Integrating Improvement Learning Into a Family Medicine Residency Curriculum

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BACKGROUND AND OBJECTIVES: Knowledge of improvement practices is a critical skill for family medicine residents who will lead patient-centered medical homes. The Accreditation Council for Graduate Medical Education includes systems-based practice and improvement knowledge as a core competency for residency education. The objective of this report is to describe the 6-year implementation and development of our practice-based improvement curriculum in a family medicine residency.

METHODS: In 2006, Oregon Health & Science University Family Medicine Residency implemented an improvement curriculum that focused on clinic-based improvement and involved longitudinal didactics. Over the course of 6 years, the curriculum has been refined to include longitudinal instruction of improvement principles according to the levels of training and clinic-based didactics and experientials that are team oriented. Residents complete ambulatory improvement projects over the cycle of 12 months and present outcomes each year. Residents evaluated their knowledge, experience, confidence, and satisfaction at the end of the academic year.

RESULTS: Ninety percent of residents designed and lead improvement projects upon graduation from residency in 2011. Resident confidence to make a change in local health care settings at the end of the curriculum was high and improved from 2009/2010 to 2010/2011. Upon graduation from the program, 100% of residents reported competence or proficiency in their ability to apply knowledge to an improvement project and present results.

CONCLUSIONS: We describe a longitudinal, practical, developmental, and clinically based experiential improvement curriculum that has been successfully integrated into a family medicine residency program.

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Leadership of improvement processes is a critical skill for medical professionals who are key players in achieving safer and more effective health care delivery systems. In 2002 the Accreditation Council for Graduate Medical Education (ACGME) adopted core competencies for medical resident education that include facility in practice-based learning, systems-based practice, and improvement knowledge. Performance improvement is a core tenet of the responsive patient-centered primary care medical home, which has emerged as the preferred model of primary care delivery. The Residency Review Committee (RRC) for Family Medicine also requires that residency training programs offer opportunities for residents to learn about improvement. The competencies are interpreted variably across residency programs, creating discrepancies in resident knowledge and competence in leading practice-based improvement.

Residency Improvement Curricula

Improvement instruction in resident education is described in a variety of settings using numerous instruction modalities across multiple medical specialties. Many improvement curricula teach residents about patient safety through specific and prescribed improvement tasks, such as chart audits and root cause analyses. Some reports highlight short-term projects that take place during elective rotation blocks without longitudinal integration. Others describe varying levels of involvement by residents in improvement activities. Improvement work may be voluntary and is often geared toward ambulatory care settings. A systematic review of the...
methodological rigor of improvement curricula in residency programs found that most residents received little didactic instruction and participated in just one change cycle, concluding that residents may not achieve sufficient exposure to change principles and their application to be able to use them effectively in practice.11

Recommended strategies for increasing the success of the implementation of improvement curricula include combining experiential project-based learning with didactics,12 modeling improvement practices for learners,13 integrating improvement projects into clinical settings,14 and incorporating resident evaluation of learning objectives.12

**Family Medicine Improvement Curricula**

Family medicine training programs are implementing integrated systems-based improvement teaching into their curricula; however, detailed information on the specific curricular components is limited. Coleman and colleagues describe a 6-month cyclic curriculum that incorporated core weekly didactic sessions, experiential learning through conducting chart audits and using Plan-Do-Study Act (PDSA) cycles, multidisciplinary clinical teamwork, incentivized participation for residents, and formal project presentations.9 Similarly, Atlantic Healthcare implemented a voluntary improvement collaborative across eight residency programs of various specialties that featured didactic sessions, use of PDSA cycles, multidisciplinary team involvement, and resident-led improvement projects. The collaborative focused on a common medication reconciliation project over a 6-month period.15

Others developed a mandatory 2-year improvement curriculum in which senior family medicine residents chose to participate in dedicated clinical improvement activities or traditional research. The curriculum included group work during protected time, web-based learning modules, project development with faculty mentors, literature reviews, data collection, and synthesis for presentation and publication.10 Through implementing a 12-week improvement program across seven mid-Atlantic family medicine residency programs, others concluded that residency programs with invested faculty leadership and more resources are more likely to create improvement-friendly environments.17

To our knowledge, this is the first report of an integrated, comprehensive, and mature curriculum in a family medicine residency program. This paper describes the development and integration of our structured, step-wise, 3-year improvement curriculum in an academic family medicine residency program at Oregon Health & Science University (OHSU) in Portland, OR, and reports the latest resident curriculum evaluation results.

