

# A CASE-BASED APPROACH TO TEACHING PRACTICE-BASED LEARNING AND IMPROVEMENT ON THE WARDS

*Chad T. Whelan, MD, Paula M. Podrazik, MD, and Julie K. Johnson, MSPH, PhD*

Since 1999, the Accreditation Council for Graduate Medical Education (ACGME) and the American Board of Medical Specialties have endorsed a set of 6 general competencies that every physician must demonstrate (Table 1). Four of these—patient care, medical knowledge, interpersonal and communication skills, and professionalism—address much of what academic health centers have traditionally taught clinical trainees [1]. However, the remaining competencies—practice-based learning and improvement (PBLI) and systems-based practice (SBP)—present a new mandate that physicians be effective participants in quality improvement efforts at both the individual practitioner (PBLI) and health system (SBP) levels of care. While much of the emphasis on PBLI and SBP skills has been in graduate education, it is important to note that the 24 Member Boards of the American Board of Medical Specialties, representing 90% of U.S. licensed physicians, now require practice improvement as part of the maintenance of certification process, making these truly life-long clinical skills [2].

Competence in PBLI requires physicians to document, review, assess, and improve their clinical practice (Table 2). As such, PBLI skills are significantly different from what is traditionally emphasized in medical education, and teaching these skills poses several challenges. First, most existing faculty members have not been trained in process improvement and evaluation of clinical outcomes, making it difficult to effectively teach and evaluate trainees in these areas. Second, learners may perceive some of these skills as being separate from direct patient care, perhaps making it more difficult to engage learners in PBLI activities. Finally, there is limited experience with incorporating these skills into clinical teaching.

Despite the challenges, significant work has al-

ready been done to develop curricula within each of the defined areas of PBLI. Many of these curricula are designed to provide the critical foundation knowledge and skills for medical learners [3–5]. However, strategies to apply and expand PBLI knowledge and skills in clinical settings are needed. If we imagine that established curricula provide an essential “bolus” of PBLI education, the sustaining “drip” of continued knowledge development and skills practice requires that PBLI be incorporated into daily clinical teaching and longitudinal patient care. While this task may seem particularly daunting in the busy setting of the hospital wards, a key strategy for teaching and assessing PBLI is to integrate these concepts into the daily work of patient care and education.

We have found that opportunities to teach PBLI arise daily during the course of clinical care, making it possible to use a case-based teaching approach during inpatient rounds. In this article, we use a fictitious case example to highlight such opportunities and to frame a discussion of strategies for bedside teaching focused on 3 defined areas of PBLI: 1) applying an evidence-based medicine (EBM) approach to patient/population-specific health problems, 2) analyzing practice performance, and 3) performing practice-based improvement activities. The strategies discussed have been tried at our institution, although experience to date is limited. Preliminary insights from our experience are shared.

## Case Example: An Elderly Patient Admitted with a Heart Failure Exacerbation

Dr. Kern, an internist at a university hospital, meets her team of 1 resident, 2 interns, and 2 medical students for morning ward rounds. The team begins with a visit to Mrs. Muir, an 81-year-old woman admitted 8 days prior with an exacerbation of congestive heart failure (CHF).

Mrs. Muir had presented to the emergency department with progressive dyspnea on exertion and lower extremity edema. Although her symptoms improved with diuresis, she had a progressive rise in

---

*Chad T. Whelan, MD, and Paula M. Podrazik, MD, Department of Medicine, University of Chicago, Chicago, IL; and Julie K. Johnson, MSPH, PhD, University of Chicago, and American Board of Medical Specialties, Evanston, IL.*

**Table 1.** ACGME General Competencies: Brief Description

The residency program must require its residents to obtain competencies in the 6 areas below to the level expected of a new practitioner. Toward this end, programs must define the specific knowledge, skills, and attitudes required and provide educational experiences as needed in order for their residents to demonstrate:

- **Patient care** that is compassionate, appropriate, and effective for the treatment of health problems and the promotion of health
- **Medical knowledge** about established and evolving biomedical, clinical, and cognate (eg, epidemiologic and social-behavioral) sciences and the application of this knowledge to patient care
- **Practice-based learning and improvement** that involves investigation and evaluation of their own patient care, appraisal and assimilation of scientific evidence, and improvements in patient care
- **Interpersonal and communication skills** that result in effective information exchange and teaming with patients, their families, and other health professionals
- **Professionalism**, as manifested through a commitment to carrying out professional responsibilities, adherence to ethical principles, and sensitivity to a diverse patient population
- **Systems-based practice**, as manifested by actions that demonstrate an awareness of and responsiveness to the larger context and system of health care and the ability to effectively call on system resources to provide care that is of optimal value

Reproduced from the Accreditation Council for Graduate Medical Education (ACGME). General competencies. Available at [www.acgme.org/outcome/comp/compMin.asp](http://www.acgme.org/outcome/comp/compMin.asp). Accessed 4 Nov 2005.

blood urea nitrogen (BUN), creatinine, and potassium (to 6.5 mmol/L), requiring further adjustment of her furosemide, angiotensin-converting enzyme inhibitor, and digoxin and discontinuation of spironolactone. After consultation with the patient's family, a decision was made to keep Mrs. Muir in the hospital while awaiting a bed at a skilled nursing unit in a local nursing home. Among the family's concerns were the patient's inability to care for herself and her need for medication monitoring. Her Mini-Mental State Examination score on day 6 of her hospital stay was 17/30.

