# Evaluation of a Quality Improvement Curriculum for Family Medicine Residents

Fred Tudiver, MD; Ivy A. Click, MA; Patricia Ward, MPH, RD; Jeri Ann Basden

**BACKGROUND AND OBJECTIVES:** East Tennessee State University's (ETSU) Department of Family Medicine initiated Quality Improvement (QI) training in its three residency programs in 2008. The purpose of the project was to develop, implement, and assess a formal curriculum and experiential learning process to train family medicine residents in QI knowledge and skills.

**METHODS:** Family medicine faculty members received training in QI theory and design. Rising second-year residents received a day-long workshop on the basics of QI principles. Residents worked in teams to develop and implement QI projects. Self-assessed QI proficiency was measured prior to and immediately following the workshop. QI knowledge was assessed with the Quality Improvement Knowledge Application Tool (QIKAT) at baseline and following project completion.

**RESULTS:** Two groups of residents (n=37) received training and completed at least 1 year on their projects. Analyses revealed that residents' self-assessed QI proficiency improved after receiving a day-long training workshop and was consistent for both groups of resident training. Application of QI knowledge as assessed by the QIKAT did not improve following QI project participation in resident Group 1 but did improve in resident Group 2.

**CONCLUSIONS:** A formal QI curriculum was successfully developed and implemented into three family medicine residency programs. Residents' QI knowledge and skills improved following training and experience conducting QI projects. Faculty and resident commitment to the program and competing time demands proved challenging to the introduction of QI training. Future studies should assess residents' sustained learning and translating QI residency experiences into practice.

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Recent national trends, including the introduction of the patient-centered medical home (PCMH), have increased the importance of incorporating quality improvement (QI) in family medicine resident training. Implementation of continuous QI is one of the "must pass" elements to achieve PCMH recognition.[1] QI provides a means to systematically analyze practices with the goal of practice improvement—one of six Accreditation Council for Graduate Medical Education (ACGME) competencies.[2] The establishment of the Physician Quality Reporting System by the Centers for Medicare and Medicaid Services created a financial incentive for eligible professionals to participate in a voluntary quality reporting program.[3] The emphasis on pay for performance makes it particularly important for medical residents to be trained in how to develop and implement a QI process within their practices.

There are a number of examples of QI programs in medical residency programs, including two recently published systematic reviews of QI programs for residents and medical students. Wong et al[4] reviewed 41 QI training programs, 27 of which included residents. Most of the programs involved ≤10 contact hours, used knowledge as the only evaluative component, and only five were in family medicine residencies. Two of these five used a hands-on QI project in their curriculum. Patow

From the Department of Family Medicine, Quillen College of Medicine, East Tennessee State University (Dr Tudiver, Ms Click, and Ms Basden); and DB Consulting, National Center for Chronic Disease Prevention and Health Promotion, Centers for Disease Control and Prevention (Ms Ward).

et al[5] also conducted a systematic review but restricted it to active engagement of residents. Five of their 28 programs included family medicine residents; however, only one of the five described a formal QI curriculum, and none used a pretest, posttest evaluative design. Mosser et al[6] identified a lack of adequate means for assessing competence in performing QI as a challenge to teaching QI. Vinci et al[7] used a pretest, posttest evaluative design of an American Board of Internal Medicine (ABIM) QI curriculum; however, careful evaluation of QI curricula in family medicine residency sites is lacking.

The purpose of the Residency Training in Primary Care Quality Improvement for Rural Health project was twofold. The first was to develop a formal curriculum, and the second was to implement an experiential learning process to train and evaluate family medicine residents in evidence-based QI of primary care. The project had an emphasis on underserved rural areas (ie, medical practices with limited resources). There were three objectives set to meet the purposes mentioned: (1) to develop a proven curriculum for providing family medicine residents with clinical and didactic experiences for utilization of the QI process in their practice of medicine, focusing on cultural competence, health literacy, and health disparities, (2) to prepare family medicine residents with the knowledge, skills, and attitudes to utilize an evidence-based QI process in their medical practice, and (3) to share information about the process with other resident programs.

