

## **The Continuous Improvement Process and the Role of Ergonomics**

Carolyn T. Coffin, MPH, RDMS, RVT, RDCS, BOEC

Seattle University

Sound Ergonomics, LLC

Today's healthcare facilities are faced with many challenges including standardizing exams, diagnostic confidence, reproducibility, timely patient care and work flow. Hospitals are exploring new management strategies, and some have implemented continuous improvement procedures similar to those employed in the Toyota Production System (TPS) and referred to as "lean manufacturing".

In the 1980's, Toyota developed a flexible manufacturing process of producing small lots of different automobile models in response to the growing need for cars. This was in contrast to the system of mass production used in the United States. This "just-in-time" manufacturing approach allowed Toyota and other Japanese manufacturers to be more flexible in their ability to rapidly change and expand their product lines in response to the market.<sup>1</sup> The Toyota Production System also allowed the achievement of high quality, low cost and decreased production time by eliminating waste.<sup>2</sup> These same principles can be employed by hospital departments to streamline a patient's experience and eliminate wasted steps and processes.

Lean management is a strategy that strives to improve work processes and the corporate culture, and it can be applied to any organization. It aims to eliminate waste, decrease inefficiencies and increase productivity. A term often used for this process is "kaizen", which means continuous improvement. Kaizen is a daily activity that humanizes the workplace and teaches employees how to recognize and eliminate waste in their work environment.<sup>3</sup> Changes to an organization's operating systems should be gradual, continuous and should involve input from all employees. The standards set by an organization should always be reviewed and changed to meet the needs of both the organization and the customer.

Changes to an organization's structure can be made at 3 levels:

- Improvements can be made in the way work is performed, which is referred to as "point kaizen". This is illustrated in imaging departments with the conversion from capturing and storing exams on film to storing them on PAC systems. The time for processing and reviewing images has been reduced, image quality has improved and the wait time for patients to receive their results or any further testing has been reduced. Work flow is redesigned and unnecessary steps are reduced or eliminated.<sup>4</sup>
- The entire patient or customer experience can be redesigned, referred to as "value stream kaizen". Here, hospitals are referred to as "value streams" rather than departments. A value stream, in this setting, is a collection of all the procedures required to move a patient through the process of diagnosis and treatment.<sup>5</sup> Patient registration can be streamlined, centralized and simplified, and wait times can be reduced. Diagnostic testing departments could be

grouped together with a central registration area so that patients can move seamlessly from one type of exam or test to another. This eliminates the “silo” effect in which different departments are located in different areas of the hospital and patients must start all over again providing their personal information to each new department. This level of re-structuring may also require that a facility no longer out-source some of its more frequently used services. For instance, a hospital may provide general ultrasound services through an in-house department but may out-source vascular or cardiac ultrasound services to an independent provider. This becomes confusing for the patients and forces them to provide their personal information and consent for treatment to another entity, which to them seems redundant and disjointed. And, they are expected to accept that the quality of care from an outside provider is at least equal to the quality of care they have been receiving in a facility with which they are familiar. Another example is how a patient flows through the system to be diagnosed and treated for a shoulder injury. The diagnosis may be made through an imaging study, either in the radiology or ultrasound departments; the patient then sees the referring physician for the results and a treatment plan. The referring physician may or may not be located in the same facility as the imaging department. Finally, as part of his or her treatment, the patient might be referred for physical therapy, which again may be in a different location. Although all of these activities relate to one injury and diagnosis, the patient has to travel to different locations and register with three different administrative offices. Throughout this process, there is always the chance that the transfer of patient information is incomplete.

- “System kaizen” changes how the entire customer experience is managed and how support departments and activities are organized. This seemingly ties in with the second level since re-organizing the support activities changes the patient experience.<sup>4</sup>

Value stream mapping can be used to initiate the organization’s transformation into the lean management model. This tool creates the basis for thoughtful decision making. First, one patient process or hospital department is chosen for improvement. Then, a summary of how things are currently being done is outlined, which produces a self-study that identifies strengths and weaknesses. The last step is to create a map of how things will look once weaknesses have been addressed and inefficiencies removed.<sup>5</sup>

Another strategy similar to Lean is Six Sigma. Six Sigma is a measurement-based, data-driven approach that focuses on improving processes. This is a goal-oriented approach that statistically determines the chances for a process defect by using a specific calculator.<sup>6,7,9</sup> Improvement efforts are based on what the patient/customer defines as a defect or flawed process, which requires an understanding of the patient’s expectations of quality. This method uses five steps: define, measure, analyze, improve and control (DMAIC). Each step requires objective measurements and data collection.<sup>7,8</sup> Not all processes need to undergo rigorous

improvement; key criteria for this determination include the importance of the process and the return on investment for implementing the improvement.<sup>7</sup>

