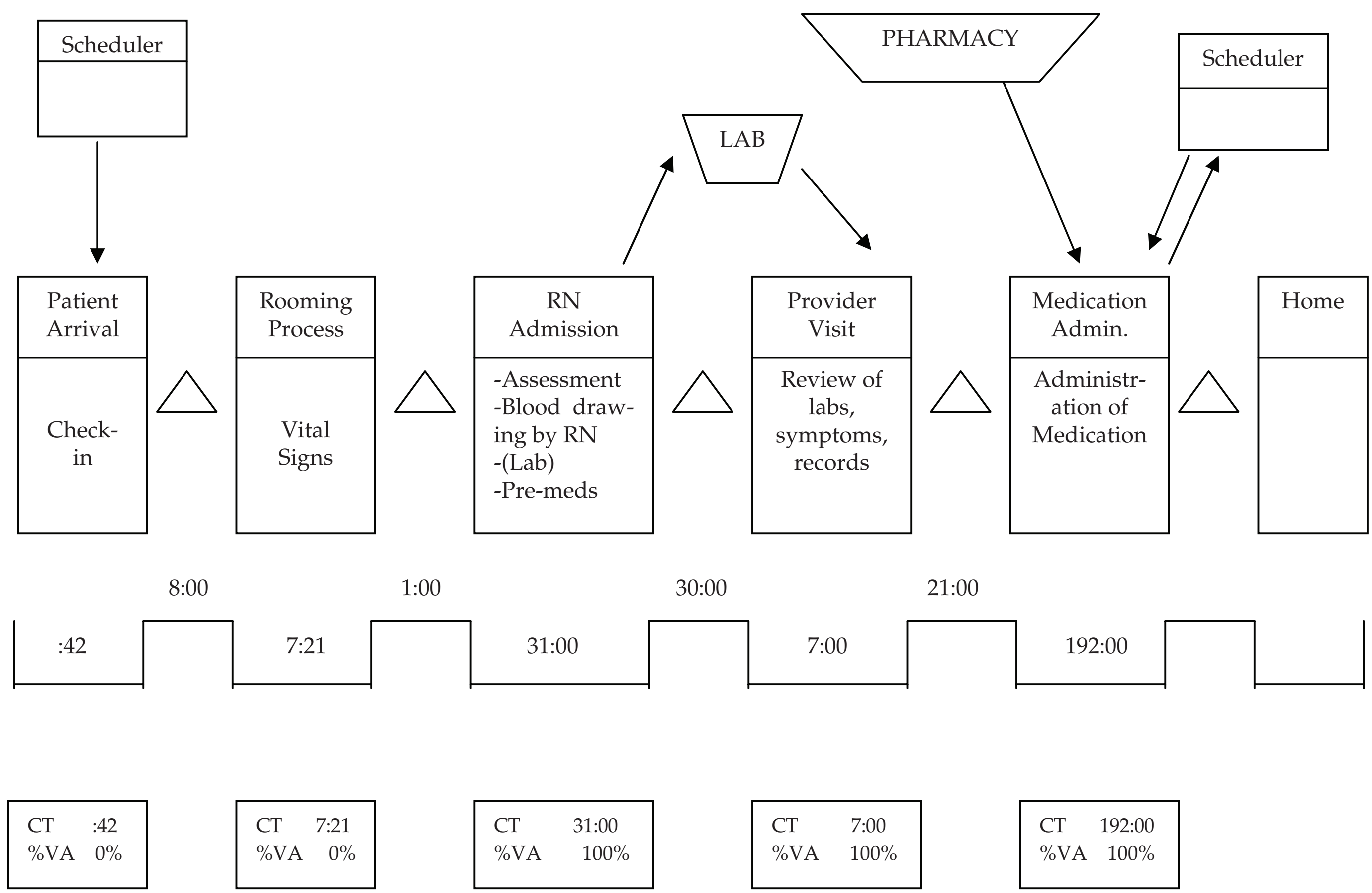
Exhibit 2 Virginia Mason Medical Center Strategic Plan



Source: Virginia Mason Medical Center internal document, 2001.

