

LEARNING BY DOING: USE OF RESIDENT-LED QUALITY IMPROVEMENT PROJECTS TO TEACH CLINICAL PRACTICE IMPROVEMENT

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All residency programs face the challenge of incorporating the 6 general competencies outlined by the Accreditation Council for Graduate Medical Education (ACGME) into residency training. Two of these competencies—practice-based learning and improvement (PBLI) and systems-based practice (SBP)—embody concepts and skills that are not well taught in the traditional residency curriculum. Fundamental to these competencies is the principle of improving patient care by examining current practices and applying a systematic, evidence-based approach for improvement. Unfortunately, many faculty are inexperienced in clinical practice evaluation and improvement and, therefore, are challenged to be effective teachers of these concepts.

In 2001, we evolved the existing quality improvement (QI) curriculum at our internal medicine residency program to address the educational gaps formed by the new PBLI and SBP competency requirements. Previously, we had been teaching residents how to investigate and evaluate their patient care practices at both an individual and a group level. However, evaluating the current quality of care is only the first step in the improvement process. With the new curriculum, we sought to engage residents in designing and implementing QI projects themselves as a way to develop practice-improvement skills and knowledge that they can apply in their future practice.

Several approaches to curriculum redesign for PBLI and SBP have been described in the literature. Ogrinc and colleagues [1] tested a 1-month PBLI elective aimed at teaching residents how to understand their workplace, collect and present data, and propose interventions. However, the time limit of the elective (4 weeks) did not allow residents to actively make changes or to see the impact of their interventions over time. Ziegelstein and Fiebach [2] described a series of activities to improve

proficiency in the concepts of PBLI and SBP, including quality assessment–systems improvement exercises, multidisciplinary rounds, morbidity and mortality morning reports, clinic chart self-audits, and nursing evaluations. Our ambition was to create a curriculum that would go beyond teaching concepts and allow our residents to experience practice improvement on a team within the framework of a long-term (8 months) hands-on project. This type of interactive approach, which gives each resident the opportunity to build team skills and practice PBLI concepts, has been shown to be a more effective strategy for changing physician behavior [3].

This article is the first of 3 articles describing how resident-led QI projects are being used in our internal medicine residency program. In this article, we provide an overview of our ongoing effort to teach PBLI and SBP using active resident participation in QI projects as the focus of the learning experience. We describe how we have incorporated these projects into the flow of our residency program and share insights gained from our 5-year experience with the QI curriculum. Examples of resident QI projects are briefly noted; 2 specific projects will be the focus of more in-depth reports to follow in future articles.

The New Curriculum

Setting

Southern Illinois University (SIU) School of Medicine is a community-based medical school that enrolls 72 medical students per year and is affiliated with 2 community hospitals. The internal medicine residency program accepts 12 categorical first-year medicine residents and 2 combined medicine-psychiatry residents per academic year. Categorical medicine residents are assigned a panel of patients in a general medicine continuity clinic to follow over their 3 years at SIU. Third-year residents are assigned a panel of nursing home patients from 3 local nursing homes to follow for 1 year as primary care providers.

Background and Goals

Prior to 2001, our approach to teaching QI was limited to having residents participate in traditional

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quality assurance projects done during a 1-month ambulatory medicine rotation. The projects largely consisted of retrospective chart reviews that assessed adherence to guidelines. The usual message delivered to residents and faculty was “try harder.” Practical guidance on how to improve care was missing, and there was no organized follow-up to see if any change in practice occurred. Generally, the projects left residents and faculty feeling discouraged.

In 2001, we developed a new QI curriculum to teach a proactive approach to quality shortfalls. Our goal was to go beyond retrospective chart reviews and engage residents in designing, implementing, and evaluating interventions to improve the quality of daily practice within the division of general internal medicine. We determined that the heart of the new curriculum would be resident-led QI projects guided by the principles embodied in the Model for Improvement described by Langley and colleagues [4]. This commonly used tool for guiding QI work asks 3 fundamental questions relevant to making a change in practice (aim statement) and incorporates the Plan-Do-Study-Act (PDSA) cycle for testing the change. One faculty member had recently received intensive training in this area at a course offered through the Intermountain Healthcare Institute for Health Care Delivery Research (<http://intermountainhealthcare.org/xp/public/institute>) and was eager to spread the concepts to others within the division. The “Advanced Training Program in Health Care Delivery Improvement” is a 20-day course with 4 meetings over a 5-month period. Local and national experts are brought together to teach the theory and techniques of guideline development and implementation, outcome measurement, health policy and economics, medical informatics, continuous quality improvement, and teams and teamwork. In conjunction with the course, participants lead a QI project at their institution and report back to the group at Intermountain Healthcare.

