J Nurs Care Qual
Vol. 33, No. 4, pp. 309–315
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Intersecting Evidence-Based Practice With a Lean Improvement Model

CE 1.0 Contact Hour

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In our journey from Magnet designation to a Lean hospital, a team of advanced practice nurses, a nurse scientist, and Lean specialists developed a crosswalk of evidence-based practice (EBP) with Lean to explicitly embed the use of evidence in our organization's 4-step problem-solving method. Once finalized, the blended Lean-EBP model now guides improvement work as highlighted in the example of updating our practice for frequency of changing peripheral intravenous catheters.
Key words: *continuous improvement*, *evidence-based practice*, *improvement*, *Lean*

IN 2010, our organization achieved its first Magnet designation. During the time of our Magnet designation, plans were underway to transform our culture and become a Lean hospital. Our Lean journey officially began in 2010 when Lean was adopted as the business management system and method for continuous improvement. Blending evidence-based practice (EBP) with Lean became a significant need to maintain our professional mandate to base clinical practice on the best available evidence while engaging in continuous improvement.

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The authors declare no conflicts of interest.

Supplemental digital content is available for this article. Direct URL citations appear in the printed text and are provided in the HTML and PDF versions of this article on the journal's Web site (www.jncqjournal.com).

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Accepted for publication: November 6, 2017
Published ahead of print: December 18, 2017
DOI: 10.1097/NCQ.0000000000000313

OVERVIEW OF EVIDENCE-BASED PRACTICE AND LEAN

Evidence-based practice

EBP is a clinical improvement model that engages nurses to use scientific inquiry to discover new evidence to regularly inform their practice and improve patient/family outcomes. It begins with cultivating a culture of inquiry. This culture sparks development of PICO(T) (problem or population, intervention, comparison, outcome, timing) questions that lead clinicians to search for the best external evidence. Retrieved evidence is critically appraised. High-level quality

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evidence related to the PICO(T) question is then integrated with clinical expertise and patient preferences/values in shared clinical decision-making with applicable populations. Outcomes of the EBP change are evaluated against metrics identified in the literature, and these findings are disseminated to clinicians and key stakeholders to make decisions for application to clinical practice. When such evidence is implemented to provide the safest high-quality care, organizations may realize financial savings due to prevention of complications and hospital-acquired conditions, decreased resource utilization and inpatient costs, lowered hospital stays, as well as avoidance of financial penalties associated with value-based purchasing.[1-9]

Lean

As a model for continuous improvement, Lean emphasizes going to the *Gemba*—the actual place where the work occurs—and finding waste or steps in processes that are non–value-added. Non–value-added activities are viewed as steps that patients would not be willing to pay for and thus bring no value. In Lean, non–value-added work may be categorized per 8 types of waste [10]: (1) waiting—idle time (eg, time patient spends waiting for imaging test); (2) transportation (conveyance)—excessive movement of patients, staff, or materials (eg, transferring admitted patient to a different unit with similar level of care soon after admission); (3) defects—repair of a product or service to fulfill patient/family expectations (eg, medication error from use of wrong insulin pen); (4) inventory—unnecessary supplies or materials (eg, more supplies on hand than needed or expired medications and/or supplies); (5) overprocessing—unnecessary or overcomplicated activities (eg, unnecessary diagnostic tests); (6) motion—excess movement (eg, time nurses spend tracking down supplies for wound dressing change); (7) overproduction—producing more than needed or before needed (eg, drawing laboratory values early to accommodate staff schedules rather than promoting sleep for patient); and (8) knowledge—inhibited flow of knowledge, ideas, and creativity (eg, lost improvement ideas due to lack of sharing or interest).

Once waste is identified, Lean thinking encourages tests of change to determine whether countermeasures can reduce and eliminate waste. These Lean improvements can produce significant cost savings in predominantly every waste category (except the waste of EBP knowledge).[11,12]

INTEGRATION OF IMPROVEMENT MODELS

In 2012, as part of our Magnet and Lean transformation journeys, a team of advanced practice nurses, a nurse scientist, and Lean specialists (experts in continuous improvement and system redesign) developed a crosswalk of EBP with Lean. Through a series of conversations, the team wove Melnyk and Fineout-Overholt's[13] 7 Steps of EBP with Lean Pathway's 4-Step Problem-Solving (4SPS) model (see Supplemental Digital Content, Figure 1, available at: http://links.lww.com/JNCQ/A406).

