Building a Better Intensive Care Unit: The Role of Industrial Process Improvement in Critical Care

Increased recognition of the gap between evidence and practice is among the defining characteristics of modern medicine. Patients frequently do not receive evidence-based therapies proven to save lives, which results in preventable morbidity and mortality and potentially costs the health system millions of dollars each year.[1] In few areas of health care is the problem as acute as in the intensive care unit (ICU). ICU complications are common and expensive, and evidenced-based therapies to prevent these problems are vastly underutilized.[2] Use of low-tidal-volume ventilation for acute lung injury, and noninvasive ventilation for obstructive airways disease, is increasing, but there are ample data to suggest that adoption is still incomplete.[3]

The science of quality improvement is designed to help close this gap between evidence and practice. Indeed, the literature dedicated to quality measurement and improvement in the ICU is extensive.[4] Yet traditional quality-improvement is quite limited in both its scope and effect. Traditional quality-improvement initiatives only target individual care processes, rely on individuals to change their behavior, and must be based on existing knowledge. As such, they lack the flexibility to adapt as the evidence base evolves and they fail to address the fact that quality is a product not of individuals but of the organization as a whole.

To address these limitations, some health policy experts and hospital administrators have sought lessons from manufacturing and industrial engineering.[5,6] Manufacturing firms seek to maximize profits by improving efficiency and reducing waste. Production defects, workplace accidents, and employee turnover are threats to that primary goal. Manufacturers that design their industrial processes to overcome these threats are rewarded with increased revenue and a better ability to compete in the global marketplace. The analogy to health care organizations is clear. Rather than profits, the goal of the quality movement is to maximize patient welfare. Unnecessary variation in care, medical errors, staff turnover, and an inability to translate new evidence into practice are all threats to that goal, in the same way that analogous forms of waste are threats to profits in manufacturing.

The most successful manufacturing firms practice what is known as "total quality management," in which every aspect of an organization's culture is geared toward quality. Perhaps the best example of total quality management is the Toyota company's production system. Toyota has become the most profitable automaker in the world by implementing the "Toyota Way," a revolutionary way of thinking about industrial process improvement.[7] The Toyota Way emphasizes long-term strategy over short-term gain, standardization of production tasks, continual observation and problem solving, and shared decision making among all employees. Toyota employees are empowered to think creatively about problems and potential solutions. Importantly, the Toyota Way is not just a set of tools for standardizing production: it is also a philosophy for quality and safety universally held among all members of the organization.

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There are many reasons why the lessons of the Toyota Way might apply directly to the ICU. In automobile manufacturing, many complex processes must work together for a single goal. The same is true in critical care. Respiratory therapy, pharmacy, blood bank, radiology, and transport must work together seamlessly to provide effective patient care. A backlog in any one area can disrupt the entire chain. Industrial process improvement seeks to reduce unnecessary variation in the manufacturing process, which can lead to accidents, errors, and waste. Reducing variation also appears to be beneficial in critical care. Protocols for weaning and sedation reduce variation and are proven to shorten duration of mechanical ventilation and ICU stay.[8] Standardizing other care processes, such as central venous line insertion, may lead to similar improvements in outcome.[9]

Another lesson of the Toyota Way that directly applies in the ICU is the readiness to adopt new technologies. The Toyota culture encourages workers to seek out and implement proven processes that can improve work flow and quality. Adoption of new evidence into practice is also a key feature of successful ICUs and may be similarly related to workplace culture. Research in this issue of RESPIRATORY CARE nicely demonstrates this point. By way of detailed interviews of the heads of respiratory therapy departments, Stoller et al show that respiratory therapy departments that rapidly adopted a set of key care practices

also seemed to possess an overall culture of change.[10] These "change-avid" respiratory therapy departments were more likely to perform continuous quality improvement, utilize effective communication techniques, empower therapists to advance new ideas, and foster a culture of change throughout the entire organization.

Despite the potential benefits of total quality management programs like the Toyota Way, there are some reasons these programs may not work well in the ICU. One concern about applying the principle of standardization to health care is that, while uniformity is the goal in making automobiles, patients differ widely in their pathophysiology, care preferences, and expected outcome. Completely standardizing care processes might limit our ability to recognize when a patient deviates from the usual course and to customize the care plan accordingly. However, these arguments against standardization begin to ring hollow when we recognize that not only do patients differ less than we think, but also that whether or not patients differ in their responses to treatment, standardization may still bring the best chances to each patient.

Another concern is that manufacturing firms and ICUs possess different incentives for quality. The primary incentive in manufacturing is profits, whereas the primary incentive in patient care is professionalism. For the most part, hospitals lack financial incentives to improve efficiency and reduce errors, and in many cases active disincentives exist: physicians and hospitals are reimbursed equally for high-quality and low-quality care. The pay-for-performance movement and Medicare's plan not to reimburse hospitals for preventable infections are steps toward linking quality to revenue. Yet total quality management in the ICU may not be effective until regulators and payers can make more of a business case for quality.[11]

Ultimately, whether total quality management programs such as the Toyota Way will improve outcomes in the ICU is a testable hypothesis. Industrial process improvement should be rigorously studied like any other quality-improvement initiative. Researchers should attempt to directly link these programs not only to evidence-based care processes but also to patient-centered outcomes and costs. We must remember that the science of quality improvement is just that: a science. As we seek to better implement evidence-based practices, the tools by which we implement these practices must themselves be evidence-based. Poor-quality patient care necessitates radical changes to the way we provide care in the ICU. It is up to all of us to determine if industrial process improvement offers a meaningful strategy for implementing this type of change.

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