



Curriculum Redesign for Teaching the PCMH in Colorado Family Medicine Residency Programs

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BACKGROUND AND OBJECTIVES: The patient-centered medical home (PCMH) is a practice model that is intended to improve the quality of care by making it safer, more comprehensive, integrated, and personal. However, most family medicine residency programs are not fully prepared to train residents on this idealized model. The Colorado Family Medicine Residency PCMH Project's overall objective is to transform 10 residency practices into PCMHs through practice improvement and curriculum redesign. This paper focuses on the programs' implementation of key PCMH components into the residency curricula and the impact on resident self-perceived competence in and use of PCMH components.

METHODS: Mixed-method evaluation assessed PCMH curricular characteristics, routine use of PCMH components in patient care, and perceived resident competence after implementation of quality improvement coaching and PCMH curriculum tools. Baseline and follow-up PCMH semi-structured curriculum interviews assessed elements included in the residency programs' curricula. The PCMH Clinician Assessment (PCMH-CA) Survey assessed routine use of PCMH components in patient care. The PCMH Competency Self-Assessment Survey assessed residents' perceived competency in applying PCMH elements in patient care.

RESULTS: Qualitative data results demonstrated active efforts by the residency programs to implement key PCMH components. Survey results showed significant improvement from baseline to follow-up (12–36 months).

CONCLUSIONS: Implementation of the key components of PCMH into practice improvement efforts and residency curricula improved residents' routine use of PCMH in patient care and their perceived PCMH competence.

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and the model has received a great deal of attention as a way of increasing quality and decreasing costs of health care.²⁻⁵ However, most primary care practices are poorly prepared to deliver this idealized model and need extensive changes to fully accomplish improvements in care. Lessons learned from major practice change efforts are that this sort of practice change is very difficult, takes longer than anticipated, and requires assistance and additional resources to accomplish.^{6,7} It is critical that primary care residency programs serve as exemplars in this area, since clinical training during residency strongly influences future practice patterns, and residents will need leadership and practice improvement skills to foster and support practice transformation in their future practices.⁸

Current residency education does not incorporate many of the PCMH elements. In 2004, an Institute of Medicine report on implementing successful medical innovations noted, "Clinical education has not kept pace with, or been responsive enough to, shifting patient demographics and desires, changing health system expectations, evolving practice

The patient-centered medical home (PCMH) is a practice model that is intended to improve the safety, comprehensiveness, coordination, and personal nature

of health care rendered to primary care patients. The major primary care organizations developed joint principles to describe and endorse the characteristics of the PCMH,¹

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requirements and staffing arrangements, new information, a focus on improving quality, or new technologies.⁹ The Future of Family Medicine report encouraged development of the PCMH model and specifically called for a period of intense innovation in family medicine residency education to enhance the capacity to produce physicians capable of effectively practicing in the PCMH and leading this transformation process.¹⁰ However, there are multiple variations in how practices and residency programs implement PCMH principles.¹¹

The Colorado Family Medicine Residency PCMH Project had a goal to transform the nine Colorado family medicine residency programs and 10 residency practices into PCMHs through practice improvement and curriculum redesign.¹¹ This project was a collaborative effort between the University of Colorado School of Medicine, Department of Family Medicine; HealthTeamWorks (a Colorado-based nonprofit practice support organization); the Colorado Association of Family Medicine Residencies; and the Colorado Institute

of Family Medicine, with funding from the Colorado Health Foundation.

Key aims for the project included implementing key PCMH components into residency curricula and facilitating curriculum redesign efforts. The evaluation aimed to answer two questions: (1) What effect does the engagement of family medicine residency practice in PCMH changes have on residents' perceived and self-reported competencies in PCMH and (2) What lessons can be learned that might guide other residency programs on this journey? This paper reports on implementation of PCMH curriculum changes and outcomes related to residents' reported use of PCMH elements in patient care and perceived PCMH competency.

Methods

Our project used a prospective observational mixed-method evaluation to assess the intervention, with the project structure and data sources for the evaluation summarized in Table 1.