## Methods

The first year of the project was dedicated to planning, curriculum development, and training family medicine faculty members on QI theory and design. In the second and third years of the project, individual teams of second-year (PGY-2) family medicine residents in three affiliated residency clinics received QI training and completed at least one Plan-Do-Study-Act (PDSA) cycle on team QI projects. QI knowledge and skills application were assessed in both groups of PGY-2 residents. This study was reviewed by the East Tennessee State University Institutional Review Board and approved as exempt.

*QI Training Workshops: Faculty*

Project staff and consultants provided training to faculty so they would be familiar with QI tools and language and could support the residents when they began the development of their QI projects. In addition, faculty at each center were chosen as project "champions" to provide guidance to the residents and conduct regular meetings of the QI team. In the first year of the study, faculty members were trained in seven topics, one 1.5-hour session per month on QI theory and design. Topics included were literature searching, critical appraisal, health disparities, rural health promotion, Healthy People 2010, cultural competency, health literacy, and concluded with a comprehensive interactive session. A Faculty QI Training Manual was developed to provide faculty with an educational tool and source of information about QI and special topics. The manual included a comprehensive lesson plan.

*QI Training Workshops: Residents*

QI project staff, trained faculty, and expert consultants trained PGY-2 residents using the same basic curriculum framework used for training faculty, with the resident training sessions being more intensive and interactive. The residents participated in didactic sessions, group activities, and an experiential activity of QI project planning and implementation. The full-day QI training seminar covered evidence-based medicine and learning to build questions, researching evidence by searching the literature, and critically appraising research literature. These foundation topics were followed by an introduction to QI and tools used for a PDSA cycle. The PDSA cycle is designed to test a change in a real work setting—by planning it, trying it, observing the results, and acting on what is learned.[8]

In the afternoon, the residents met in clinic-based teams, with a "champion" facilitator to plan and discuss potential QI projects. Using fishbone diagrams and PDSA, each clinic team brainstormed to form a relevant QI question for their clinic and began the process of developing a QI plan to address this question. Worksheets provided a standardized format with step by step directions on how to development a comprehensive QI project.

The Resident Quality Improvement Manual provided standardized QI planning tools for the purpose of training through practice as well as aid in the development and implementation of a QI plan. The resident manual was based on published literature of other resident QI training programs[4-5,8] and was very similar in content to the faculty manual with the exception of the faculty lesson plan development section. To enhance the accessibility of training materials and activities included in the manual, several web pages on the Quillen College of Medicine/Department of Family Medicine website provided information about the QI process. Forms and tools for each of the steps to complete a QI project were available and videos of the training workshops were posted. (www.etsu.edu/com/familymed/researchdivision/improvement/default.aspx).

Additional training workshops were developed for each group. During July of each year, 3 hours of a 2-day Family Medicine Department workshop for PGY-2s were dedicated to Quality Improvement and the Patient-Centered Medical Home. Workshop topics included health literacy, cultural competency, and health disparities. PGY-2s were required to attend, but workshops were presented at each clinic site during lunch and were open to all staff and residents.

*Implementation of Residents' QI Projects*

Six weeks after the daylong training workshop, faculty met with the residents to help them determine how to further develop their QI project Action Plan and the next steps to implementation. The team's initial steps were to: (1) develop an aim, (2) describe how various disciplines work together to form the system of care for patients, (3) identify, collect, and display appropriate measures of care, including cost, and (4) recommend changes to the clinical improvement team. For the rest of the academic year, project faculty and staff met with residents approximately once per month to facilitate projects. Meetings focused on QI project implementation within the clinics; topics included appropriate tools and methods for data collection, timing of implementation, and barriers.

Residents shared the progress of their projects with faculty and residents at the other participating clinics at approximately 6 months into the projects. Residents' QI project topics from each year are shown in Table 1.

*Measures*

**Self-assessed QI Proficiency Survey.** Two measures for knowledge assessment were used. The first was a self-assessed QI proficiency survey of current skills to develop and implement a QI project based on a measure developed by Ogrinc et al.[9] Using nine faculty members, we conducted a face validity evaluation for clarity and relevance. Raters used a scale of 1–5 to indicate a score for each question as the question related to nine face validity measures. As a result, several items were re-worded, and the order of the presentation of questions was changed due to feedback from the face validity process.