The new curriculum begins with a foundation of knowledge presented through didactic material but emphasizes active learning through participation in the resident-led projects designed to lead to improved practices. Resident involvement in identifying topics and designing and implementing practice changes rather than simple chart review is the key difference between the new and old curriculum. The key educational objectives of the new curriculum are to build teamwork and practice-based improvement skills.

Table 1. Change Concepts

Send reminders of current best practice and use case presentations to make a point (academic detailing)
Share data collected for learning purposes and motivation (data feedback)
Develop standard protocol/order sets
Test and develop links with community resources
Enhance patient self-management support; empower patients to take an active role in their own health care
Develop decision support tools
Build a patient registry

Didactic Material

Didactic material is presented during the first 2 months of each academic year and consists of 5 core lectures presented to all residents. The series begins with an overview of the quality of health care in the United States, which provides the backdrop for the remaining sessions. The Institute of Medicine reports on medical errors [5] and other problems currently undermining quality of care [6] are reviewed, and the interaction between quality, cost, and access is explored. Common injury sources, the definition and classification of medical errors, and current hospital initiatives are discussed in a patient safety session led by the Chief Medical Officer at our affiliated hospital, Memorial Medical Center.

Ideas for resident projects are solicited from faculty and are presented with potential change concepts (**Table 1**) in another session. Changing physician behavior can be very difficult. There is no one way to always improve performance [7]. Residents first need to understand terminology, such as academic detailing and data feedback. They will explore use of these concepts later in their projects. Tools such as run charts (ie, graphs used to track data over time) and cause-and-effect diagrams are taught at the same meeting. The content of a good aim statement and sample aim statements are reviewed as well. The remaining sessions are devoted to a discussion of evidence-based medicine, statistics, and data analysis. Residents are expected to use these tools and apply these concepts in the course of their projects.

In 2004, we added an online training module offered through the Institute for Healthcare Improvement called “The Model for Improvement: A Powerful Engine for Change” (www.ihl.org/ihl/programs). This module reinforces key quality concepts introduced

Table 2. Timeline for Resident Quality Improvement Projects, Academic Year 2006–2007

August 13	Finalize teams and submit a list of team members
August 27	Submit an aim statement describing the purpose and goals of the team's project
November 20	Report preliminary data and ideas for change at noon conference
November to March	Use PDSA cycles to test and implement change strategies
March 15	Start to analyze follow-up data and prepare final presentations
April 30 through May 4	Final project presentations: 25-minute oral presentation with 5 minutes for questions; poster
May 22	Grand rounds presentation (top 2 teams)

PDSA = Plan-Do-Study-Act.

in the core lectures, such as how to write an aim statement for a QI project, the PDSA cycle, and how to measure improvement, and then explores these concepts in more depth. Residents can use any computer to complete the module at their own pace.

Resident-Led Quality Improvement Projects

The core of the new curriculum is participation in the design and implementation of resident-led QI projects, which is required for all second- and third-year categorical medicine residents and fourth- and fifth-year combined medicine-psychiatry residents. At this time, first-year residents do not participate directly. Currently (2006–2007 academic year), 30 residents are participating.

At the beginning of the academic year, residents receive detailed handouts outlining the rules and expectations for the projects as well as the project timeline (Table 2). Guidelines for chart review and for local internal review board approval are included, as are descriptions and examples of QI tools for data analysis and tracking. Statistical help is available on an individual basis at any time during the project at the resident's request.

Residents form teams by the end of August. Each team must have a minimum of 2 and a maximum of 5 residents and include at least 1 senior resident (third-year categorical or fourth- or fifth-year combined medicine-psychiatry resident) who serves as the team leader. Residents are free to form their group within these guidelines and are not assigned to groups unless absolutely necessary.

Each team has a faculty mentor from the division of general internal medicine, chosen by the team, and a nursing representative, who may also be invited by the team or is assigned by the chief nurse. The faculty mentor and nursing representative serve as advisors only; residents are responsible for background research, baseline data collection, and implementation

of their project. However, teams are expected to meet periodically with their mentors to discuss their QI projects. Faculty buy-in and involvement are essential to the success of the resident QI projects. However, faculty expertise in clinical practice improvement is not a prerequisite. We have found that faculty can be effective coaches in this process, even when they learn with and from trainees.