Exhibit 3 Hematology/Oncology Superflow Value-Stream Map

Lead Time	298:03
Processing Time	238:00
% Value Added (VA)	79%
% Non-value Added (NVA)	21%



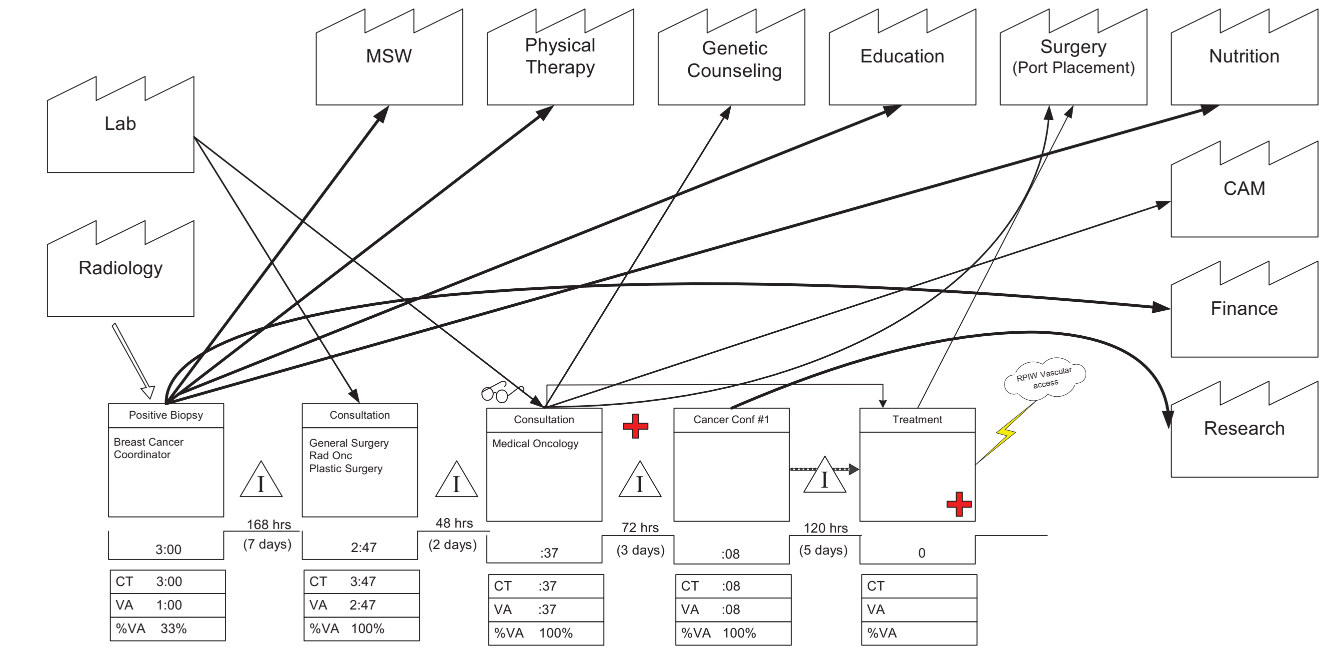
Lead Time: Arrival at reception desk to discharge

CT: Cycle Time

Source: Virginia Mason Medical Center, RPIW report out, 2005.