By integrating improvement models, the addition of evidence can reduce the waste of knowledge. Lean supports EBP changes through its 4 rules.[14] As new evidence is discovered, practice changes are incorporated into the clinical pathway (rule 1). By visually displaying where the new evidence will be used in the pathway, the upstream and downstream connections (rule 2) and associated binary changes become apparent. From here, standard work (rule 3) helps staff integrate changes to the step-by-step procedure as "muscle memory." Hence, Lean optimizes the effectiveness of care as the process becomes more efficient and continuously improved (rule 4). In our organization, several Lean-EBP improvement projects have saved significant costs by reducing length of stay, emergency department visits, and 3-day all-cause readmissions, as well as avoiding costs associated with hospital-acquired infections. Supplemental Digital Content, Table 1 (available at: http://links.lww.com/JNCQ/A407), showcases examples of clinical improvement projects that

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integrated both Lean and EBP with successful quality, safety, and financial outcomes at our institution. In the following discussion, we describe how Lean and EBP were coalesced by highlighting the tools and techniques of each framework to address the frequency of changing peripheral intravenous (PIV) catheters in hospitalized patients.

Lean's big vague concern and EBP step 0

In the Lean 4SPS method,[15] "big vague concerns" spark the problem-solving process. Big vague concerns are issues that need further examination to determine whether a problem actually exists. In EBP, the prelude to clinical improvement is cultivating a culture of inquiry (step 0). In the pursuit of EBP, clinicians use critical thinking and pose clinical inquiry questions about their practice. This ongoing curiosity about the best evidence to guide clinical decision-making is the foundation of EBP. Both EPB and Lean require staff to constantly ask the question "why." In Lean, this is typically done after a problem or gap is discovered between what should be happening and what is actually happening. In EBP, the current process may appear to be working effectively; hence, no problem or gap is visible. EBP's foundation using a culture of inquiry is what surfaces the problem or gap between best available evidence and a current practice that is outdated compared with the evidence. Both models are essential to optimize clinical excellence by identifying problems that need to be resolved. As a result, the product of the integrated model is that big vague concerns fuel the creation of PICO(T) questions, leading clinicians to search for the best available evidence that may inform what should be happening in clinical practice.

Lean step 1 and EBP steps 1, 2, and 3

Big vague concerns are funneled into Lean step 1 (do we have a problem) to determine whether a problem actually exists. This step involves sorting out what is actually happening from what should be happening. Going to the *Gemba* (actual place where the work is occurring) is critical at this juncture to learn, observe, and collect baseline data about the problem, which helps quantify the gap and illuminate its impact.

Lean step 1 can be augmented by EBP steps 1, 2, and 3. In EBP step 1, a knowledge or problem-focused trigger spurs a focused PICO(T) question that is used in EBP step 2 (search for external evidence). After critically appraising the evidence in EBP step 3, high-quality evidence can be used to inform what should be happening—in other words, establishing what the standard should be for addressing the identified clinical issue/problem.

In our PIV example, an intermediate care unit nurse was curious about the policy rationale for restarting PIVs every 72 to 96 hours and discovered it was based on the 2006 Infusion Nurses Society (INS) guideline.[16] As PIV insertion and use vary on the basis of patient circumstances, she asked why 1 standard can be universally applied to patients who are uniquely different. Her background question was: "Has the 2006 INS guideline changed in 10 years?" To answer this question, she performed a literature search and found the guideline changed in 2012,[17] recommending PIVs only be changed when clinical indications are present. The nurse then inquired with a foreground question (that was likely used to change the INS's recommendation) to broaden the search for high-quality evidence: "In hospitalized patients, does changing PIVs when clinically indicated, compared with every 72 to 96 hours, result in more efficacy for patient and cost outcomes?"

Lean step 1 requires measurement of the current gap (what is actually happening). In our PIV example, after gathering baseline data on the Neuro Trauma Unit, the nurse determined that 16 PIVs were routinely changed (unnecessarily) per month. She described the negative impact of the current policy in terms of patient satisfaction, RN workload, and supply cost.

Lean step 2

In EBP, root causes to practices that are not based on the best available evidence often represent the time delay between

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dissemination and implementation of science at the bedside. In the Lean 4SPS method, what should be happening advises we should follow current evidence-based INS guidelines to change PIVs only when clinically indicated. But what was actually happening was we were using an outdated (2006) policy stating PIVs should be changed every 72 to 96 hours.

In exploring the root cause using Lean step 2, one starts with the point of cause, defined as the time and place when the problem was first discovered. In our PIV example, the point of cause was the nurse's curiosity to look at PIV guidelines. The next step in root-cause analysis is to identify direct causes of the outdated PIV problem. To understand the primary root cause, a series of 5-why's questions helped the nurse arrive at root cause: an inadequate system for policies to stay updated with current evidence (see Supplemental Digital Content, Table 2, available at: http://links.lww.com/JNCQ/A408). In the 5-why technique, repeatedly asking why helps examine the problem until the root cause is uncovered.