On the evening of hospital day 7, Mrs. Muir was noted to be confused and agitated. She subsequently climbed out of bed, fell, and was found lying on the floor pulling at her Foley catheter. The covering in-

**Table 2.** ACGME Defined Areas of Practice-Based Learning and Improvement

Residents must be able to investigate and evaluate their patient care practices, appraise and assimilate scientific evidence, and improve their patient care practices.

Residents are expected to:

- Analyze practice experience and perform practice-based improvement activities using a systematic methodology
- Locate, appraise, and assimilate evidence from scientific studies related to their patients' health problems
- Obtain and use information about their own population of patients and the larger population from which their patients are drawn
- Apply knowledge of study designs and statistical methods to the appraisal of clinical studies and other information on diagnostic and therapeutic effectiveness
- Use information technology to manage information, access online medical information; and support their own education
- Facilitate the learning of students and other health care professionals

Reproduced from the Accreditation Council for Graduate Medical Education (ACGME). General competencies. Available at [www.acgme.org/outcome/comp/compFull.asp](http://www.acgme.org/outcome/comp/compFull.asp). Accessed 4 Nov 2005.

house resident was summoned. At the time of the resident's assessment, Mrs. Muir was back in bed, calm, and falling asleep. Findings on examination included temperature, 100°F (37.8°C); heart rate, 94 bpm; blood pressure, 158/78 mm Hg; and respiratory rate, 18 breaths/min. The patient was sleepy but without focal findings or evidence of head injury; she opened her eyes to voice. The lungs were clear. Heart examination revealed regular rhythm and rate, without murmur. The abdomen was benign. Genital examination showed a Foley catheter in place. Joint examination revealed full range of motion.

The covering resident initiated an extensive diagnostic work-up, which was remarkable for a urinalysis that was positive for both nitrite and leukocyte esterase and demonstrated pyuria and bacteriuria. The patient's blood count, renal function (BUN/creatinine ratio), and electrolytes were at baseline, with a pulse oximetry reading of 98% on room air. Cultures were sent, and antibiotics were started for a presumed urinary tract infection. The Foley catheter was discontinued. Orders were placed to administer neuroleptic medication as needed for agitation, and a sitter was arranged.

It is now the morning of day 8, and Mrs. Muir is awake, alert, and oriented to person. On rounds, Dr. Kern and the primary team learn of Mrs. Muir's episode of confusion and her subsequent work-up and treatment from the covering resident.

### PBLI Teaching Opportunities

The scenario of Mrs. Muir represents a routine case seen on a typical inpatient medicine service. An exacerbation of a common chronic illness (CHF) prompted hospitalization of this elderly patient, but complex comorbid conditions contributed to a prolonged hospital stay. The delayed discharge in this case lays the groundwork for an attending physician to focus on PBLI teaching. After just a few days in the hospital, much of the typical clinical teaching surrounding CHF may already have been covered. However, patients with multiple common conditions for which there may be evidence to support specific interventions can provide an opportunity to discuss PBLI concepts.

For instance, if Mrs. Muir had been identified as being at high risk for delirium based on her cognitive impairment, renal insufficiency, and severe chronic illness, her delirium may have been prevented by using evidence-based strategies to prevent delirium in elderly, at-risk hospitalized patients [6–8]. In addition, if the team were to reflect on Mrs. Muir's care (eg, Was the diagnosis of delirium made? Was it adequately assessed? Was it treated appropriately? Could it have been prevented?), potential process improvement needs might be identified, which could lead to a discussion of plans for improving the care of patients like Mrs. Muir. Thus, by taking the opportunity to review the care of Mrs. Muir, the attending would be able to teach PBLI concepts and methods as well as maintain interest and focus on a patient who may otherwise receive less attention due to the duration of her hospitalization.

Reviewing patient care addresses 2 defined areas of PBLI (ie, “analyze practice experience using a systematic methodology” and “obtain and use information about [one's] own population of patients and the larger population from which [one's] patients are drawn”) (Table 2). Thoughtful clinicians have reflected on the care of their patients long before the ACGME incorporated specific competencies in this area. However, reflection can take many forms. Without a systematic approach to review our practice patterns, we run the risk of allowing the extremes of our clinical experience to affect our practice far more than they should. Relying on the last “big save” or “crash and burn” to drive future decision making may be

doing a disservice to our population of patients. Thus, systematic methods of reviewing care are essential.