Each team must submit its topic and aim statement by the end of August; these are reviewed by the faculty mentors and the authors for feasibility. The teams are instructed to choose a project that is grounded in their own clinical experiences, and they are encouraged to select a topic that they feel is important and worthwhile. The project can be based in the inpatient, outpatient, or nursing home setting. Teams can elect to build on a project that was started in a previous year or to start a new one. Frequently, second-year residents will continue the same project into their third year. Teams are strongly encouraged to include other key stakeholders in the clinical care processes they are studying. Opinion leaders and others who will be affected by a change must be aware of the project and involved to assure sustainability and spread. For example, inpatient projects need to include appropriate hospital personnel.

Aim statements for the QI projects should focus on outcomes and be as specific as possible. The statement should be clear and succinct, indicate the target population, and identify the general approach. Each team must answer the 3 fundamental questions relevant to making a change in practice [4]:

- (1) What do you want to accomplish?
- (2) How will you know that a change is an improvement?
- (3) What changes can you make that will result in an improvement?

Once the project and aim statements are approved, teams study the relevant care process and collect

baseline data. This step teaches the team to develop a data collection form. The teams are encouraged to collect just enough data. We do not want them to get bogged down or discouraged by reviewing large numbers of charts. Therefore, groups can study a pilot population or use sampling techniques.

In November, each team is allotted 10 minutes at a noon conference to succinctly present the aim of their project, their baseline data, and their ideas for change to their fellow residents and faculty. This conference helps enforce the timeline and keeps the teams engaged and on target. From November to April, teams implement change strategies and measure follow-up data to assess the effectiveness of their interventions. They are encouraged to test interventions in small pilot groups using PDSA cycles.

In May, each group presents its final results in a poster and a 30-minute PowerPoint presentation to faculty, residents, and students. For 1 week, noon conferences are devoted to resident QI presentations. Each member contributes in the presentation of the group's work. Posters are displayed in the department of medicine hallway for 1 week to highlight resident accomplishments and to allow ample time for review. Although to date one group has published its project and others have presented their projects in poster sessions at regional meetings, the primary goal of the projects is educational.

Project Examples

Resident projects have covered a broad range of topics (Table 3) using a variety of change concepts. Creative thinking is encouraged.

One of the most successful projects thus far was to improve the perioperative use of β -blockers in orthopedic surgery. This particular project was carried out over 2 years. In the first phase, residents gathered baseline data on perioperative β -blocker use and the rate of postoperative cardiac events. Residents developed a streamlined preoperative risk assessment form, tested it, and implemented its use in one of our affiliated hospitals. In the second year of the project, postintervention data were collected. The use of the standardized physician preoperative risk assessment form increased overall utilization of β -blocker therapy from 19% to 64% and also led to a reduction in perioperative cardiac events. Residents published their project in a peer-reviewed journal [8], and the use of the risk assessment form is spreading beyond orthopedic surgery to include all major surgeries.

Although the results are not as dramatic as those

Table 3. Examples of Resident Quality Improvement Projects

Screening/preventive care
Pneumococcal vaccination
Colorectal cancer screening
Osteoporosis screening
Depression screening
DVT prevention, diagnosis, and use of D-dimer test
Appropriate perioperative use of β -blockers
Diabetes care
Foot care
Managing dyslipidemia
Microvascular complications (retinopathy, nephropathy)
Hypertension control
Improving HbA _{1c} levels
Overuse/misuse of antibiotics for acute respiratory conditions
Depression care
Medications and laboratory monitoring
Appropriate follow-up

DVT = deep venous thrombosis; HbA_{1c} = glycosylated hemoglobin.

of the β -blocker project, other resident QI projects have shown some success, such as increased compliance with laboratory monitoring related to antidepressant use, increased pneumococcal vaccination rates, and improvement in process measures for diabetes care. In addition, a project related to deep venous thrombosis prevention prompted one of our referral hospitals to change the D-dimer assay they use in their laboratory.