Participating PGY-2 residents were given this self-assessment prior to and immediately following the full day QI training didactic sessions to determine if an effective change had taken place. The measure contained nine items to determine confidence with a QI process using a Likert-type scale of 1–5. The results of the survey indicated how comfortable a resident was with current skills to develop and implement a QI project. The scale ranged from "Not at all comfortable" to "Very comfortable." An overall QI proficiency score was computed from the nine Likert-scaled assessment items with possible scores ranging from 9 to 45.

**Quality Improvement Knowledge Application Tool.** After extensive searching, we elected to use the Quality Improvement Knowledge Application Tool (QIKAT) to measure the effects of QI project participation on QI knowledge and skills application. Ogrinc et al[9] had developed the QIKAT for a practice-based learning and improvement (PBLI) elective. The QIKAT presents three hypothetical clinical scenarios in which a QI intervention is needed to address patient care. Three basic questions must be answered for each scenario that correspond to three improvement elements: the aim of the improvement (an identified goal), a measure that is appropriate to determine if the aim is met and a change or intervention that must also relate to the aim and measure, following a PDSA process.[10]

Due to scheduling constraints, residents in Group 1 completed an initial QIKAT 3 months after the training workshop. Residents in Group 2 completed an initial QIKAT immediately after the QI training

**Table 1: Resident Quality Improvement Projects, Department of Family Medicine, East Tennessee State University, 2009–2011**

| Group | Location | Quality Improvement Project | Completed Cycles |
|---|---|---|---|
| 1 | Clinic 1 | "Pap-ing our way to Quality"—devising interventions to improve documentation and meet goals for screening.* | 2 |
| | Clinic 2 | "Clinic Time Flow Study"—identifying time lags and devise interventions to create more efficient visits.* | 2 |
| | Clinic 3 | "Diabetic Blood Pressure Control"—implementing a systematic way to ensure diabetic patients are prescribed appropriate blood pressure medications. | 2 |
| 2 | Clinic 1 | "Resident Feedback"—surveying patients to identify concerns with international residents to improve communication and care in the practice. | 1 |
| | Clinic 2 | "Reducing Hospital Bounce-backs"—follow-up with patients to monitor compliance to reduce "bounce-back" visits. | 1 |
| | Clinic 3 | "Diabetic Foot Inspections"—implementing a systematic way to ensure proper foot exams are performed on all diabetic patients. | 1 |

* Tennessee Academy of Family Physicians student paper winner

workshop. Both groups completed a follow-up QIKAT at the time of their project presentations.

Three raters (all study authors) individually scored each of the QIKAT responses. Scoring considered whether the answers incorporated improvement fundamentals and whether the three improvement elements bore some relationship to each other. "Gold standard responses" (case studies created by Ogrinc) were used as a guideline for determining appropriate responses. A coding system was developed to assign points to the elements and fundamentals in order to have a quantitative number that could be used to assign an overall score for each completed QIKAT. (Table 2.) Each scenario was scored from 0 (low) to 5 (high), generating a cumulative score of 0 to 15 points. After initial scoring, the raters met to resolve substantial differences in their assigned ratings. Weighted inter-rater agreement was calculated from the three raters on the raw scores. The inter-rater reliability was established by calculating intra-class correlation coefficients with 95% confidence intervals and was excellent for both baseline and follow-up cumulative scores (pre=0.91, post =0.84).

*Data Analysis*

Data were analyzed using PASW Statistics 18 (SPSS Inc, 2010, Chicago). QI Proficiency Survey responses and QIKAT scores were analyzed using mixed-model ANOVAs. The QI Proficiency Survey ANOVA compared overall pre- and post-training scores (within-subjects factor of assessment period) and Group 1 and Group 2 differences (between subjects factor of resident training group). The QIKAT ANOVA compared overall baseline and follow-up scores (within-subjects factor of assessment period) and Group 1 and Group 2 differences (between-subjects factor of resident training group). As follow-up to significant interaction, paired *t* tests were conducted on pretest and posttest scores for each group, as well as independent *t* tests on Group 1 and Group 2 scores for each assessment period.