Six sigma principles are well suited for healthcare facilities because of the potential for reducing medical errors, as well as streamlining patient exam time. One medical facility implemented these principles in the outpatient CT lab by reducing patient preparation time. The result was a 45% increase in the number of examinations without adding more equipment or shifts.<sup>9</sup> Many continuous improvement methods encourage, for the most part, bottom-up management rather than top-down management. A program in Great Britain called The Productive Ward: Releasing time to care™ by the NHS Institute has demonstrated how they addressed improving healthcare delivery. Patient care teams are given the skills, information and time to identify areas for improvement and to make changes in how they care for their patients. The results have been increased quality of care, reduction in hospital stays, increased productivity, improved employee morale and decreased absence rates.<sup>10</sup>

Another approach is the Quality Control Circle (QCC) which is intended to be a self-governing organization of employees who work toward goals that have been determined by management. In practice in the healthcare sector, the members of a patient care team receive training in problem solving and group processes. The team then meets regularly to discuss work-related problems and provide solutions using a set of statistical tools. The solutions are presented to management for implementation as part of the standard work practices. This concept motivates workers to contribute to the effectiveness of the organization, and the team can become a permanent feature of the organization.<sup>11,12</sup> Techniques commonly used include brainstorming, formally identifying changes that will generate major results, identifying the likely causes of a problem, analyzing the problem, generating & selecting appropriate solutions, preparing an action plan, presenting the plan for management approval and implementation of the solutions.<sup>12</sup>

As medical facilities move to implement continuous improvement methods, optimizing work flow is one process that can be reviewed. More efficient work flow in ultrasound departments not only improves the patient experience but can improve productivity. The use of protocol management programs, which are available on many ultrasound systems, can provide a number of benefits. Protocols, which are tailored to each facility's requirements, standardize each type of exam so that a patient's exam is reproducible regardless of who performs the exam or in which facility. Standardized protocols expedite the interpretation process, since physicians have the expectation that the image sequence for exams will be logical and the same or similar each time. New employees and/or students can more readily learn the department's exam protocols if they have a standard list to follow. Per diem employees can more readily fit into a department's work flow if there is a standardized exam protocol. And, exam time may be reduced. This has the benefit of not only increasing department productivity but also reducing transducer time for the sonographers, which subsequently reduces their exposure to injury risk factors.

Occupational injuries, or work-related musculoskeletal disorders (WRMSD) among sonography professionals has been increasing since it was first reported in 1997.<sup>13,14</sup> Many of the challenges facing imaging departments center around a stable, experienced workforce which means that worker injury can have a large impact on the department's bottom line and worker morale. Improving an ultrasound department's work flow and productivity could potentially result in each sonographer performing more exams each day. This increased volume could lead to injuries if the individual worker is unaware of how to optimize the workstation and how to make changes in his/her work postures. Mitigating these risk factors lends itself to the Quality Control Circle (QCC) approach since it engages the workers in meaningful discussions as to how to reduce injury risks.

The following are steps for adapting QCC to the ultrasound department:

1. Identify a specific goal toward which the sonographers will work. In this example, the goal is to reduce the risks for WRMSD in the department. The employees are then instructed in problem solving and statistical quality control.
2. The sonographers determine specific times during which they can meet regularly to discuss the areas of most injury and the various causes for these injuries. Typically, this would involve evaluating the workstation equipment, which includes not only the ultrasound system but the exam table and chair as well. This also involves reviewing how each sonographer performs each exam and which work postures should be changed in order to more closely approximate neutral body positions. It may be beneficial to have an industry-specific ergonomics specialist perform a worksite evaluation during this step in order for the sonographers to understand what postures should be changed, how exams can be performed in a more comfortable, ergonomic way and how the workstations can be arranged so as to optimize good work postures. This evaluation would provide the group with a formal report focusing on areas that need to be improved and highlighting areas that are working well.
3. The team then considers the appropriate solutions giving consideration to the associated costs, the effectiveness of each solution and the likelihood that one or more solution will be implemented. In this step, the sonographers may determine that to reduce arm abduction, and consequently shoulder pain and injury, they should raise and lower the exam table as appropriate throughout the exam. This is a reasonable solution only if the exam table is easily & quickly height adjustable. If each exam room has this type of table, then implementing this solution has no associated costs and has a high likelihood of being implemented through worker education. However, if this type of exam table has to be purchased for each exam room, it may not be a feasible solution at this time. Therefore, the team would have an alternative solution for this problem, such as using less expensive height adjustable chairs or standing and sitting throughout each exam in order to reduce arm abduction.