Table 1: Project Components and Evaluation Data Sources

| Project Components | |
|--|---|
| <ul style="list-style-type: none"> • Practice improvement coaching • Implementation of practice quality improvement teams and team-based care • Leadership alignment for the PCMH • NCQA PPC-PCMH recognition support • PCMH curriculum redesign consultation • PCMH curriculum modules • Bi-annual Learning Collaborative Sessions | |
| Evaluation Data Sources | |
| Completed at baseline and follow-up at each site | |
| <ul style="list-style-type: none"> • Semi-structured PCMH curriculum interviews | <ul style="list-style-type: none"> • Faculty and staff involved with curriculum |
| <ul style="list-style-type: none"> • PCMH Clinician Assessment (25 items and four subscales) | <ul style="list-style-type: none"> • All faculty and resident clinicians (resident results reported here) • Self-report by web-based survey |
| <ul style="list-style-type: none"> • PCMH Competency Self-Assessment | <ul style="list-style-type: none"> • Resident clinicians only • Self-report by web-based survey |

PCMH—patient centered medical home
NCQA—National Committee for Quality Assurance

PCMH Intervention

Practice Support. Quality improvement (QI) coaches worked individually with practices to facilitate quality improvement efforts. Practice coaching has been shown to be effective in helping practices make the changes required for optimal program implementation,¹² but has not been tested specifically for practice or curricular redesign in residency practices.¹³ QI coaches and other project staff also assisted with the NCQA PPC-PCMH recognition process, leadership alignment, and training within the practice. Practices participated in twice yearly learning collaborative meetings to share practice and curriculum redesign experiences. The project provided funding for practice coaching, assistance for curriculum redesign, participation in the bi-annual Learning Collaboratives, and other technical support to assist with PCMH transformation efforts.

Curriculum Support. Initial assessment of program coverage of PCMH topics was performed at baseline, including the PCMH Competency Self-Assessment by residents and the PCMH Curriculum Interviews described in detail below. A report of this assessment was provided to each program and used to plan curricular changes to better incorporate PCMH topics in the curriculum and provide residents with experiences in key areas. Curriculum redesign consultants worked collaboratively with each program to integrate the PCMH competencies into the curriculum and to create supervised resident experiences as leaders in the QI process; the project team also helped develop tools and specific PCMH curricula. Curricular topics were also covered in the learning collaboratives.

Protections. This evaluation project was reviewed by the Colorado Multiple Institutional Review Board and approved as exempt from human subjects research review.

Participants and Sites. All nine Colorado family medicine residencies and 10 practices participated. One residency has nine residents per class, three have eight residents per class, four have six residents per class, and one has six residents per year in the core program and four per year in a community health center track. All programs are in metropolitan areas (population 50,000 or more), with seven in primary care health professional shortage areas. The programs vary in patient populations, but most care for large percentages of Medicaid and uninsured populations. One program was a participant in the Preparing the Personalized Physician for Practice (P4) Project.¹⁴ At the beginning of the project just three of the 10 practices had a fully implemented EHR. During the 3-year project, four practices initially implemented EHRs, two practices changed to new EHRs, two upgraded to new versions, and the remaining two prepared for initial EHR implementation.

PCMH Measures

We used a mixed-method evaluation to assess baseline practice PCMH characteristics from multiple perspectives.

Interviews and Qualitative Data Analysis. Nine semi-structured PCMH Curriculum Interviews of faculty and staff were conducted with each program, assessing the program's baseline and 3-year follow-up coverage of core PCMH components and competencies. Baseline interviews helped to determine "gaps" in the curriculum related to PCMH. The key PCMH components were Population Management, Information Systems, Team Approach, Coordination of Care, Quality Improvement, Patient Centeredness, Personal Physician, and Leadership Skills. Interviews included faculty and staff involved in each program's curricular design. The same investigator performed baseline and follow-up interviews for each residency. Interview results provided

contextual data about implementation of PCMH components in the programs and practices.

The interviews were audio recorded and transcribed. An iterative process was used to identify and refine themes around PCMH curriculum redesign, with the interviewer initially rating the training needs for each PCMH curricular area immediately after interviews. Our qualitative analysis team met regularly to review data as it was collected. Team members individually immersed themselves in the data to identify themes and then met to discuss each other's analyses to identify common themes. Investigators went through cycles of reading, summarizing, and re-reading the data. The senior author then over-read and verified the results based on the transcriptions.

Survey Data and Statistical Analysis. Surveys were administered at initial engagement with practice coaching activities and again at the end of the 3-year project, with the period between survey administrations ranging from 18 to 30 months.