### PBLI Teaching: Applying and Practicing EBM

Recognizing the teaching opportunities inherent in this case, Dr. Kern challenges the team to generate questions about Mrs. Muir's clinical course and specifics of her care that the group would benefit from discussing.

A student speaks up first, saying “I'd like to know the appropriate strategies to prevent future CHF exacerbations in a patient like Mrs. Muir.”

“Also, what are indications for Foley catheter placement in this patient?” adds one of the interns.

“I'm not sure why Mrs. Muir became delirious. It would be useful to know what caused this,” says the other student.

“I'm wondering whether we may have missed something in our care of Mrs. Muir,” says the resident.

Dr. Kern engages the group in a brief discussion of the first 3 questions, reminding the team of the fundamental difference between background and foreground questions.

“This case also has many foreground questions worth investigating. Let's meet this afternoon to continue this discussion. I'd like each of you to generate a focused question relevant to Mrs. Muir's case and report back to the group on the evidence you've found to address your question.”

The now well-accepted components of EBM (Table 3) [9] figure prominently in the PBLI skill set. Of all defined areas of PBLI, EBM is probably the area in which there is the greatest medical educational experience to date. Calls for developing EBM skills have been in place for more than 10 years [10]. Initially, many medical schools implemented an EBM curriculum as part of a preclinical course or as a didactic or interactive workshop component of the medicine clerkship, separate from patient care. Similarly, many residency programs initially implemented EBM workshops during an ambulatory block. While some of these stand-alone sessions have been shown to improve EBM knowledge and skills among participants, they were much less effective in promoting the use of EBM methods in the clinical arena [11].

Many medical schools and residency programs have subsequently sought to disseminate EBM teaching beyond the traditional stand-alone courses and workshops and to integrate these concepts into clinically focused activities. Methods include EBM morning

report, EBM faculty development programs, and EBM consult rotations. Although still early in their development and evaluation, these supplements to traditional EBM teaching show promise for inculcating EBM methodology into clinical practice [12–14]. This experience supports the concept of complementary “bolus and drip” educational interventions, whereby initial didactic efforts are reinforced and expanded upon using strategies to integrate skills practice into clinical activities.

EBM is a clinical skill set aimed primarily at improving the care of an individual patient. As illustrated in the case, the team caring for Mrs. Muir articulated several questions relevant to her care. A thoughtful attending-led discussion of the answers, with associated relevant background information, certainly may be an effective means of teaching the important clinical information in this case. However, this approach fits most closely with the ACGME competency of medical knowledge. Another approach to address the medical knowledge competency *and* the EBM aspects of the PBLI competency is to use formal teaching rounds to assist the team in performing the components of EBM.

For example, Dr. Kern could facilitate a discussion of how to transform vague clinical questions that arose on rounds into well-structured clinical questions using the PICO format (patient/population, intervention, comparison, outcome). Such questions might include:

- In elderly hospitalized patients, is delirium a risk factor for falls?
- In elderly patients with dementia, CHF, and renal failure, what is the long-term prognosis as compared with elderly patients without significant comorbidities?
- In patients admitted with decompensated CHF, does routine placement of urinary catheters improve outcomes (eg, length of stay, morbidity, mortality) compared with urine output monitoring without catheters?

Finally, Dr. Kern could discuss how to acquire supporting evidence to address the team’s questions using effective search strategies and instruct the team to present the evidence they found the following day. After the team members reported their findings, Dr. Kern could lead a discussion of a pertinent study that was found, how to appraise the validity of the evidence, and how to apply the results to Mrs. Muir. Such integration of EBM into clinical teaching provides a critically important opportunity for learners to apply and practice EBM skills in the course of their clinical practice.

**Table 3.** Major Components of Evidence-Based Medicine (EBM)

Asking a well-constructed clinical question pertinent to a patient- or population-specific health problem
Acquiring an answer to that question from an appropriate information resource
Critically appraising the evidence from the information resource for validity, impact, and applicability
Applying the new information to the patient or population
Assessing the effectiveness/efficiency of steps 1 through 4 and seeking ways to improve EBM skills

Adapted with permission from Sackett DL, Straus SE, Richardson WS, et al. Evidence-based medicine: how to practice and teach EBM. 2nd ed. New York: Churchill Livingstone; 2000.

### PBLI Teaching: Systematic Approaches to Analyzing and Improving Practice

During teaching rounds later that afternoon, Dr. Kern begins with a refresher on how to structure focused clinical questions. Five questions relevant to Mrs. Muir’s case are developed. The EBM teaching ends with a brief overview of effective search strategies for the 5 questions. After concluding the EBM discussion, Dr. Kern reminds the team of the question Dr. Lin raised during morning rounds.