## Results

*Participants*

Thirty-seven PGY-2 residents from three affiliated family medicine residency clinics took part in the Residency Training Program, Group 1, n=18; Group 2, n=19. Off-cycle residents and other circumstances resulted in missing data for some measures. We collected pre- and post-training self-assessment QI proficiency surveys from 15/18 (83%) of the residents in Group 1 and 18/19 (95%) of the residents in Group 2. We were able to collect completed baseline and follow-up QIKATs from 17/18 (94%) residents in Group 1 and 18/19 residents in Group 2 (95%).

*Self-assessed QI Proficiency Survey*

The pre- and post-training means and *P* values for each assessment item and overall scores for each group are presented in Table 3. Analysis revealed a significant main effect of assessment period on self-assessed QI proficiency, F(1, 31)= 65.69, *P*<.001. Residents' post-training means were significantly greater than pre-training means for all nine survey items and the calculated overall score for both training groups.

*Quality Improvement Knowledge Application Tool*

Analysis revealed a significant interaction between resident group and assessment period on QIKAT scores (F (1, 33)=11.17, *P*=.002). Follow-up tests revealed that there was no significant difference between baseline and follow-up scores in resident Group 1 (*t* [16]=1.65, *P*>.05) but that the mean follow-up score was significantly improved from the mean baseline score in resident Group 2 (t [18]=3.34, *P*=.004). Furthermore, there was a significant difference between Group 1 and Group 2 mean baseline scores (*t* [33]=3.48, *P*<.001, but no significant difference between Group 1 and Group 2 mean follow-up scores (t [33]=1.05, *P*>.05. (Figure 1.)

## Discussion

The major findings of this study demonstrate the development and successful implementation of a formal QI curriculum into three affiliated family medicine residency programs. Residents' self-assessed QI proficiency improved after participating in a day-long training workshop and was consistent for both training groups. Residents' application of QI knowledge as assessed by the QIKAT did not improve following QI project participation in resident Group 1, likely due to elevated baseline scores. After adjusting the

**Table 2: Quality Improvement Knowledge Application Tool (QIKAT) Scoring Table**

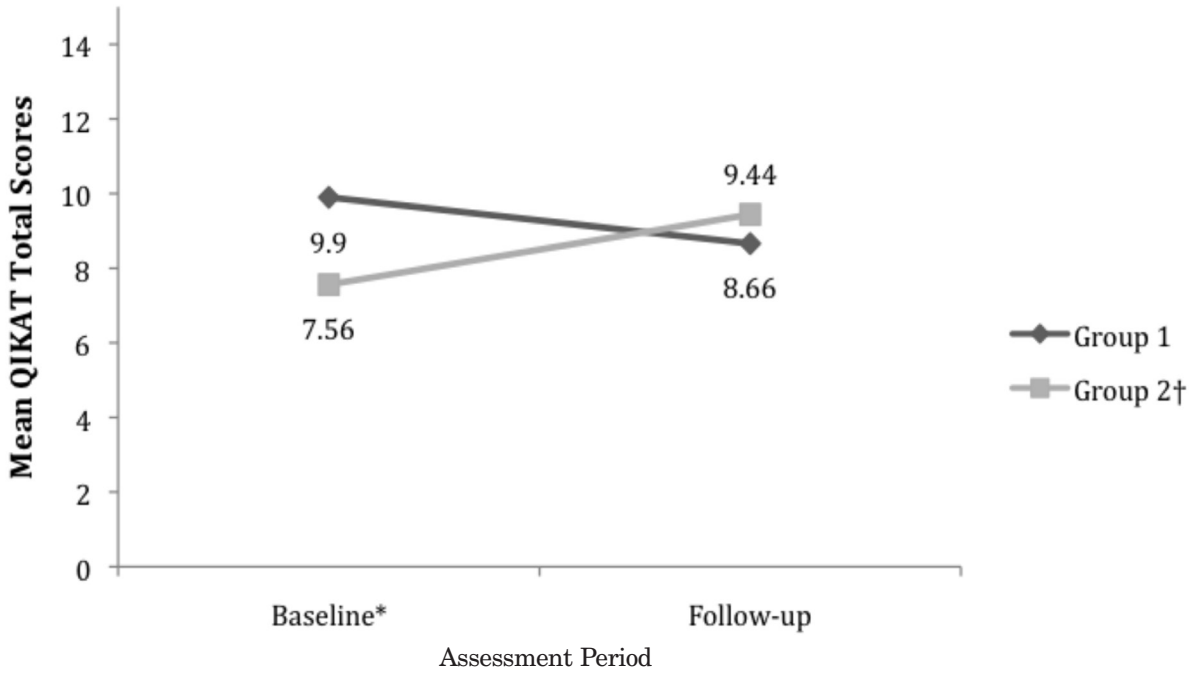
| Code | Elements |
|---|---|
| A 1 point | 1. Aim = Appropriate aim/goal identified. |
| M 1 point | 2. Measure = Appropriate measure is identified. |
| C 1 point | 3. Change/Intervention = A change that might be worth testing is identified. |
| **Code** | **Fundamentals** |
| P 1 point | 4. Process Indicates knowledge of system |
| F 1 point<br>Final score | 5. Customer focus<br>_____points (maximum of 5 points) |