**Methods**

**Setting**

The curricular development and improvement work occurred in the OHSU Family Medicine Residency Program, a 3-year residency program with 36 residents participating in full-spectrum primary care. Residents are based at one of three family medicine clinics for their ambulatory rotations. The curriculum has been developed, implemented, and revised annually under the leadership of an affiliated faculty member with expertise in health services management and performance improvement, working closely with senior family medicine residents and the residency program director.

**Curriculum Design and Evolution**

This improvement curriculum was implemented in 2006 at the request of residency leadership and in response to the ACGME requirements for building knowledge and competencies in improvement.9 The initial curriculum consisted of required monthly didactic and interactive learning sessions. A detailed syllabus and reading list were developed, drawing on the Institute for Healthcare Improvement’s eight domains of knowledge for the improvement of health care19 as well as curricular innovations in teaching improvement in several health disciplines.19-22 Residents completed a structured evaluation form at the end of the year, and while feedback was generally positive, the residents expressed interest in more hands-on activity. Evaluation results led to a substantial redesign of the curriculum for year two (2007–2008) and in each subsequent year.

In response to resident and faculty feedback, the curriculum has evolved over the past 6 years, with each year’s experience serving as its own improvement cycle leading to curricular changes based on the previous years’ evaluation results. Major curricular changes have included decreased emphasis on large-group didactic sessions, a streamlined curriculum tailored to class year, and modification of learning sessions as the clinics have implemented and integrated an electronic health record (EHR) and other technological enhancements to support patient care. The clinic-based improvement experiential project has also adapted as the three clinics have adopted and evolved clinic-specific strategies of team-based care and the patient-centered primary care medical home. Table 1 summarizes the curricular evolution, and Table 2 illustrates the developmental stages of improvement learning by class.

The overall learning competencies for the improvement curriculum now are to:

- Understand and be able to describe basic concepts, models, methods, and tools of improvement.
- Understand and be able to apply concepts of systems-based practice in the clinical setting.
- Demonstrate integration of knowledge of improvement concepts and tools through applications to various practice situations and contexts.
Apply knowledge of improvement concepts and tools to an organizational improvement process in the physician’s own practice and present results of project work.

The curriculum is conceived as a longitudinal 3-year learning program, with attention to avoiding repetition and increasing content and application in parallel with residents’ overall competency and knowledge development. The current required improvement curriculum includes four primary curricular strategies:

1. **Foundational learning through personal improvement**

   - **Apply** knowledge of improvement concepts and tools to an organizational improvement process in the physician’s own practice and present results of project work.

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1. **Foundational learning through personal improvement**
2. **Collaborative improvement strategies:**
3. **Leadership development:**
4. **Improvement application and leadership:**

### Table 1: Evolution of the OHSU Family Medicine Curriculum

<table>
<thead>
<tr>
<th>Year</th>
<th>Didactic Sessions</th>
<th>Clinic-Based Improvement Projects</th>
<th>Practical Learning Sessions by Class</th>
<th>Oral Presentations</th>
</tr>
</thead>
<tbody>
<tr>
<td>Year 3 (2008–2009)</td>
<td>Three didactic sessions</td>
<td>Monthly work sessions</td>
<td>PGY1: PIP</td>
<td>Teams present clinic-based projects at end-of-year FMR conference</td>
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<tr>
<td>Year 5 (2010–2011)</td>
<td>Introductory didactic session by class Mid-year check-in by class</td>
<td>Monthly work sessions Added just-in-time didactic sessions at clinics; topics defined by project evolution</td>
<td>PGY1: PIP PGY2: Evidence-based decision making PGY3: Leading improvement</td>
<td>Teams present clinic-based projects at end-of-year FMR conference</td>
</tr>
<tr>
<td>Year 6 (2011–2012)</td>
<td>Introductory didactic session by class Mid-year check-in by class</td>
<td>Monthly work sessions, with just-in-time didactics</td>
<td>PGY1: PIP PGY2: Using EHR for panel management PGY3: Leading improvement</td>
<td>Teams present clinic-based projects at middle and end-of-year FMR conferences Teams present projects to FM Research Day</td>
</tr>
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**OHSU—Oregon Health & Science University**  
**PGY—postgraduate year**  
**FMR—family medicine residency**  
**PIP—personal improvement project**  
**EHR—electronic health record**