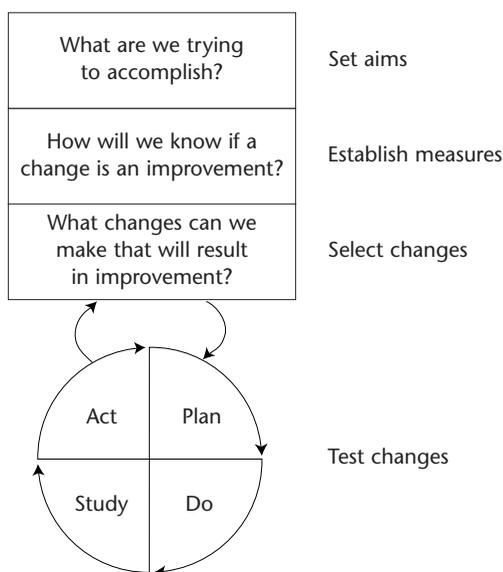
“Dr. Lin, earlier today you wondered whether the team might have overlooked something in the care of Mrs. Muir. How would you suggest we look into this?”

“I guess we could look back at her record and see if we caused her delirium, but I’m not sure how we would really know,” replies the resident.

Dr. Kern takes this opportunity to provide a 1-minute lecture on key concepts in systematically reviewing care and introduces the concept of the case audit.

“It may be difficult to know for sure what exactly caused or contributed to Mrs. Muir’s delirium,” says Dr. Kern. “However, we could look at the steps in her care that we did or didn’t take that *may* have influenced her risk for delirium. If we can accurately measure those steps, or processes of care, we might be able to get a sense of whether we did all that we could to prevent the delirium.”

Dr. Kern continues, “When measuring processes of care, we’re interested in knowing if there are generally agreed-upon ‘right ways of doing things’ that can be measured and that are both explicit and objective. During teaching rounds tomorrow, we can do a case audit, which is a tool to help us systematically review the care given to Mrs. Muir that



**Figure 1.** The Model for Improvement. (Adapted with permission from Langley G, Nolan KM, Nolan TW, et al. The improvement guide. San Francisco: Jossey-Bass; 1996:10.)

may have contributed to or prevented her delirium. If we identify areas where we may have been able to do better, we can discuss plans to improve our care in the future.”

While EBM emphasizes the importance of appraising and assimilating best evidence into patient care practices, an equally important element of PBLI is medical practice review, or monitoring and reflecting on the processes and outcomes of care to identify learning or improvement needs. By voicing concern that the team may have missed something in the care of Mrs. Muir, the resident has provided Dr. Kern with an opportunity to discuss approaches to assessing and improving one’s practice. An unstructured review of Mrs. Muir’s care would be complex and fraught with potential areas for disagreement. For example, was Mrs. Muir’s acute renal failure simply a reflection of her tenuous status or the result of inappropriately aggressive diuresis? A structured approach to reviewing care is essential. Similarly, by using a structured approach to improving care, the team may develop effective strategies for preventing similar suboptimal care in the future.

### Model for Improvement

The Model for Improvement (**Figure 1**) [15] is a commonly used systematic methodology that can guide improvement work at multiple levels (eg, team, clinical service, hospital). This tool for accelerating

the pace of quality of care improvement has 2 parts: 3 fundamental questions relevant to making a change in practice and the Plan-Do-Study-Act (PDSA) cycle for testing the change.

- **What are we trying to accomplish?** An *aim statement* is needed to focus improvement efforts. The aim should be time-specific and measurable and should define the target patient population for the improvement.
- **How will we know that a change is an improvement?** Measurable outcomes must exist or be established, because data are needed to assess and understand the impact of changes designed to meet the aim.
- **What changes can we make that will result in an improvement?** Simply changing a process of care is no guarantee that care will be improved. Changes most likely to bring about improvement must be identified.
- **PDSA cycles.** The change must be tested via PDSA cycles to conclude that a result is an improvement. The PDSA cycle applies the scientific method to discover effective and efficient ways to change a process. PDSA cycles are short and quick.

Similar to the early days of EBM, important curricular initiatives in the area of quality improvement have been established to provide important foundation knowledge to medical learners [16,17]. While many rigorous methods exist, the measurement tools must be easy to use and simple to evaluate if we are to incorporate these practices into our busy clinical days. These tools can be used to review the care of a single patient or a panel of patients of interest. Either way, they should use established measures of care that can be generalized from the particular patient or set of patients to the larger population.