Another way to capture ideas on root cause is by using a fishbone, or cause-and-effect, diagram. Many problems that we need to solve in health care are complex, with multiple root causes. In such scenarios, fishbone diagrams are useful to uncover the varied root causes that contribute to the problem (see Supplemental Digital Content, Figure 2, available at: http://links.lww.com/JNCQ/A409). Finding root causes as opposed to one direct cause is essential for eliminating the problem with sustained results. If only one of many potential direct causes is resolved, the problem may continue. Using this approach in our PIV example, the nurse examined direct causes that may have led to current practice by answering the first question on why our practice was not consistent with current evidence. This "first why" resulted in fishbone categories of methods, machines, materials, and staff. This analysis revealed that methods were guided by an outdated PIV policy, and machine contributions resulted from the electronic medical record (EMR) that was designed for nurses to document the day and time of PIV insertion in the lines/drains/airway flow sheet, which prompted intravenous restarts despite normal skin and site assessment. Materials for changing PIVs showed that supplies were stocked on the basis of average daily usage according to current PIV practices, and the staff followed hospital policy.

Both EBP and Lean approaches to problem solving lead to the same outcome to change the policy to conform to current evidence or identified standard. Solving to root cause in Lean methodology has one major advantage over using a PICO question to uncover the best available evidence. This advantage can be best described by the system that Lean builds to support and reinforce the standard using systematic check and adjust cycles. In our PIV example, by solving the root cause of the problem, the organization can bring the policy up-to-date with evidence. It can then also improve the system of clinical policy and procedure review by incorporating a regular check for current evidence to ensure policies and procedures are evidence-based. By enhancing this review system, not only does the PIV policy stay up-to-date with current evidence but also all clinical policy and procedure reviews do this step every time.

Lean step 3 and EBP step 4

In Lean step 3, we ask "Have we confirmed cause and effect?" To answer, we form a hypothesis: If we do X, then Y will happen. EBP has a similar process based on a PICO(T) question: If we do X, then Y will occur. For our PIV question, we formed the following hypothesis: If nurses change PIVs only upon clinical indication (process metric), then there will be 16 fewer PIV unnecessary restarts by the end of 3 months (outcome metric).

There are differences in hypothesis testing depending on the quality of evidence that exists for a clinical issue.[13] When insufficient evidence exists, there are 2 options: either base a practice decision on the highest form of available evidence or conduct original research. In the first option we may conduct a small test of change using Lean tools such as

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the Plan, Do, Check, Adjust/Act process. Likewise, for a system issue, our hypothesis may lead us to conduct a small test of change to confirm cause and effect. Another option is to conduct original research to generate new knowledge and contribute to science.

If a sufficient research base exists, the evidence is first evaluated for quality using a grading system. In our PIV example, the literature in EBP step 1 that supported a practice change (Cochrane systematic review[18] and Centers for Disease Control and Prevention guidelines[19]) was appraised to be of high quality (EBP step 3). When translating such evidence into practice, we often use Lean methodology to conduct a test of change and guide the implementation process. When evidence exists, identified metrics from the literature should be included in the test of change to verify whether evidence outcomes can be obtained, generating internal evidence for the practice change.

Lean step 4 and EBP steps 5 and 6

Lean step 4 ("Have we confirmed the countermeasure?") and EBP step 5 (Evaluate the outcome) asked us to review results of our test of change using process and outcome metrics described in earlier steps. This check-and-adjust phase provides an opportunity to assess whether the results are what was desired. If results are positive, the next step is to create standard work, which sequentially outlines how work is performed in a step-by-step fashion to ensure the process is performed in the same manner by all clinicians. When results are not in the desired direction, steps 1, 2, and 3 should be revisited to redefine the problem, examine the root cause, and adjust the hypothesis.

In testing our PIV hypothesis on the Neuro Trauma unit from March to June 2016, we analyzed process and outcome data. We specifically asked if (1) *the PIV test of change reduced the number of referral calls to intravenous therapy*: data revealed the number of calls was reduced by 89%; (2) *changing PIVs only per clinical indication reduced the number of unnecessary PIV restarts*: data from an EMR benchmark report on intravenous dwell time for patients admitted to the Neuro Trauma unit during the test of change period indicated only 3 PIVs were unnecessarily restarted. (These 3 PIVs were restarted by a float nurse who was not aware of the test of change.) Furthermore, the 137 PIV restarts that were prevented lessened discomfort for patients; (3) *extended PIV dwell time increased the number of cases of phlebitis*: data revealed no phlebitis in the 137 PIV cases; and (4) *the change in our intravenous practice influenced costs*: we estimated annual labor and supply savings of $3231.81 and $2505.60, respectively, per inpatient unit based on the results of our test of change.