### Table 2: Developmental Learning of Improvement by Class

<table>
<thead>
<tr>
<th>PGY1s</th>
<th>Teaching: Basic and advanced improvement theory and tools (based on IHI domains)</th>
<th>Experiential Application: Resident-selected Personal Improvement Projects</th>
</tr>
</thead>
<tbody>
<tr>
<td>PGY2s</td>
<td>Teaching: Data collection tools to drive change, practices; applied data analysis; panel management</td>
<td>Experiential Application: Resident-selected panel management projects incorporating topics taught</td>
</tr>
<tr>
<td>PGY3s</td>
<td>Teaching: Leadership assessments, team management, career planning for leadership of improvement teams</td>
<td>Experiential Application: Lead clinic improvement projects</td>
</tr>
<tr>
<td>PGY4s</td>
<td>Combined program preventive medicine/family medicine residents co-teach improvement curriculum to residents and function as clinic coaches</td>
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**Projects:** An introduction to learning about improvement concepts and methods is facilitated by engaging the postgraduate year one (PGY1) interns in a focused personal improvement project. Each intern develops and implements a personal improvement project involving rapid cycle improvement using the PDSA methodology.
model and presents this to the rest of the intern class. Examples of intern projects include increasing physical activity, improving diet, and creating personal time for playing musical instruments. The personal improvement projects provide practical and personally satisfying experience in using improvement methods, increasing interns’ understanding of improvement methods, and increasing their engagement in learning about improvement.

2. Step-wise didactic sessions appropriate to resident level of training: The relevance of the improvement curriculum is reinforced by class-specific learning sessions and projects, with PGY2s focusing on patient panel management and use of data for decision making and PGY3s focusing on leadership of improvement teams, conflict resolution, and integration of improvement strategies into daily work. Table 2 summarizes the curriculum by year of training.

3. Clinic-based team improvement projects: Time is allocated monthly at clinic-based resident conferences to ensure protected time for the resident teams to work on their improvement projects; each clinic site is assigned a coach who is experienced in improvement methods (either a senior resident who has completed additional training in improvement or an attending faculty with expertise). Residents select one or more topics that are important to their work at that clinic site, and work in either one or two groups.

4. Demonstration of improvement knowledge and presentation skills: Formal presentations for both clinic-based and personal improvement projects are completed with demonstration of effective use of improvement concepts.

Teaching occurs largely during protected time for residents who are free from other clinical obligations during those sessions. The training year-specific didactics take place during 4 weeks of protected didactic time in which senior residents assume intern responsibilities. PGY1 residents participate in all 4 weeks; PGY2 and PGY3 residents each participate in two 1-week sessions of the didactic time over the year. The practical curriculum that is clinic based takes place for 1 to 2 hours during residents’ clinic-based didactic sessions, once per month (residents have a 4- to 5-hour didactic session every week and once monthly the session occurs at continuity clinics). In addition, quality improvement concepts and practice are the focus of discussion by class twice yearly during the weekly didactics.

Since residents design and implement year-long improvement projects in their continuity clinics, they are exposed to multiple cycles of change, in contextually relevant clinical settings. The OHSU improvement curriculum incorporates educational components that reflect sound learning principles that address ACGME competencies: resident-driven experiential learning complemented by didactics on theory, real-world application of skills linked to health systems improvement, integration into clinical practice, faculty support and mentorship, and formal evaluation and assessment.