### Case Audit

One systematic method that may have educational value is the *case audit*, sometimes referred to as a *chart audit*. Simply defined, a case audit is a systematic review of an individual patient’s care to determine what has been done and what, if anything, could have been done better. A case audit is a combination of 2 established methods of reviewing care for medical trainees—the chart-stimulated recall oral examination and the record review; both methods have been recognized by the ACGME as effective evaluation tools

[18] and have been used successfully in educational situations [19]. In a case audit, as in the chart-stimulated recall exercise, the care of a single patient is reviewed in depth by the team involved in the care of that patient. However, the case audit probes the team about their adherence to recommended standards of care. For care that did not meet accepted standards, a well-run case audit exercise provides an opportunity for the team to discuss why the care was substandard and to plan specific strategies to improve future care of similar patients. Thus, the case audit exercise adds the component of the Model for Improvement to the chart-stimulated recall oral examination and the record review.

To conduct a case audit, the attending physician selects a case that should be reviewed not because of a known deficiency in care (eg, as may be the case with a morbidity and mortality conference or a root cause analysis) but because the patient is at high risk for having a deficiency in care. Mrs. Muir is such a patient—an elderly medical patient with multiple comorbid conditions and a prolonged hospital stay. It is important to establish the expectations of the chart audit exercise at the outset. All participants must realize that the goals of the session center on learning how to self-evaluate care decisions and how to plan for self-improvement, not on assigning blame for questionable decisions. The attending then leads the team through the exercise, with one member serving as the designated recorder using a case audit sheet, and those who provided care for the patient searching the chart for documentation to answer the questions. A case audit also can be used to stimulate discussion about the clinical topics of interest or to delve deeper into important concepts within PBLI, such as how quality of care can be measured.

When Dr. Kern and the team meet the following afternoon for teaching rounds, she reminds them they will be doing a case audit.

"Yesterday we discussed how a case audit would help us review our care of Mrs. Muir. For the next hour, we will do a case audit, discuss some principles of measuring and affecting quality, and develop a plan for improving the care we provide as a team. This is the tool we'll be using for this exercise." Dr. Kern holds up the case audit form (**Figure 2**), which is a list of yes/no questions addressing some key issues in delirium prevention, recognition, and treatment. "As I go through the questions on the form, let me know if you'd like me to explain any of these items."

Dr. Kern continues. "For this exercise to work, we

need to adhere to certain ground rules. First, this is a self-reflection exercise and not one of blame. Each of us on this team is responsible for Mrs. Muir's care. So, where we did well, we did well as a team. Where we dropped the ball, we did that as a team as well."

"Next, if we find problems, we'll need to discuss why they happened and explore ways to prevent them from happening again. The chart audit is ultimately a teaching tool, and we should all learn from the process."

"And finally, my role as your attending is to teach you why the elements of the chart audit tool represent important aspects of delirium care and prevention."

Dr. Kern then assigns tasks to each member of the team. The primary intern for the case, who knows Mrs. Muir's chart best, is asked to review the chart for answers to the audit questions. The medical student who knows Mrs. Muir's case well is asked to help the intern fill in details that may not be recorded. The resident is asked to record what the team did and did not do. The remaining intern and student are asked to begin to think of ways the team can improve their care for future patients like Mrs. Muir.

For each question, the intern and student consult the chart for documentation that provides the answer to the question. If documentation is missing, they provide details based on memory. The reliance on memory to reconstruct the details prompts Dr. Kern to discuss why documentation is important for proper communication about the clinical details of a case.

During the exercise, the team realizes that, while they had made the diagnosis of delirium, they had not performed a formal assessment for it. Dr. Kern spends 5 minutes discussing the value of the confusion assessment method for identifying delirium and how to use it. The team also realizes that they did not assess Mrs. Muir's risk of developing delirium, although all of the information needed to perform that assessment was available in the chart. Finally, they recognize that the urinary catheter, which was likely no longer necessary, may have contributed to Mrs. Muir's delirium.

Dr. Kern then turns to the resident and asks, "Dr. Lin, based on your notes, what are the 1 or 2 areas where you think we should focus our plan for improvement?"

"I think we should look at avoiding unnecessary Foley catheters," he replies. "We also should try to identify people at risk for delirium when they're admitted to the hospital."

1. Was the diagnosis of delirium made?	Yes	No	Comments
<i>Teaching points:</i> How was the diagnosis made? Discussion of the confusion assessment model (CAM) [7]			
2. Was/were the cause/causes of the delirium found?	Yes	No	Comments
3. Was/were the cause/causes of the delirium treated?	Yes	No	Comments
4. Was the patient agitated?	Yes	No	Comments
5. Was the agitation appropriately treated?	Yes	No	Comments
<i>Teaching point:</i> Review of the pharmacologic treatment for agitated delirium			
6. Was the patient assessed for risk of developing delirium at admission?	Yes	No	Comments
<i>Teaching point:</i> Risk assessment of the elderly patient at hospital admission for prevention [6]			
7. Were precipitating factors during hospitalization identified?	Yes	No	Comments
<i>Teaching point:</i> Identifying precipitating factors for the development of delirium in the hospitalized elderly [8]			
<b>Assessment:</b> <u>Delirium was diagnosed, but not by any formal tool such as the CAM. Risk for delirium was not assessed on admission, although all information needed for assessing risk was available in the chart. Precipitating factors were not identified in a timely fashion, specifically the urinary catheter.</u>			
<b>Plan for practice improvement:</b> <u>The admitting intern will now formally assess all patients older than 65 years for delirium on admission. As part of the initial presentation from the intern, the attending will specifically ask if an assessment for delirium was done on admission.</u>			