(1) The PCMH Clinician Assessment (PCMH-CA) survey of residents assessed their routine use of the PCMH components as part of patient care. The PCMH-CA was derived from two previously developed instruments, the Assessment of Clinician Depression Management and the Assessment of Clinician Diabetes Management, which assess clinician use of elements of the chronic care model.⁸ Previous versions have been shown to be related to improvements in diabetes outcomes in two studies, one not yet published.¹⁵ Items were adapted to be appropriate across chronic diseases, and items were added to assess other PCMH concepts. PCMH-CA results were analyzed using principal factor analysis with oblique rotation, retaining factors as determined by the proportion criterion. Cronbach's alpha was computed for each subscale to confirm internal consistency. Subscale

scores were computed and used as outcome variables in the analysis of change over time. The final PCMH-CA version included 25 items and four subscales. (See survey at http://pcmhelearning.com/theme/intervision_custom/pdf/PCMH.CA.pdf for the PCMH-CA). Subscales were scaled to a 0 to 100 range, with higher scores corresponding to higher degrees of implementation of or competency in the PCMH model.

(2) The PCMH Competency Self-Assessment measured residents' perceived competency in applying the PCMH elements in patient care, using a set of PCMH resident competencies developed during the initial stages of this project and since used by other residencies and projects for designing PCMH curricular redesign. (See survey at http://pcmelearning.com/theme/intervision_custom/pdf/PCMH%20Competency%20Self-Assessment%20Survey.pdf for the PCMH Competency Self-Assessment.)

Initially, means, standard deviations, and frequency distributions were examined for all measures and surveys. The structure of the data was hierarchical, with respondents nested within practices. Because surveys were anonymous, pre and post data could not be linked to individuals, only practices. Multilevel models (general linear mixed models) with random effects for practice were used to examine pre-post differences in PCMH-CA scales (Team-Based Clinical Systems Redesign, Information Systems, Patient Centeredness, and Self-Management Support). Only one independent variable was included in each model, an indicator variable for pre- versus post-time effect. Demographic information was not collected and thus no covariates were included. Intraclass correlations for residents within practices were as high as 0.131, confirming the need for multilevel models with adjustment for clustering. In the first analysis, the outcome variable consisted of scores on the PCMH-CA scales. In the second analysis, the outcome variable consisted of scores on scales

from the Resident PCMH Competency Self-Assessment Survey. Statistical analysis was performed using SAS version 9.3 (SAS Institute, Cary, NC).

Results

Interview Data

Interviews with residency faculty and staff revealed themes regarding program implementation of PCMH elements. Programs identified several areas for further development, including the need for dedicated curricular time for the PCMH, flexibility in scheduling to include residents in QI efforts in the clinic, involvement of residents in developing a team approach to care, training in techniques for patient self-management support, development of resident leadership skills, and resident involvement with the development and use of patient registries and population management. Faculty also identified a need for faculty development, as many of the PCMH components were not something that faculty were trained in or currently teaching or practicing. Faculty also expressed a concern that they did not have the time or resources to develop specific PCMH curricular content.

The baseline assessment guided programs in key changes that positively influenced implementation of PCMH curricular components and identified curricular needs at the onset of the project. This led to the development by our team and the programs of specific curricula, materials, and trainings related to these areas.

Dedicated Instructional Time. Although programs were teaching some aspects of PCMH in the curriculum at baseline, they were not labeled as such, and programs realized that intentional teaching time needed to be dedicated to PCMH teaching (didactic sessions, clinic experiences, precepting, etc). There were similarities and differences in how programs accomplished dedicated time. Four of the programs set aside blocks of time for specific PCMH teaching, varying

from 2 weeks each year of residency training to a 4-week block during the second year of residency training. Five programs chose to integrate PCMH components into their existing community medicine or practice management curricula. There were common elements in both approaches, including increased resident clinic time, resident projects related to PCMH, resident involvement on the QI teams, use of the PCMH e-Learning curriculum modules described below, and didactic sessions that related to PCMH.

Project Support for PCMH Curriculum Development. To assist programs with specific curricular content and materials for PCMH, our team developed an e-Learning PCMH curriculum, a web-based tool that utilized the PCMH competencies developed by our team. The e-Learning curriculum comprised 12 specific PCMH modules and offered programs flexibility regarding how they could choose to integrate the modules into their curricula. Interestingly, the PCMH e-Learning curriculum also became a faculty development tool, utilized by several programs as a way for their faculty to learn more about PCMH.

