

Can car manufacturing techniques reform health care?

The production techniques developed by Toyota have made the Japanese company one of the world's most efficient manufacturers. Now, a number of US hospitals are adopting the car maker's techniques to cut costs, reduce errors, and improve patient satisfaction. Michael McCarthy reports.

In 2001, Gary Kaplan, the chief executive of Virginia Mason Medical Center in Seattle, Washington, flew to Japan to see how Toyota built cars. The company is world-renowned for its highly efficient "just in time" production system that has made its employees some of the most productive, and its cars some of the most sought-after, in the world.

Kaplan was impressed. What he saw, he says, "was what's possible: that you can create products with no defects; you can have exactly what you need when you need it—and no more and no less—and have that happen every single time. It was the antithesis of what you see in health care."

Since 2001, Virginia Mason Medical Center has sent seven teams to Japan, at a cost of over US\$1.6 million, to train in the Toyota approach. As part of the 2-week course, the teams of doctors, nurses, and other staff analyse assembly line production at a Hitachi air conditioner plant. There they identify every step a worker takes to complete a task, timing each step with a stop watch.

They then must find ways to eliminate any waste or inefficiencies they identify.

Back in Seattle the teams then apply the same techniques to streamline hospital and clinic operations. To date, the centre credits the approach with reducing the distance walked by the staff by 34 miles a day, freeing up 13 000 square feet of space that had been used for storage and other unproductive uses, and saving the hospital \$11 million in planned capital investments. Infection rates are down, says Kaplan, and patient satisfaction is up.

The Toyota Production System was developed by the company's founder Sakichi Toyoda, his son Kiichiro Toyoda, but primarily by Taiichi Ohno, a company engineer. The goal of the approach is to refine production so that work flows smoothly from one step to the next with no wasted time, effort, or resources. The essential elements of each step are identified. Any step that does not add value to the product is considered waste or "muda". The process is then reorganised to eliminate any

muda. The new process is then standardised, mistake-proofed, and implemented. Then the analysis is done again, and again, and again, a process of continual, incremental improvement called "kaizen" in Japanese.

"Every value stream we've ever mapped—and we've mapped all our major processes—in every process there's been over 50% non-value-added time", Kaplan says.

John Black, a former Boeing Company employee who helped introduce the Toyota Production System to the aerospace giant's assembly lines, and whose Seattle-based company now works with health-care organisations, says "muda" is everywhere in the US health-care system. "You look around a hospital, and what you see are people waiting", Black says. "Patients are waiting for doctors; doctors are waiting for patients."

Patients waiting, like excess inventory piling up on an assembly line, are a sign that services are not flowing. Mike Kaupa, senior vice president of lean production at Park Nicollet, a health-care network in Minneapolis, MN, said one of the first things he did when he started to apply the Toyota approach was go on a "waste walk" around the hospital and clinic to see how many waiting rooms there were. When he got back to his office he obtained the blueprints for the hospital and the main clinic and found that those two buildings alone had 50 000 square feet dedicated to waiting rooms, space that had cost roughly \$7.5 million to build.

Using Toyota techniques, Park Nicollet cut patient waiting times to the point that the centre's new ambulatory clinic has no waiting

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Toyota's techniques are being studied by teams of health workers from Seattle

rooms. This is possible because the clinic adopted the "one-piece flow" production system used by Toyota. Before, patients were processed in batches. If there were five examination rooms, for example, patients were scheduled in batches of five. The nurses and doctors would then hustle from room to room hoping to clear the rooms for the next scheduled batch checked in. Delays inevitably occurred, and patients backed up in the waiting rooms.

Now, the patients are "feathered in", Kaupa says. The first patient of the day is signed in at 0800 h and immediately sent to the exam room, the next patient comes in at 0810, the next at 0820, and so on in 10-minute intervals. The nurse, followed by the doctor, and then perhaps by the lab technician, sees each patient in order so that the services they provide come to the patient in a steady, even "flow". At the end of the day, no additional patients are signed in after 1600 h, so the clinic gradually empties room by room until it's empty. At closing time the rooms are empty.

Louise Barker, circulating nurse in the Virginia Mason operating room who trained in the UK and worked in NHS hospitals until she moved to Seattle 3 years ago, says small changes make a big difference. Shadow boards, for example, commonly used in factories to keep tools in order, are now used in the Virginia Mason operating rooms to ensure that all the drugs and instruments needed during a procedure are at hand and easily found. "This is not rocket science", Barker says.

A big source of inefficiency in health care is the unnecessary variations in practice, says Park Nicollet's Kaupa. In one exercise, the Park Nicollet team brought the hospital's orthopaedic surgeons into a room where all the instruments and supplies they had ordered for total hip and total knee replacement surgery were laid out on a table, each with a

price tag attached. The surgeons had no idea that they used so many different instruments and supplies for the same procedures, Kaupa says, and after a discussion they were able to reduce the number of instruments on the case carts by 60%. The exercise was repeated for general surgery, and the centre now has to sterilise and decontaminate 40 000 fewer items per month.

A key element to success of the approach is to remind doctors that the patients, not the doctors, are the customers, says consultant Black. The new outpatient oncology clinic at Virginia Mason, for example, was designed to serve patient needs not doctors' preferences, says Henry Otero, an oncologist. Instead being off by themselves in private offices, doctors now work from small centrally located workstations right next to the nursing and scheduling teams. The result is better communication, faster resolution of problems, and fewer errors, Otero says.

As part of the design process, a team of doctors, nursing, clerical staff, and patients sat down with the old clinics floor plan to work out how far a patient had to walk during a visit to the clinic. They used a piece of blue yarn to keep track of the distance the patient travelled as they went from registration, to the waiting room, to the laboratory, to the clinic, to the chemotherapy infusion room, and so on. The result was shocking, says Otero, "The yarn kept getting longer and longer."

The exercise revealed that the typical patient had to travel 736 feet during a visit. And if they had to undergo additional therapy, such as radiation treatments, that distance might stretch to over 1300 feet. "We had no idea how far our patients were walking", Otero says. With the new design, services come to the patients, who now have to travel a total of only 126 feet.

Otero cannot say the adoption of the Toyota approach has improved

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Lean production techniques have enabled one clinic to eliminate waiting rooms

his life so far. He says the continuous change as improvements are constantly being implemented is difficult to deal with. The experience of his patients, however, has clearly improved, Otero says. "I see my patients getting into the room on time; I see my patients getting treatment without having to walk long distances; I see them not waiting."

Harvard Business School professor and physician Richard Bohmer, who studies innovations in health-care delivery, says the Toyota approach seems promising. Past attempts to apply business-management techniques to health care have been limited to individual processes, he says, such as pharmacy inventory control. And policy-reform initiatives, such as pay-for-performance, have sought to effect change by trying to influence the decision-making of individual doctors. Both approaches ignore the "ebb and flow" of staff and services in hospitals and clinics. Efforts to apply the Toyota approach require doctors and other health-care providers to seriously ask who are their customers and just what are the services they provide. "What they are doing is noteworthy", Bohmer says, "because they are really trying to stop and ask what is the nature of medical work? What is it we do? And how do we organise it?"

Michael McCarthy