Interpretation of the final QIKAT score for each scenario is based on these guidelines: 0=No response, 1=Attempted, but way off the mark, highest possible score if only one element addressed, 2=Needs substantial modification, elements unrelated, highest possible score if two elements addressed, 3=Good, needs modification, elements poorly related, 4=Very good, needs minimal modification, elements related, 5=Excellent, no modification needed, elements clearly related.

**Table 3: The Effect of a Quality Improvement (QI) Training Workshop on Residents' Self-assessed Quality Improvement Proficiency**

| Statement | Group 1 | | | Group 2 | | |
|---|---|---|---|---|---|---|
| | Pre | Post | *P* Value | Pre | Post | *P* Value |
| Clearly defining a problem statement | 3.20 | 4.00 | .003 | 2.94 | 3.89 | .001 |
| Describing the roles of different professionals in health care improvement | 3.47 | 3.93 | .048 | 3.28 | 4.06 | .002 |
| Applying the best research evidence | 3.07 | 3.60 | .041 | 2.78 | 3.56 | <.001 |
| Developing appropriate measures to assess outcome | 2.80 | 3.73 | .008 | 2.67 | 3.67 | <.001 |
| Assessing the process of care | 2.93 | 3.80 | .004 | 3.00 | 3.47 | .027 |
| Developing a data collection plan consistent with time and resource limitations | 2.60 | 3.60 | <.001 | 2.67 | 3.67 | .001 |
| Analyzing collected data | 2.80 | 3.60 | <.001 | 2.39 | 3.39 | <.001 |
| Implementing a structured QI plan to test a change | 2.53 | 3.80 | <.001 | 2.33 | 3.78 | <.001 |
| Sustaining an implemented plan over time | 2.80 | 3.47 | .019 | 2.61 | 3.72 | <.001 |
| Overall Score | 26.20 | 33.53 | <.001 | 24.72 | 33.00 | <.001 |

**Figure 1: Quality Improvement Knowledge Application Tool (QIKAT) Score Changes in Group 1 and Group 2 Residents**




* Group 1 baseline scores were significantly greater than Group 2 baseline scores.
† Group 2 follow-up scores were significantly greater than Group 2 baseline scores.

methodology for scheduling issues encountered in the first training year, QIKAT scores improved in resident Group 2.

We elected to use an adapted version of the QIKAT as it was the only tool with specific criteria demonstrating validity in assessing knowledge application in process improvement applications. In order to assess our resident QI training curriculum within a family medicine setting, after conducting our own validity test on the QIKAT, we established inter-rater reliability on a standardized scoring process. As Ogrinc found with his QI curriculum,[9] the psychometric development will make it more applicable to a range of environments and users.