Leadership Development. Our assessment identified the development of resident skills in leadership for practice redesign as a crucial need. In addition to leadership in the PCMH e-Learning curriculum, our team developed a PCMH leadership skills workshop. Residents (and sometimes faculty) from each program participated in this workshop. Specific PCMH leadership skills addressed included developing a shared leadership model (less hierarchical than traditional leadership), staff engagement, development of team-based care, and leading teams through change.

QI Team Participation. Another important PCMH curricular component implemented by all programs was the involvement of residents

on QI teams developed through the practice improvement part of the project. Eight of the 10 programs instituted QI teams that met twice per month. One program that did not implement practice-wide QI teams involved residents in disease-specific QI efforts. Programs expressed difficulty with residents' consistent participation on QI teams due to competing time demands, which became an issue for curricular redesign. Some programs involved residents in their NCQA PPC-PCMH recognition application: specifically, they researched guidelines for clinically important conditions and developed patient self-management tools. Although all programs struggled with population management due to difficulties extracting patient registry data from their EHRs, all programs involved residents with EHR implementation including clinical decision support and work flows. Residents were involved in team-based care activities, including huddles and the formation and implementation of team-based care within the practice. There was agreement on the areas of relative strength and weakness both within interviewees for each program and across programs. Specific PCMH curriculum implementation approaches and outcomes are described in Table 2.

Survey Data

Patient-Centered Medical Home Clinician Assessment (PCMH-CA). Results of analyses of PCMH-CA subscales over time are included in Table 3.

Residents reported statistically significant increases in routine use of all PCMH components as part of patient care ($P < .01$). It is important to note that the relative level of use of PCMH components was low across the categories, with none of the areas near the 100-point ideal (average post-score = 53.77).

PCMH Competency Self-Assessment. Results from the pre and post resident scores for the PCMH Competency Self-Assessment also showed

Table 2: PCMH Curriculum Implementation Qualitative Data

| PCMH Curriculum Component | PCMH Curricular Change | Implementation of Change | Outcomes (Qualitative and Quantitative) |
|------------------------------------|---|--|---|
| Dedicated curricular time for PCMH | <ul style="list-style-type: none"> • Creation of PCMH Block (four programs) varied in length from 2–6 weeks • Specific PCMH content integrated into Practice Management and/or Community Medicine (five programs) | <ul style="list-style-type: none"> • Increased residents' time in clinic with patients/PCMH activities • Use of PCMH e-Learning curriculum • Resident involvement in PCMH clinic activities (huddles, patient registries, evidence-based practice guidelines) | <ul style="list-style-type: none"> • Improved residents' perceived competence for PCMH elements • Improved residents' knowledge for PCMH elements • Increased resident involvement and engagement in practice improvement |
| Quality improvement | <ul style="list-style-type: none"> • Creation of quality improvement teams in the practice • Involvement of residents on quality improvement teams and practice improvement activities | <ul style="list-style-type: none"> • Arranged resident schedules to be available for quality improvement team meetings • Resident leadership on quality improvement teams and practice improvement efforts • Resident involvement in determining quality measures for CICs for NCQA recognition | <ul style="list-style-type: none"> • Improved resident participation and engagement in practice improvement • Improved resident leadership skills and preparation for leading PCMH efforts • Improved resident understanding of quality measure and the NCQA recognition process |
| Team approach to care | <ul style="list-style-type: none"> • Resident involvement on care teams within clinic | <ul style="list-style-type: none"> • Residents participate in huddles and other team-based care practice activities | <ul style="list-style-type: none"> • Improved resident involvement and engagement in team approach to patient care |
| Patient centeredness | <ul style="list-style-type: none"> • Increased clinic time for residents • Resident panel management • Patient advocacy and cultural sensitivity | <ul style="list-style-type: none"> • Arrangement of resident schedules for consistent days/times in clinic • Intentional patient panel management so that resident has ownership of their patient panel • Inclusion of specific curriculum for cultural sensitivity and patient advocacy | <ul style="list-style-type: none"> • Consistent resident time in clinic allowed for increased continuity with patient care and patient panel • Residents know their patients and take ownership of their care |
| Patient self-management support | <ul style="list-style-type: none"> • Resident involvement in developing evidence-based guidelines for CICs • Patient and family communication skills | <ul style="list-style-type: none"> • Residents develop evidence-based guidelines for CICs • Residents participate in communication skills and motivational interviewing curriculum | <ul style="list-style-type: none"> • Improved resident understanding and implementation of evidence-based guidelines into patient care • Improved resident communication skills |
| PCMH leadership skills | <ul style="list-style-type: none"> • Resident leadership on QI teams and clinic care teams • Implementation of PCMH leadership skills curricula | <ul style="list-style-type: none"> • Dedicated time for residents to lead QI teams • Resident participation in PCMH leadership workshop | <ul style="list-style-type: none"> • Improved resident leadership skills for leading the PCMH |
| Population management | <ul style="list-style-type: none"> • Development of disease-specific registries • Limited ability to create registries due to lack of EHR registry capability | <ul style="list-style-type: none"> • Resident involvement with development of disease-specific registries | <ul style="list-style-type: none"> • Due to limited ability to create registries, residents report population management as lowest area of competence |