Curriculum Evaluation
A systematic evaluation of the improvement curriculum is ongoing, illustrating curricular cycles of improvement and redesign. We considered various methods found in the literature, including the use of a standardized tool such as QIKAT to assess knowledge but were unable to identify any reported comprehensive assessment that addressed all of the components in the OHSU curriculum. We developed a resident satisfaction and self-assessment of learning survey, which is completed independently by each resident at the end of the academic year. Informal focus group discussions have also been conducted to obtain additional comments, and in June 2009, a faculty member performed a qualitative evaluation as part of an overall curriculum review. The in-person evaluations have been less structured and therefore are not reported here.

The resident survey addressed self-assessment of baseline knowledge, improvement knowledge, application, utility, perceived competence, learning styles, and satisfaction with the curriculum. No IRB approval was required for the educational evaluation and program assessment. Results are analyzed using Microsoft Excel and are compared to previous years’ results. Key themes are identified and used in ongoing curricular review.

Results
While the OHSU improve curriculum has a 6-year history, the results presented here reflect data from the 2009/2010 and 2010/2011 academic years. The curriculum had reached a point of concrete development in 2009 that allowed for a robust evaluation. The evaluation data from the 2009/2010 and 2010/2011 academic years are drawn from identical surveys. Evaluation data from the 2011/2012 academic year are being collected at the time of this report.

Eighty-six percent and 94% of residents responded to evaluations of the 2009/2010 and 2010/2011 improvement curriculums, respectively. Of 2009/2010 evaluation respondents, 35% were in PGY1 training, 35% in PGY2, and 29% in PGY3. For the 2010/2011 evaluation, 34% were trainees in PGY1, 31% in PGY2, and 31% in PGY3. Thirty percent of respondents each year had received no formal training in improvement prior to this experience.

Knowledge and Experience
Self-reported resident knowledge and experience with clinical improvement projects increased from the initiation to completion of the curriculum each year. Knowledge and experience also increased with year of training and improved from the 2009/2010 to 2010/2011 year. While 17% of residents (all of whom were in PGY1) reported that they knew nothing about improvement
Figure 1: End of Year Self-Reported Resident Knowledge and Experience With Improvement

Graphical representation of self-reported resident knowledge and experience with improvement curriculum. In 2010, 30 of 36 total residents and eight of 12 PGY3 residents completed surveys. In 2011, 34 of 36 total residents and 10 of 12 PGY3 residents completed surveys. Results are presented in percentages.

Figure 2: Self-Reported Resident Confidence in Ability to Make a Change to Improve Health Care in a Local Setting

Graphical representation of self-reported resident confidence level to make a change that would improve the local health care setting. Thirty of 36 residents completed surveys in 2010, and 34 of 36 residents completed surveys in 2011. Results are presented in percentages.
at the beginning of the 2009/2010 academic year, 100% reported knowing about improvement and having some amount of experience at the end of the year. Forty-eight percent of all residents and 75% of PGY3s in 2009/2010 and 38% of all residents and 90% of PGY3s in 2010/2011 reported that they had designed and led improvement projects by the end of the academic year. At the end of the 2010/2011 curriculum, 94% of residents reported having either participated in or designed and led improvement projects compared to 83% at the end of the prior academic year. Ninety percent of PGY3 residents reported having either participated in or designed and led improvement projects at the end of the year compared to 10% at the beginning of the year (Figure 1).

Confidence
Resident confidence in ability to make a change in the local health care setting improved from 2009/2010 to 2010/2011. While 30% of residents were either confident or very confident that they could make a change at the local level at the end of 2009/2010, 54% of residents were confident or very confident in their abilities at the end of the 2010/2011 curriculum (Figure 2). At the end of the 2010/2011 academic year, 64% of PGY3s rated themselves proficient in their ability to apply knowledge to an organizational improvement project and to present the results of the project. All of the PGY3s rated themselves at least competent. Fifty-eight percent of PGY1s and 60% of PGY2s considered themselves early learners, while self-reported competency was achieved by 42% of PGY1 and 40% of PGY2 residents at the completion of the 2010–2011 curriculum.