Exhibit 4 Breast Cancer Value-Stream Maps

Current State Value-Stream Map Breast Cancer



Number of cancer patients per year ÷ 2080 hours = 6.7 hours takt time

<u>**Definitions**</u>

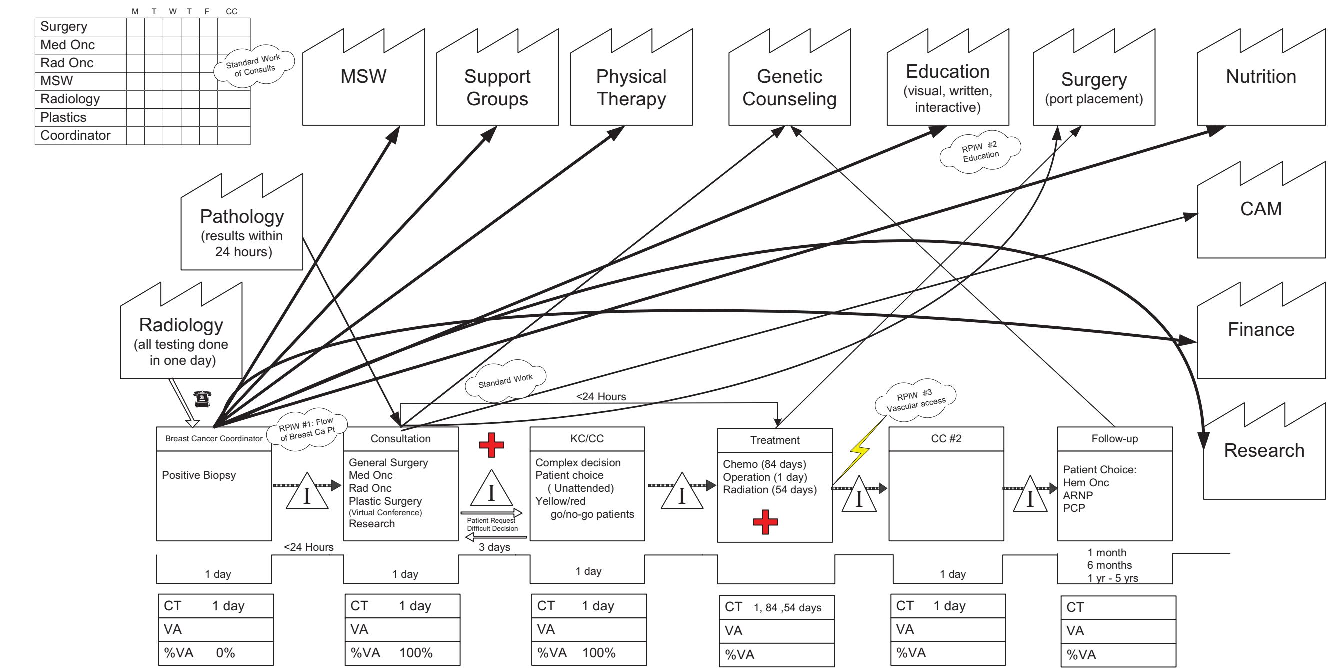
CT = Cycle Time: Total manual working time for one cycle of the work sequence.
LT = Lead Time: Total elapsed time from positive biopsy to start of treatment. Current = 20 days. Future = 10 days.
PT = Processing Time: The sum of all cycle times.
CO + Change Over: The length of time between the last piece of one run to the production of the first piece of the next run.
VA = Value Added : Part of the process that changes the form, fit, or function of the product or service; something that the customer ***is*** willing to pay for.
NVA=Non Value Added: Part of the process that does not change the form, fit or function of the product or service; something that the customer ***is not*** willing to pay for.

Lead Time	480 hrs (20 days)
Process Time	6.5 hours
Value Added (VA) TIme	4.5 hours
Non Value Added (NVA)	476.5 hours
% VA	1%
% NVA	99%

1/04 Dubuque/Sylvester

Exhibit 4 (continued)

Future State Value-Stream Map Breast Cancer



Number of cancer patients per year ÷ 2080 hours = 6.9 hours takt time

Definitions

CT = Cycle Time: Total manual working time for one cycle of the work sequence.
LT = Lead Time: Total elapsed time from positive biopsy to start of treatment. Current = 20 days. Future = 10 days.
PT = Processing Time: The sum of all cycle times.
CO + Change Over: The length of time between the last piece of one run to the production of the first piece of the next run.
VA = Value Added : Part of the process that changes the form, fit, or function of the product or service; something that the customer ***is*** willing to pay for.
NVA=Non Value Added: Part of the process that does not change the form, fit or function of the product or service; something that the customer ***is not*** willing to pay for.