**Figure 2.** A case audit for hospitalized patients with delirium, using the case of Mrs. Muir as an example. (Developed by Paula Podrazik, MD, Department of Medicine, University of Chicago.)

At this point, Dr. Kern leads the team in a discussion of an improvement plan focused on these 2 points and guides them in defining their first PDSA cycle. She also makes sure that the plan has a mechanism for measuring the effects of the changes. As the session concludes, the team is focused on areas where they can improve rather than on where they have failed.

In summary, using the case audit tool allowed Dr. Kern's clinical team to review and document the care they provided to Mrs. Muir, to discover areas of substandard care, and to plan for improvement in the care of future patients like Mrs. Muir. The exercise also allowed Dr. Kern to provide the group with relevant teaching pearls drawn from best evidence and the literature on aging. Importantly, providing the opportunity to discuss potential areas for improvement allowed

the team to avoid feeling dejected and, instead, to focus on doing better in the future.

### Census Audit

Another tool for performance monitoring is a *census audit*, which can provide a focused review of a panel of patients with a specific educational perspective. Unlike institutionally designed performance monitoring, which relies on reviewing areas of care chosen by the hospital or clinic, census audits can be easily designed and implemented by a team of physicians to address quality of care issues *they* are interested in following.

For example, in Mrs. Muir's case, Dr. Kern's team may want to learn if the inappropriately extended use of the urinary catheter was an isolated event or if it was part of a larger pattern. By using a simple structured tool (**Figure 3**) to measure catheter use patterns among a daily census of inpatients, the team can

Foley catheter in use?			Yes	No
If yes:	Where was it placed? _____			
	When was it placed? _____			
	Appropriate indication when placed?	Yes	No	
	Appropriate indication now?	Yes	No	
	If no, discontinue			
	If yes, plan to discontinue?	Yes	No	
Patient safety issues/systems issues?				
Summary:	Proportion of patients with Foley catheters _____			
	Proportion of patients with catheters with indication when placed _____			
	Proportion of patients with catheters with indication now _____			
Patient safety issues/systems issues themes: _____				
_____				
_____				
Plan for change: _____				
_____				
Plan to remeasure: _____				
_____				

**Figure 3.** Census audit for Foley catheter use. Questions in the *gray area* are answered for each patient on a service. Based on the assessment of individual patients, the *white area* is completed. An example of a *patient safety/systems issue* might be that 50% of catheters are placed in the emergency department. An example of a *plan for change* might be to perform a “line check” presentation on each patient, including intravenous lines, central lines, feeding tubes, and urinary catheters. Examples of a *plan to remeasure* might be in 1 week, 2 weeks, or daily. (Developed by Chad T. Whelan, MD, Department of Medicine, University of Chicago.)

develop an understanding of their own patterns of care. During walk rounds, the team would review the questions within the audit for each patient, spending no more than 1 to 2 minutes gathering the data. After completing the census audit, the team can discuss those patterns and identify areas and methods for self, team, or system-wide improvements in care.

Census audits are designed to be incorporated into the clinical workflow of patient care, so they must be simple and focused. They are not designed to evaluate complex medical decision making but rather simple decisions that have objective measures of quality. Unfortunately, evaluation of these team-designed audits as tools for teaching PBLI in the inpatient setting has been very limited.

Based on their experience with the case audit exercise, the team chooses to perform a census audit of the use of Foley catheters across their panel of patients as part of their plan for improvement. Dr. Kern creates a census audit form incorporating objective

and explicit measures of appropriate Foley catheter use. After discussing the purpose of the census audit with the team, Dr. Kern accompanies the team on rounds, during which the interns provide the information needed to complete the audit and the senior resident records the results for each patient on their team. After completing the census audit, the team reviews the summative results and discusses the team’s performance. Dr. Kern then leads the team in a discussion aimed at reducing inappropriate catheter use in the future.

### PBLI Challenges

Incorporating PBLI into training programs has proven to be challenging. Unlike certain other ACGME competencies (eg, medical knowledge), the direct clinical applicability of PBLI may not be apparent, especially to those less familiar with systematic methods for improving processes and outcomes of clinical care. However, PBLI is a valid and clinically applicable competency for practicing physicians. The

challenge is to design educational approaches that effectively incorporate PBLI into the care of patients in a real-time basis and to integrate tools into the teaching that serve to reinforce and organize such activities.