Satisfaction
Resident satisfaction with the learning about general improvement concepts within health care improved from 19% in 2009/2010 to 51% in 2010/2011 (Figure 3). Resident satisfaction with integration into ongoing clinic-based improvement projects was greater among residents who were able to attend at least three (of 12) clinic-based improvement work sessions. There was no dissatisfaction with learner integration into clinic-based improvement projects among residents who attended five or more clinic-based improvement sessions.

Discussion
Findings
The results of this study indicate that resident self-reported knowledge and experience with improvement theory and projects in the clinic setting improved after participating in the curriculum detailed in the methods section. Knowledge and experience tended to improve with seniority of the residents. Ninety percent of residents designed and led improvement projects upon graduation from the program. The results of this study indicate that resident self-reported knowledge and experience with improvement theory and projects in the clinic setting improved after participating in the curriculum detailed in the methods section. Knowledge and experience tended to improve with seniority of the residents. Ninety percent of residents designed and led improvement projects upon graduation from residency in 2011. In addition, resident confidence to make a change in the local health care setting at the end of the curriculum was high and improved from 2009/2010 to 2010/2011. Upon graduation from the program, 100% of residents reported competence or proficiency in the ability to apply knowledge to an improvement project and present results. Resident satisfaction with learning general health care improvement techniques improved from 2009/2010 to 2010/2011 and was likely attributable to the addition of monthly clinic-based didactic sessions. Resident satisfaction with their integration as learners into the clinic-based improvement projects...
was correlated with attendance at those sessions.

Relevance
The results of our evaluation indicate that residents feel they possess the experience and confidence necessary to be physician champions for improvement projects in their clinical settings upon graduation from residency. The correlation between attendance at the monthly didactic sessions and feelings of integration into the ongoing clinic-based improvement projects demonstrates the importance of real-time presence in being a part of an improvement project. Attendance can be particularly challenging for PGY1 and PGY2 residents who often have call or away rotation obligations.

The literature review did not reveal any mention of a longitudinal 3-year developmentally appropriate adaptive curriculum such as reported here. A distinct advantage of the OHSU family medicine residency improvement curriculum is the strong organizational support it receives from the family medicine department. This curriculum has been integrated as part of the overall curricular redesign and evolution to respond to RRC requirements.

Strengths and Limitations
The strength of this study is that it is the first to our knowledge to describe a longitudinal, developmentally appropriate adaptive curriculum in a residency program. This study is limited in that data are both retrospective and subjective. Surveys were completed once at the end of each academic year, and there is a potential for recall bias. In addition, responses may be dependent on resident interest in improvement as well as personality traits. The survey involves a small group of individuals from one academic family medicine training program and therefore may not be generalizable.

Conclusion and Future Implications
Our model may serve as a template for other family medicine training programs looking to integrate improvement instruction into their educational programs to fully comply with RRC and ACGME requirements and may also have general relevance for other residency programs. This curriculum has evolved over 6 years, with annual iterations of improvement strategies. Important developments include class-specific sessions focused on improvement knowledge appropriate to year of training and a clinic-based improvement curriculum that reflects changes in the ambulatory setting. All three ambulatory sites have developed greater emphasis on team-based care as Oregon has facilitated adoption of the patient-centered primary care medical home model. During this time there has also been full integration of the use of an EHR, and the resulting ability to access and mine data for decision making and panel management. In the early years of the improvement curriculum, residents did not know how to access data and were often stymied in their improvement projects by a lack of readily available data. Now data utilization is an expected competency of all residents, which is demonstrated and enhanced through this improvement curriculum.

Over the years, the improvement curricular methods and techniques have become accepted by the faculty as a whole and are now tied to a new longitudinal learning curriculum that the department is implementing in its new 4-year training program. In 2012 the first 4-year class was initiated, and the Class of 2016 is expected to lead multidisciplinary teams in clinic-based improvement projects in their PGY4 year. Moving forward, it will be advantageous to study whether reported resident gains in improvement knowledge during the residency program are sustained during their fourth year, after graduation, and upon establishing clinical practice. Additional research could also examine the clinical outcomes of residents’ and graduates’ ambulatory improvement projects to assess the impact of this comprehensive curriculum on health service delivery.

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