In conclusion, the measurable gap was closed, confirming the hypothesis and supporting this practice change. The impact of the change was multifaceted: RN workflow was improved, resource costs were decreased (projected savings of $19 612 per year), and unnecessary PIV restarts were reduced. This clinical improvement example reinforces the need to blend EBP with Lean problem solving. In the absence of EBP, Lean principles may not have identified we had a problem because there would be no measurable gap about what should be happening with PIV care.

Using EBP step 6 (Disseminate findings), test of change results were shared with the Clinical Leadership Group and Practice Council. A new protocol reflecting the EBP changes was adopted by the organization. To educate stakeholders, a tip sheet was distributed to nursing units and the policy was shared in unit announcements, shift huddles, and via e-mail. A follow-up project summary was presented to the EBP Council in November 2016 and Coordinating Council in April 2017.

The PIV project identified the need for updating our policy/procedure/protocol review process to include a step for reviewing the evidence. The accreditation department designated the policy review process improvement as a strategic priority for fiscal year 2018. A checklist is in development to include a required step for reviewers to check for current evidence. An additional feature

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will ensure that the list of key stakeholders for each clinical policy and procedure has more frontline staff members identified who are familiar with the evidence provided by their professional organizations. Adding the review of evidence as a reliable step in the clinical policy and procedure system will help prevent situations such as this one in the future with other clinical practices.

KEY LEARNINGS FROM MODEL INTEGRATION

A clinical excellence culture is grounded on the EBP model to reduce the research-to-practice gap and thus integrate current evidence into practice in a more expedient manner. Lean originates in the manufacturing industry and does not focus on this important aspect of health care. Thus, early model integration difficulties arose from lack of a shared language between Lean's 4SPS and the 7 steps of EBP. EBP specialists watched Lean leaders demonstrate a business approach focused on performance gaps with a system to identify root causes, measure process and outcome metrics, and check and adjust plans for the next improvement cycle. Lean experts listened to how EBP clinical experts approached a problem that involved searching, appraising, and summarizing current evidence. Common themes that arose from using both methods included the Lean and EBP PICO(T) question (What should be happening?). Going to the *Gemba* (unit) to directly observe within the Lean approach was similar to EBP's application of the evidence with clinical expertise and the patient's preferences to make the right clinical decision for each unique patient situation.

As learning occurred over time, Lean provided a common language and process for problem solving across all departments. All staff members and clinicians learned the Lean model; however, not all employees were familiar with terms such as PICO(T) and levels of evidence. Thus, a major challenge of implementing the integrated EBP/Lean model is to ensure equal learning opportunities are offered for the staff to increase their knowledge, skills, and confidence with EBP competencies, especially clinicians who have a unique body of discipline-specific knowledge generated through research. Such learning is critical to impact clinicians' ability to successfully apply relevant evidence in Lean/EBP improvement projects to reduce the waste of knowledge for individual patients and populations as a whole.

Business leaders in health care are focused on improving quality while eliminating cost. An EBP culture helps educate business leaders to efficacious evidence-based care that will accelerate achievement of this goal and thereby garner resources to complete the EBP work. Combinations of the business and clinical models may not fit every single problem or situation. Stocking unit supplies to deliver patient care in a cost-effective manner may be strictly business, but when improvement delves into how hands-on patient care is delivered, evidence is paramount to the solution and setting the standard.

By integrating EBP into the Lean business model (or vice versa), we assure that the critical step of assessing knowledge is at the forefront of our practice. Thus, we can be confident our practice is consistent with current evidence and has the capacity to generate better outcomes for our patients and families. Similarly, with the addition of Lean's robust system of tools and processes, we can be better equipped to adequately support and ensure our new practice targets are reached. Thus, integration of the 2 models provides a rich context for efficient business and effective clinical solutions ranging from initiatives such as alarm fatigue and sepsis care to assessment of malnutrition in the hospitalized adult and beyond.

CONCLUSION

Integration of clinical and business improvement models is possible and necessary in today's health care environment. Nurses can take a leadership role to forge partnerships with operational colleagues to ensure evidence is deliberately applied in organizational improvement work. By collabo-

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rating to intersect these improvement models, nurses and interprofessional colleagues better ensure that patients are provided care based on the highest clinical effectiveness known to science, using efficient health care processes that eliminate waste and reduce costs.

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Disclosure Statement:

The authors and planners have disclosed no potential conflicts of interest, financial or otherwise.

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