When done well, the case audit can be a powerful tool for teaching clinical practice self-reflection and improvement. To our knowledge, case audits have not been widely incorporated into clinical teaching and evaluation. One reason is that doing a case audit requires dedicated teaching time to perform one well. The ACGME estimates that record reviews will take approximately 30 minutes to perform [18], and if incorporated into a traditional team activity, we have found that it may take twice as long to complete. A case audit also requires significant team management skills as the members explore their own care of a patient. If this exercise is rushed or managed improperly, the team may walk away frustrated, angry, or humiliated about the care provided. However, if done well, this exercise may result in meaningful medical practice self-reflection and plans for improvement using PBLI skills.

Potentially more powerful is the ability to analyze practice patterns across a group of patients and to link this information to changes in practice patterns or systems of care. The population of interest may be an entire clinic population, a single day of clinic patients, or a day of patients in the inpatient setting. Traditional methods of feedback and summative evaluation play an important role but are rarely able to provide the detailed information required to systematically analyze a physician's own care. Hospitals and medical clinics are increasingly recognizing the importance of quality measures. In response to some internal and many external factors (eg, pay for performance, public reporting of quality measures), many hospitals and clinics have developed quality scorecards for the specific areas of interest to the facility. While physicians or teams of physicians may have access to their own performance measures, these scorecards are generally not developed for educational purposes, which may present some limitations to their use (ie, they are chosen to meet the needs of an institution, not the educational needs of individual learners or teams). However, when used for educational purposes, scorecards may be very effective [20], and efforts to incorporate these performance measures into educational activities may prove valuable.

Another major barrier to the teaching and evaluation of PBLI in residency programs is the limited skill set of most medical faculty members. As a newer area

of professional expertise, many faculty members may not understand the competency, let alone have the skills or confidence to adequately teach and evaluate the components of the competency. The typical faculty member has not been trained in methods of clinical improvement. Many residency programs have addressed this barrier by identifying key faculty members who have the relevant skills or are willing to obtain them through specialized training programs. These faculty members then perform PBLI-related activities in stand-alone sessions designed to provide core knowledge and skills required for residents to become competent in PBLI. Reports of the success of these PBLI teaching programs are beginning to surface [3–5].

While these programs show promise and will likely develop over time, they do have limitations. The primary limitation of this approach is that most programs that teach PBLI do not have a process whereby these skills are incorporated into daily longitudinal patient care. However, if PBLI is to be taken up as a valued clinical competency, it may be better served if these programs are actively supported by implementation of PBLI into trainees' clinical rotations.

### **One Institution's Experience**

We have faced many of these challenges in attempting to develop and implement PBLI curricula into our internal medicine residency program. An EBM curriculum has been evolving for years and is now a series of 4, 4-session modules that take place over 2 years. Each module occurs in an ambulatory block rotation. The first 3 modules emphasize skills development, and the final module focuses on skills practice. Attempts at incorporating EBM education into clinical teaching have been less successful. Currently, several internal medicine faculty members have been trained in EBM and informally attempt to provide EBM teaching during clinical activities. This year, we also started an evidence-based morning report that occurs once each month. Currently, it is our perception that the uptake and incorporation of EBM into clinical medicine among our residents is variable. Thus, our experience closely mimics the national trends.

We have taken a different approach than that taken by many other programs in teaching residents how to analyze their practice performance and perform practice-based improvement activities. Currently, our residency program does not have a stand-alone skills-building curriculum in the areas of self-evaluation and improvement. However, as we have developed

the concepts of team-oriented evaluation and improvement through simple auditing tools, we have had some success in incorporating PBLI into clinical rotations. Initial experience with using these audits came from one of the authors during inpatient teaching months. We now have a toolbox of case and census audits (approximately 5 of each) available to faculty for use during their inpatient teaching as well. Audit forms have been disseminated during a formal faculty development session on their use as well as through informal colleague-to-colleague communication. Formal evaluation of these methods is currently underway, and preliminary results have been promising, with both clinical and educational outcomes of interest [21]. While we are unsure of exactly how to best use these tools, we do know that our experience with case audits has been limited due in large part to the significant time required to complete one effectively. The use of census audits, however, has been much more vigorous.

### Conclusion

Using a fictitious clinical scenario, we have demonstrated the relevance of PBLI to individual patients and providers as well as to populations of patients and teams of providers. We have also shown how PBLI can be taught using a case-based approach with the aid of case audit and census audit tools. If PBLI is to remain a meaningful competency that is both sustained and developed, it must have relevance to everyday clinical care. Incorporating PBLI teaching into clinical care may be facilitated with structured activities and tools that assist faculty members who have not developed specific expertise in this area, but who are willing to try to use new techniques in their clinical teaching. As this educational field matures, we can look forward to a better understanding of the most effective "bolus and drip" approaches to fostering high-level knowledge and skills through our clinical teaching.