Each solution should have an alternative, especially if it has an impact on the department's budget. Although using ergonomic workstation equipment is an important part of reducing injury risks and has a high return on investment (ROI), changing worker behavior is critical to

the success of any ergonomics program. Making these no or low cost changes is a significant first step toward an injury-free and productive department; and ergonomic equipment can be planned for and purchased over time

4. Once the team has identified solutions they feel will be effective in the department, it prepares an action plan that is submitted to management.
5. Management then must approve the plan and assist in starting the implementation process. The department manager may schedule worker education sessions that regularly review best work practices; group stretching exercise sessions may be implemented; and ergonomic equipment, including personal adaptive products, may be added to the budget.
6. Once the action plan is implemented, the changes should be evaluated for effectiveness. This can be done as a formal pilot program or by using informal reporting. It is valuable at this stage to engage an industry-specific ergonomics specialist to provide a long-term compliance program which may include someone on the team being responsible for adherence to the program.

Ergonomics can affect an entire organization by enhancing the most important component of its business – the ability of workers to do their work. Ergonomics strives to fit the job to the worker rather than expecting the worker to fit into a static work environment. By reducing injuries, experienced workers can be retained and can perform at their best level. This impacts the quality of patient care, productivity and profits.

Initiating a continuous improvement program requires that the key personnel are willing to make changes. Very often workers and/or managers are resistant to change for a variety of reasons. Workers will be resistant if they have not been consulted about the process or the need for change. They fear that any changes might negatively affect their established work patterns or may even threaten their jobs. In busy departments, the workers may not view the benefits of change as outweighing the effort. In some instances, fatigue is a factor and the effort needed to implement change and to assess the effects seems too exhausting. Clearly communicating the need for continuous improvement programs and the components of those programs will create awareness among the workers. Establishing the culture of “bottom-up” management empowers the employees and allows them to develop the skills to actively participate in the change process. This type of environment gives the workers “permission” to change and demonstrates respect for their role in the organization. Traditional “top-down” management can be viewed by the employees as unapproachable and unconcerned with their issues and concerns. The employees continue to work in a difficult environment which can lead to work injury and poor morale. In healthcare, this can transfer to poor patient care, long wait times, and a disinterested workforce.

Conclusion:

## REFERENCES:

1. Cusumano MA. The Limits of “Lean”; Sloan Management Review. Summer, 1994, pp 27-32
2. Orenstein B., Lean Management: Wisconsin’s Theda Care Improves its Radiation Oncology Care Process; Radiology Today, June 15, 2009; pp 14-17
3. <http://en.wikipedia.org/wiki/Kaizen>. Kaizen 4/15/2009
4. Jones DT. Lean Thinking for the NHS; Lean Enterprise Academy webinar; [www.leanuk.org](http://www.leanuk.org)
5. Abdulmalek FA, Rajgopal J. Analyzing the benefit of lean manufacturing and value stream mapping via simulation: A process sector case study; Inter J of Production Economics, 107 (2007) 223-236
6. Six Sigma – What is Six Sigma? Retrieved from <http://www.isixsigma.com/sixsigma>.
7. Linderman k, Schroeder RG, Zaheer S, Choo AS, Carlson CL. Six Sigma: a goal-theoretic perspective; J of Operations Management, Vol 21, Issue 2, March 2003, pp 193-203.
8. Schroeder RG, Linderman , Liedtke C, Choo AS. Six Sigma: Definition and underlying theory, J of Operations Management 26 (2008),pp 536-554.
9. Kwak YH, Anbari FT. Benefits, obstacles, and future of six sigma approach Technovation xx (2004) 1-8.
10. Rapid Impact Assessment of The Productive Ward: Releasing time to care™: Executive Summary, NHS Institute for Innovation and Improvement, January 2011.
11. Lillrnak P. The transfer of management innovations from Japan. Organization Studies 1995 16: 971-989.
12. Gaikwad V V, Gaikwad A V. Quality Circle as an Effectige Management Tool: A Cse Study of Indira College of Engineering and management Library; ICAL 2009, 650-653. Retrieved from <http://crl.du.ac.in/ical09>.
13. Pike I, Russo A, Berkowitz J, Baker J, Lessoway V. The prevalence of musculoskeletal disorders among diagnostic medical sonographers. *J Diagn Med Sonography* 1997; 13:219-227.
14. Evans K, Roll S, Baker J. Work-related musculoskeletal disorders (WRMDS) among registered diagnostic medical sonographers & vascular technologists: a representative sample. *J Diagn Med Sonography* 2009; 25:287-299