Lead Time	201 days
Process Time	144 days
Value Added (VA) TIme	143 days
Non Value Added (NVA)	58 days
% VA	70%
% NVA	30%

3/04 Dubuque/Sylvester

Source: Virginia Mason Medical Center internal documents, 2004.

Exhibit 5 Target Progress Report Sheet

Target Progress Report

Team Name:	Date:
Department:	TAKT Time: (include calculation)
Product/Process Summary:	Team Leader: Sub-Team Leader: Workshop Leader: Process Owner: KPO Coach (if applicable):

Metric (units of measurement)	Baseline	Target	Day 2	Day 3	Day 4	Final	30 days mm/dd/yy	60 days mm/dd/yy	90 days mm/dd/yy	% Change
Space (square feet)		(>= 50%)								
Inventory (dollars)		(>= 90%)								
Staff Walking Distance (feet)		(>= 50%)								
Parts Travel Distance (feet)		(>= 50%)								
Lead Time (minutes)		(>= 50%)								
Work in Process (WIP) (units observed in the process)										
Standard Work In Process (SWIP) (lead time/takt time); target SWIP should be target lead time/takt time		(>= 50%)								
Quality (defects)(%)		0								
Productivity Gain (FTEs – see target metric definitions for formula to calculate baseline)		(>=50%)								
Environmental, Health & Safety (5S) (levels 1 thru 5) – specify for physical space or virtual space										
Set-up Reduction (minutes)		9 minutes or less								
Remarks:										

Takt time: the rate or time that a completed product or activity is finished in order to match customer requirements.

FTE: Full-time equivalent

Source: Virginia Mason Medical Center internal documents.

Exhibit 6 Rapid Process Improvement Workshops Completed, 2001–2005

Date	Unit	RPIW
2001	Department of Medicine and Satellites	Lead Time Reduction (Port Angeles), Lead Time Reduction (Kirkland), Gastroenterology
	Cancer and Cardiovascular Services	Cancer Care 3P
	Perioperative Services and Department of Surgery	Perioperative Services #1, Perioperative Services #2
	Administrative Services	Release of Information, Records Completion Area
2002	Department of Medicine and Satellites	Sleep Disorder Center, General Internal Medicine Process of Physical Exam, Federal Way Preauthorization and Referral Process, GI Endoscopy, Hyperbarics 3P, GI Endoscopy Physician Flow, GIM Patient and Information Flow, Bellevue & Downtown General Internal Medicine Results Reporting, Endoscopy
	Cancer and Cardiovascular Services	Mammography 3P Workshop, Cardiac Device, Cancer Care, Heart Cardiac Cath Lab, Cancer Care Patient Education, Heart CVL, Cancer Care, Echo Lab, Cardiac Cath & EP Lab
	Perioperative Services and Department of Surgery	Periop, Periop Sinoscopy, Periop PACU, Surgery Scheduling CSR, Orthopedics, Periop Pre Day Surgery, Urology, Peri-operative Services
	Administrative Services	Foundation, Billing #1, CIS, Human Resources, Accounts Payable, Education resources, Billing #2
2003	Department of Medicine and Satellites	Carscog Lipid Management, Dermatology Patient Prep for Exam, The Junk Drawer VM Kirkland Skill Task Alignment, Injection Room, Federal Way Medical Records, Pediatric Patient Flow Downtown, Improving Laboratory STAT Turnaround Times, Level Loading Ambulatory Care Visit, Psychiatry Patient Flow, RX Refill Process, Results Reporting, Pediatrics Immunization, Sleep Lab, Neurology Laboratory, Lynnwood Amb. Discharge Process, GIM Refill Authorization, Amb. Transplant Services, Disease State Management, PM & RMD Flow, Rehab Medicine Patient Flow, Neurology, Federal Way Speciality Clinic, Dermatology 3P, Adult Ambulatory Visit Flow, Peds Well Child Check Visit, Winslow Medical Records Prep, GI Ambulatory
	Cancer and Cardiovascular Services	Heart Patient Flow, Cancer Services 3P, Anticoagulation Clinic, Delivery of Chemotherapy / Biological Agents, Heart EP Cath Lab to PCU Flow, Radiation Oncology, Medical Oncology, Heart-Outpatient Stress Echo, Cancer Conference, Amb. Specialty Scheduling, Heart CVL, Cancer Chemotherapy, Radiology
	Perioperative Services and Department of Surgery	Periop Surgical Patient Flow, ENT Referral Information Flow, OR Supplies, Short Stay Perioperative Services, Urology Surgery Schedule, Periop GI ERCP, OR/CS Instrument Turnaround, Orthopedics & Sports Medicine, Periop Induction Room