This study adds to the small body of literature of carefully evaluated curriculum-driven QI education interventions, using validated measures in a family medicine residency. At the commencement of this project, in 2008, studies that had conducted a hands-on training with primary care residents using an evaluation method with validated measures were limited. The systematic review of effectiveness of teaching QI by Boonyasai and colleagues[11] reported that standardized measures for assessing QI resident training did not exist; they reported assessment measures in seven studies involving medical residents including the QIKAT, pre- and post-self-reported knowledge surveys, efficacy or behavior change surveys, and commitment to change surveys. Vinci et al[7] found that PGY-2 residents had significantly improved QIKAT scores after receiving QI training and completing QI projects. However, this study was conducted over two 1-month rotations at a single siambulatory site based on an off-the-shelf Practice Improvement Module from the ABIM. The current study was conducted at three family medicine residency practice sites over 2 years. Our curriculum was designed for QI to be incorporated into the daily routine of a primary care practice setting.

Systematic reviews published after we began our project[4-5,12] reported that adequate and validated QI medical curriculum assessment tools were still lacking. Windish[12] found fewer than one third of the studies reviewed reported validity evidence for evaluation instruments with only two validated instruments available, the QIKAT and the objective structured clinical exam.[13] A QI curriculum for medical residents is currently available on MedEdPortal,[14] with similar objective-driven educational outcomes as our project. This curriculum includes an assessment of residents' QI competencies using the Quality Improvement Proposal Assessment Tool (QIPAT).[15] This was the only other validated instrument available when we began our project; however, it assessed QI intervention proposals, which were not the focus of our study. As residency programs continue to face the challenges of the new ACGME core competencies, many new curricula will emerge.

*Limitations and Challenges*

While our findings are encouraging, this study also had limitations. While our 9-month experience fits into the traditional resident "block" scheduling, it may not be the ideal way to learn or practice PBLI. The time limitations of residents' rotations hindered the resident QI teams' ability to make and follow up on changes. Scheduling was a constant challenge to this project, as illustrated by the QIKAT findings. Group 1 residents completed their first QIKATs 3 months after the day-long training workshop rather than immediately after the workshop as Group 2 did; preliminary work on Group 1 projects likely elevated the baseline scores, resulting in a ceiling effect. Additionally, time restraints in two clinics during follow-up assessment in Group 1 may have resulted in rushed and incomplete answers. Adjustments for these factors were made in Group 2, which allowed for significant improvement to emerge. Although the intent of the QIKAT was to measure the effects of QI project participation on knowledge and skills application, perhaps a more robust effect would have been shown had we administered the QIKAT before and after the training workshop as well as after project completion.

As others have found,[6,16] one of the greatest challenges implementing a QI program was obtaining buy in from clinic faculty and the residents. Residents have competing demands on their time and at the beginning of the projects it is difficult for faculty, residents, and clinic staff to see the value in spending the time it takes for the development, implementation, cycling of the intervention, and collecting data for assessment. The importance of identifying an appropriate champion for resident teams is significant. Lack of support for the projects can also result in limited reinforcement of QI principles, such as the need for numerous cycles of change to determine effectiveness of the intervention. Although the inclusion of clinic staff in QI training and project implementation was planned, scheduling a full-day training workshop for residents, faculty, and staff to attend was not feasible. The workshop included a section on the importance of team work and a team-based approach, but ideally clinic staff should have been involved in the QI training process.

Future studies should assess residents' sustained learning and translating QI residency experiences into practice. Repeating the QI Proficiency Survey and/or QIKAT after residents graduate as well as surveying graduates regarding their QI activities in their current practice would provide meaningful feedback for determining the impact of the QI curriculum beyond residency. Additional measures such as the QIPAT, which assesses QI proposals, may be useful for determining whether the QI curriculum and project experience translate to their individual QI project development. Finally, the department is committed to the PCMH model and future QI curriculum implementation and evaluation should address a team-based approach to quality improvement.

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**CORRESPONDING AUTHOR:** Address correspondence to Dr Tudiver, East Tennessee State University, Department of Family Medicine, Box 70621, Johnson City, TN 37614. 423-439-6728. Fax: 423-439-2440. tudiverf@etsu.edu.

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