---

*Corresponding Author: Chad T. Whelan, MD, 5841 South Maryland (MC 2007), University of Chicago, Chicago, IL 60637 (e-mail: cwhelan@medicine.bsd.uchicago.edu).*

*Acknowledgment: This work was supported by an educational grant from the Donald W. Reynolds Foundation.*

### References

1. Accreditation Council for Graduate Medical Education. Outcome project: general competencies. Available at [www.acgme.org/outcome/comp/compFull.asp](http://www.acgme.org/outcome/comp/compFull.asp). Accessed 26 Oct 2005.
2. American Board of Medical Specialties. Maintenance of certification. Available at [www.abms.org/MOC.asp](http://www.abms.org/MOC.asp). Accessed 1 Nov 2005.
3. Ogrinc G, Headrick LA, Morrison LJ, Foster T. Teaching and assessing resident competence in practice-based learning and improvement. *J Gen Intern Med* 2004;19(5 Pt 2):496–500.
4. Chakraborti C, Davidoff S, Kendrick D, et al. A firm-based residency program enables residents to apply system of care principles to their learning practice. *ACGME Bulletin* 2004;Nov:15.
5. Ziegelstein RC, Fiebach NH. "The mirror" and "the village": a new method for teaching practice-based learning and improvement and systems-based practice. *Acad Med* 2004;79:83–8.
6. Inouye SK, Viscoli CM, Horwitz RI, et al. A predictive model for delirium in hospitalized elderly medical patients based on admission characteristics. *Ann Intern Med* 1992;119:474–81.
7. Inouye SK, van Dyck CH, Alessi CA, et al. Clarifying confusion: the confusion assessment method. A new method for detection of delirium. *Ann Intern Med* 1990;113:941–8.
8. Inouye SK, Charpentier PA. Precipitating factors for delirium in hospitalized elderly person. Predictive model and interrelationship with baseline vulnerability. *JAMA* 1996;275:852–7.
9. Sackett DL, Straus SE, Richardson WS, et al. Evidence-based medicine: how to practice and teach EBM. 2nd ed. New York: Churchill Livingstone; 2000.
10. Sackett DL, Rosenberg WM. The need for evidence-based medicine. *J R Soc Med* 1995;88:620–4.
11. Badgett RG, Paukert JL, Levy LS. Teaching clinical informatics to third-year medical students: negative results from two controlled trials. *BMC Med Educ* 2001;1:3.
12. Linzer M, Brown JT, Frazier LM, et al. Impact of a medical journal club on house staff reading habits, knowledge, and critical appraisal skills. A randomized control trial. *JAMA* 1988;260:2537–41.
13. Thom DH, Haugen J, Sommers PS, Lovett P. Description and evaluation of an EBM curriculum using a block rotation. *BMC Med Educ* 2004;4:19.
14. Smith CA, Ganschow PS, Reilly BM, et al. Teaching residents evidence-based medicine skills: a controlled trial of effectiveness and assessment of durability. *J Gen Intern Med* 2000;15:10–5.
15. Langley GL, Nolan KM, Nolan TW, et al. The improvement guide: a practical approach to enhancing organizational performance. San Francisco: Jossey-Bass; 1996.
16. Headrick LA, Richardson A, Priebe GP. Continuous improvement learning for residents. *Pediatrics* 1998;101(4 Pt 2):768–73.
17. Cleghorn GD, Headrick LA. The PDSA cycle at the core of learning in health professions education. *Jt Comm J Qual Improv* 1996;22:206–12.

18. Accreditation Council for Graduate Medical Education and American Board of Medical Specialties. Toolbox of assessment methods. Version 1.1. Available at [www.acgme.org/Outcome/assess/Toolbox.pdf](http://www.acgme.org/Outcome/assess/Toolbox.pdf). Accessed 26 Oct 2005.
19. Ognibene AJ, Jarjoura DG, Illera VA, et al. Using chart reviews to assess residents' performances of components of physical examinations: a pilot study. *Acad Med* 1994;69:583-7.
20. Callahan M, Fein O, Battleman D. A practice-profiling system for residents. *Acad Med* 2002;77:34-9.
21. Achenbach C, Swamy R, Henkle G, et al. Seizing the "missed opportunity": the use of census audits to increase inpatient immunizations [abstract]. Presented at the Society of Hospital Medicine Annual Meeting; 2005 Apr 29-30; Chicago, IL.

**How to cite this article:**

Whelan CT, Podrazik PM, Johnson JK. A case-based approach to teaching practice-based learning and improvement on the wards. *Semin Med Pract* 2005;8:64-74. Available at [www.turner-white.com](http://www.turner-white.com).

Copyright 2005 by Turner White Communications Inc., Wayne, PA. All rights reserved.