Date	Unit	RPIW
	Administrative Services	Charge Slip Revision, Donor Recognition Process, Infection Surveillance, Biweekly Payroll, Health Resource Services, Patient Safety Alert, Admin. Scheduling, Clinical Research, Coding, Billing, Chart Integrity, Linen, VM Health System & Medical Center Boards, Preparation Process, Supply Chain, Finance Month-End Close, Insurance Payment Process, Release of Information, Supply Chain, Clinical Research Billing, HR Service and Process, RCA Incomplete Chart Process, Hospital Billing, Admin. Patient Arrival, HR Business Partner, Clinical Research
2004	Department of Medicine and Satellites	Clinical Laboratory CPOE Collection List, Sandpoint Pediatrics, PA - Internal Medicine Patient Flow, Issaquah - Optimizing Preventive Care Visits, Flu Shot (Spanish Team), Flu Shot (Avian Team), Flu Shot (Swine Team), Call Center, Lynnwood Patient Arrival, Federal Way Adult Family Medicine Flow, Federal Way Front Desk, Sleep Disorders Center, VM Winslow Patient Flow in Urgent Care, PA - Chart Prep Ensuring Info. Availability for the Patient Visit, GI
	Cancer and Cardiovascular Services	Vascular Access Device Placement, Cath & EP Labs Information Flow, Flow of the Comprehensive Prostate Cancer Clinic, Flow of Ancillary Services for Medical Oncology Patient, Echo-Scheduling & Resource Flow, Breast Cancer Patient Flow
	Perioperative Services and Department of Surgery	General Surgery Coding and Billing, Superflow - Family Flow, Superflow - Medication Flow, Superflow - Ambulatory Outpatient Flow, Superflow - Ambulatory Inpatient Flow, Gynecology/ Gynecology Oncology, Superflow Workshop: Perioperative Supplies Equipment Scheduling Team, Superflow Workshop: Perioperative Housekeeping Team, Superflow Workshop: Anesthesia Team, Superflow Workshop: Perioperative Surgical Team, Ophthalmology, Lab Superflow Workshop, PAAC Superflow Workshop, Surgery Superflow Workshop, Neurosurgery Patient Flow, Ambulatory Surgery Centers, Urology - Dissecting Patient Flow, Dept. of Plastics Chronic Wound Referrals, ENT Increasing Efficiencies in Audiology, Periop Day of Surgery Patient Preparation
	Administrative Services	Capital Budgeting Process, Charge Description Master, BRI Clinical Study Closeout, BRI Clinical Research and Radiology Info Flow, VNet Information Retrieval, Infection Control - Post-Exposure Management of Pertussis, Credentialing, Claims Payment Audit, Valet Parking, Performance Evaluation, Patient Communications, New Leader Orientation, Contract Review Process, Quality & Compliance Peer Review Survey, Service Recovery/Phase 2, Accounting Month-End Close, Approval of Medical Record Forms, Reassignment, Prospect Research, Payment Processing, Executive Scheduling II, Clinical RN Orientation, Referral and Pre-Authorization, Help Desk, Inpatient Record Assembly & Analysis Health Information Services, Temporary “Volume 90” Health Information Services, Standardized Charge Entry, Employee Health New Staff Intake Process, BRI Clinical Study Budget Negotiation, Transcription