Residents can learn from unsuccessful projects as well. A few teams encountered roadblocks and systems failures that impeded their progress. Obstacles such as these provide residents with real world experience in dealing with barriers to change and improvement. Failures are shared along with successes at the end-of-year presentations to enable all residents to learn from both experiences. In fact, our residents have learned as much about systems-based practice from failures as they have from successes. For example, one group, working on improvement of diabetes care, developed a flow sheet to be placed on the front of the patient record to track quality indicators. The idea had merit. However, the team did not educate all of the residents who were placed in the pilot group and did not clearly define who was responsible for filling out the sheets. It

was not surprising to find that most sheets were blank at the end of the study period. A review of this project indicated that the residents failed to define roles and failed to use PDSA cycles to test their ideas.

Evaluation and Compliance

As noted, residents receive an information packet at the beginning of the academic year outlining the rules and expectations for the project as well as the rewards and consequences. Residents must sign for this packet, which assures us that each resident is aware of our expectations. At the end of the academic year, residents complete evaluation forms assessing their experience with the QI curriculum and resident-led projects. Faculty and peers also evaluate the poster and PowerPoint presentations. We use this feedback to improve the resident experience.

Compliance with resident projects is encouraged through a system of rewards. Faculty and peer evaluations are tabulated each year to determine the 2 best projects. Each member of the top 2 teams receives a gift certificate for the purchase of books. In addition, the top 2 teams present their work and receive recognition at the department of medicine grand rounds.

Participation for 2 years and completion of a QI project is considered a milestone required for graduation from our residency program. If residents do not comply with the requirements of the project after sufficient reminders, documentation is sent to the program director for disciplinary action. Fortunately, this has not been a major problem.

Lessons Learned

We are currently in our sixth year of implementing the new curriculum. Each year we re-evaluate the program and make changes based on the feedback we receive. Overall, we view the new curriculum as a great success. We have many examples of improved patient care, residents are actively learning to use QI techniques, and faculty members are motivated and learning the QI processes along with the residents. Our observations and lessons learned from this 5-year experience should be useful to other residency programs.

We have encountered some difficulty in forming resident teams. Personality conflicts among residents have been minimal but occasionally arise. This is one reason that residents are first given the opportunity to choose their partners and form their own teams. If this does not go smoothly, we intervene and assign residents to teams. Typically, 1 or 2 residents out of approximately 30 each year need help with assignment to a team.

It is crucial that each resident participates fully in the project and does his or her fair share of the work. Teams do not have protected time for their project, so the residents must work together and share responsibility, especially for data gathering and tests of change. An assessment of teamwork is one of the items included in the residents' year-end evaluation. Occasionally, residents will indicate that 1 or 2 team members did the majority of the work. This can be avoided by having faculty mentors assess for this problem in real time and encourage participation by all team members during the course of the project. Faculty must be active advisers but cannot do the work for the residents.

Team size was also found to be a factor in how the teams functioned. Those with more than 5 residents tended to be inefficient. As a result, team size was limited to 2 to 5 members.

Working on a multidisciplinary team is a new concept for some residents. In these cases, residents may need to be encouraged to elicit and include ideas generated by nursing and other ancillary personnel. We have seen projects fail because nursing input was not sought in the planning stages of the project.

The project aim statements need to be reviewed carefully to assure general feasibility of the projects. Initial aim statements may need to be revised because they are too general or do not include clear goals.

Teams frequently need more statistical help than they anticipate. They can fall into the trap of collecting too much or too little data. While teams learn to use the PDSA cycle for improvement, some teams fail to pilot test their ideas or try to make changes that are too large.

Finally, although the role of faculty is advisory and we want to encourage residents to take charge, we have occasionally found that supervision was too loose, with groups meeting with their mentor only 1 or 2 times during the year. Over the years, we have observed that the most successful groups meet regularly with their faculty advisor. To facilitate this, this academic year we built time into the regular conference schedule for teams to meet once a month with their faculty mentor.

Feasibility of Spread to Other Institutions

We feel that the clinical experiences and workload of our residents are comparable to those at other internal medicine training programs. Our program is supervised by one faculty member who serves as a resource for all teams and who is responsible for organizing the didactic curriculum and tracking the

resident projects. We anticipate that larger institutions will have different logistic challenges in the implementation of resident-led projects. We nevertheless anticipate that, with local modifications, our QI curriculum for residents is transferable to other settings. It is based on the Model for Improvement, a widely used tool for guiding QI work at many levels of care. The fundamental concepts of this QI model have been used in clinical practice to transform everything from individual physician offices [9] to large systems such as the Veterans Affairs health care system [10]. It is time to use these proven tools for improving quality of care to improve resident education.

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