Date	Unit	RPIW
		Clerical Support Process, Hiring a Provider, Patient Menu Ordering System, Admin. Phone Access, Release of Information
January–May 2005	Corporate Kaizen Promotion Office (KPO)	Product Location OR OMNI, Radiology ABN Coding, EOC Rounds, Revenue Cycle Claims Processing, Surgery Case Cart Distribution, Sterilizing Instrument Flow, ABN Process, TES Edits, Coding, New Product Review
	Hospital KPO	Emergency Department Flow, Pharmacy IV Medication Distribution, Oncology Medication Claims Payment, Patient Flow, Hospital Outlier
	Clinic KPO	Port Angeles Ambulatory Visits, Mammography, Radiology Scheduling, GI Procedures - Production Planning, GI Room Turnover, Results Turnaround, Hyperbaric Flow, Dermatology

Source: VMMC, 2005.

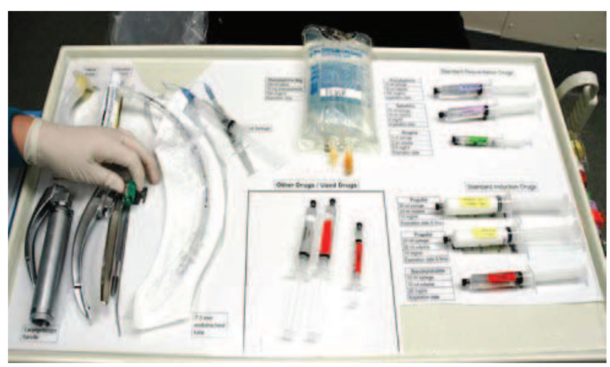
Exhibit 7 Example of 5S

PC Configuration Room Before 5S

PC Configuration After 5S

Anesthesia Shadow Board Before 5S

Anesthesia Shadow Board After 5S



Source: Virginia Mason Medical Center, 2005.

Exhibit 8 Everyday Lean Idea Worksheet—Winning Idea, August 2005

My Everyday Lean Idea

My Name: Ultrasound Team (Shannon Boswell) **Date:** July / 25 / 2005

Where I Work: Ultrasound / Radiology

When should I write down my ideas?

1. When I see a mistake being made in my work area.
2. When the problem happens.
3. When something you do every day makes you think there is a better way to get the job done.
4. When you see ways to make Virginia Mason safer for patients in your work area.
5. When you see ways to make Virginia Mason better for you and your work team.

How can I use this tool?

1. Complete an Everyday Lean Idea and get feedback from your team members if the idea will impact other processes. Who knows? Their input might make your idea better!
2. Try your Everyday Lean idea, implement it if logical and then pick an idea coach to review how it went (see back). This could be a teammate or your supervisor.
3. Don't be discouraged if one idea doesn't work. Many times, several ideas are needed to find the right solution.

1. Here's the situation and problem it is causing

- Remember, a picture is worth 1,000 words!
- Circle the types of waste involved
- What happens if you ask "why" 5 times?

We have so many standard processes, it's hard to remember them all. We wanted facts about compliance, rather than anectodal information.

2. Here's a description of my idea

Our team came up with a check off list of all pieces of standard process required for invasive procedures. All fields are expected to have a "✓" or we will assume it was not done.

please see attached form.

3. Here's how I tested my idea

We used this for 102 procedures. The compliance was calculated. The finding were posted.

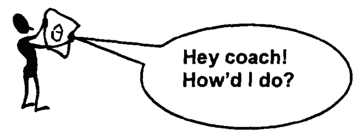
4. Here's the effect from trying the idea

We know exactly where we are at all time on pt. safety compliance. We mades some changes to the form (for mistake-proofing.) ~~We educated non-100%~~ compliant team members.

- 1 of 2 -

Exhibit 8 (continued)

5. Here's what I learned in reviewing the idea



My idea coach was
- [x] My supervisor: Jim Sapienza
- [ ] My teammate: ______
- [ ] Other: ______

Seeing a Problem (check all that apply)
- [x] *Good start*—I saw the problem and decided it could use some Everyday Lean help
- [x] *Good use of waste wheel*—I identified the waste that caused the problem
- [x] *Good job drilling deeper*—I also asked "why?" 5 times to find the root cause

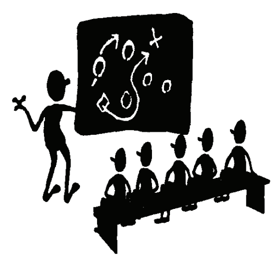
Getting an Idea (check all that apply)
- [x] *Good awareness*—I could see the problem
- [x] *Good start*—I had an improvement idea
- [x] *Good next step*—I tried my idea

Getting Results (check all that apply)
- [ ] *Good attempt*—The idea didn't work as hoped; I'll need to come up with new ideas
- [ ] *Good kaizen energy*—The idea worked but I still need to fully implement it

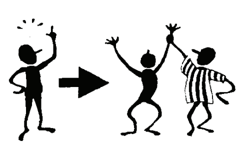
or:
- [x] *Good kaizen effect*—The problem was solved and the waste was eliminated

Notes on Next Steps for the Idea (e.g., a plan for testing or implementing the idea if needed, other tasks to make it successful, etc.): Jim liked it so well, it has been rolled out to all areas in radiology. We use it in mammo too! People like to have this in front of them.

6. Here's how my supervisor is sharing and recognizing this idea



- [x] We recognized and celebrated this Everyday Lean Idea in the following way: Sharing @ manager meeting
- [x] We are keeping a copy of this Everyday Lean Idea to reference during the next performance evaluation.
- [x] This idea was so helpful that we want the rest of Virginia Mason to be inspired by it. We are sending it to VMPS Implementation at M/S G2-KPO.



- 2 of 2 -

Source: Internal documents.

Exhibit 9 2002–2004 VMPS Results

Target Progress Report – RPIW's

Team Name: Virginia Mason Medical Center		Date: 2002-2005 roll-up as of May 05
Client: NA		TAKT Time:
Product/Process Summary: All 275 RPIW's from 2002-2004measured at 90 days post RPIW		Team Leaders: Gary S. Kaplan, MD, Chairman & CEO J. Michael Rona, President

Metric (units of measurement)	Baseline	Target	Results at 90-days	Percent Change
Space (square feet)	53,954 sq ft	31,921 sq ft	41,359 sq ft	24% Reduction
Inventory (dollars)	$709,731	$135,629	$350,480	51% Reduction
Staff Walking Distance (feet)	481,822 ft	240,314 ft	301,672 ft	38% Reduction
Parts Travel Distance (feet)	486,566 ft	189,079 ft	114,775 ft	77% Reduction
Lead Time (minutes)	1,926,719 min	907,610 min	914,751 min	53% Reduction
Work In Process (WIP) (units)	640,993 units	320,495 units	247,134 units	62% Reduction
Standard Work In Process (SWIP)	---	---	---	---
Quality (defects)(%)	---	---	---	47% Reduction
Productivity Gain (a) (minutes/FTE)	228.87 FTE	137.71 FTE	151.98 FTE	44% Gain
Environmental, Health & Safety (5S)	---	---	—	Organizational Level 3
Set-up Reduction (minutes)	572,203 min	190,092 min	101,882 min	83% Reduction

REMARKS: Other Capital and Operating Cash Savings:
SAVED $5-7M budgeted capital by using 3P effors in Dermatology, Cancer Center, Hyperbaric
SAVED $1-3M budgeted capital saved by avoiding planned move of Endoscopy suites after 3P
SAVED $6M capital by avoiding the addition of new surgery suites that were not needed after 3P
SAVED $1M+ by not replacing positions following attrition (from executive to line staff)
SAVED $450K on VAP associated costs from 2002 to 2004

(a) Number includes minutes of work eliminated from multiple operators converted to FTE equivalents.

Data compiled and validated by Christina Saint Martin, May 2005

Source: Virginia Mason Medical Center internal PowerPoint presentation, 2005.

Endnotes

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[2] K. Mishina, "Toyota Motor Manufacturing, U.S.A., Inc.," HBS Case No. 693-019 (Boston: Harvard Business School Publishing, 1992).

[3] "Toyota Is Now the World's Second-Largest Car Maker," *Knight Ridder Tribune Business News*, January 24, 2004.

[4] T. Fujimoto, "The Evolution of a Manufacturing System at Toyota" (New York, NY: Oxford University Press, 1999).

[5] S. Spear and H.K. Bowen, "Decoding the DNA of the Toyota Production System," *Harvard Business Review* (1999): 104.

[6] Ibid., p. 102.

[7] Ibid., p. 101.

[8] Ibid.

[9] Shirouzu and Moffett, "Bumpy Road: As Toyota Closes in on GM, Quality Concerns Also Grow—Amid Record Profits, It Strives to Staunch Flow of Errors; Dearth of Production Gurus—Tutoring Americans in Kaizen," *The Wall Street Journal*, August 4, 2004.

[10] Ibid., p. 97.

[11] This paragraph draws on J.R. Hackman and R. Wageman, "Total Quality Management: Empirical, conceptual and practical issues," *Administrative Science Quarterly* 40 (2) (1995): 309–342.

[12] D. Blumenthal and C. Kilo, "A report card on continuous quality improvement," *Milbank Quarterly* 76(4) (1998): 625–648.

[13] S.M. Shortell, C.L. Bennett, and G.R. Byck, "Assessing the impact of continuous quality improvement on clinical practice: What it will take to accelerate progress," *Milbank Quarterly* 76 (4) (1998): 593–624.

[14] M. Beer, "Why Total Quality Management Programs Do Not Persist: The Role of Management Quality and Implications for Leading a TQM Transformation," *Decision Sciences* 34 (4) (2003): 623–642.

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[16] Shortell, Bennett, and Byck, "Assessing the Impact."

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[22] D.N. Thompson, G.A. Wolf, and S.J. Spear, "Driving improvement in patient care: lessons from Toyota," *The Journal of Nursing Administration* 33 (11) (November 2003): 585–595.

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[24] As quoted by Dr. Gary Kaplan, October 7, 2005, personal communication.

[25] The IHI, as part of their 100,000 lives campaign, centralized six clinical best practices. In addition to the four mentioned at VMMC, IHI developed best practices around rapid response teams and preventing adverse drug events. The IHI released specific data and how-to guides to support hospitals in implementing bundles.

[26] VMMC internal PowerPoint presentation.

[27] "Health care professionals learn how to use value- stream mapping at workshop," *Physician Business Week*, October 25, 2005, p. 20; "To boost efficiency, hospitals borrow principles from factory floor," *Managed Care Business Week*, May 3, 2005, p. 122; J. Sneider, "Hospitals going 'lean' to become more efficient," *The Business Journal* 21 (38) (2004): A14.