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Table 2 (continued)

| PCMH Curriculum Component | PCMH Curricular Change | Implementation of Change | Outcomes (Qualitative and Quantitative) |
|---------------------------------|--|--|--|
| Information systems | <ul style="list-style-type: none"> • Use of evidence-based guidelines at point-of-care patient care | <ul style="list-style-type: none"> • Engagement of residents in researching and developing evidence-based guidelines for NCQA recognition process • Implementation of evidence-based guidelines at point of care with patients | <ul style="list-style-type: none"> • Improved residents' perceived competence for use and implementation of evidence-based guidelines |
| Integrated and coordinated care | <ul style="list-style-type: none"> • Integration of behavioral health (BH) • Resident involvement in patient follow-up with labs and referrals | <ul style="list-style-type: none"> • Co-consults with BH professionals • Residents track and respond to lab results and specialist referrals | <ul style="list-style-type: none"> • Improved residents' perceived ability to work with patients on BH issues • Improved residents' perceived ability to coordinate their patient's care |

PCMH—patient-centered medical home
 CIC—clinically important condition
 NCQA—National Committee for Quality Assurance
 QI—quality improvement

Table 3: PCMH Clinician Assessment, Baseline Versus Follow-Up Survey Results (Residents Only)

| PCMH CA Measure | Before (n=250) | After (n=198) | Difference (Effect size) | P Value |
|-------------------------------------|----------------|---------------|--------------------------|---------|
| Team-based delivery system redesign | 40.7 | 50.2 | 9.5 (.60) | .0002 |
| Patient-centered care | 40.6 | 49.6 | 9.0 (.53) | .0005 |
| Self-management support | 49.8 | 58.4 | 8.6 (.51) | .0006 |
| Information systems | 41.3 | 49.8 | 8.5 (.49) | .0005 |

PCMH CA—patient-centered medical home Clinician Assessment

statistically significant increases in scores for all domains ($P<.05$) except for Personal Physician; however, this domain had the highest pre-survey score (76.3 compared with 63.4 as mean pre-score for the other domains). Results for the PCMH Competency Self-Assessment are shown in Table 4.

Discussion

The results from three different PCMH assessment approaches indicated that key PCMH components can be implemented into family medicine residency curricula. This improved residents' routine utilization of PCMH components in patient care and residents' perceived PCMH competency. These improvements

required that residency programs modify the residency curricula. Modifications across all programs included resident involvement with practice QI teams, PCMH leadership development, project support for PCMH curriculum development, and intentional and dedicated PCMH teaching time. Programs were able to accomplish this through different methods of either creating blocks of PCMH teaching time or integrating key PCMH concepts into already existing curricula. Freeing up residents for consistent time to participate with QI teams and take active participation and leadership proved to be difficult for all of the programs.

Although integration of PCMH principles into residency education

is an emerging area of study, other researchers have also been able to show significant changes in resident attitudes after implementation of PCMH concepts. Evan et al found that residents' attitudes toward chronic pain patients significantly improved after participation in a PCMH innovation curriculum.¹⁶ A retrospective study demonstrated that alumni ratings of the practice-based curriculum increased following implementation of the PCMH model, which included resident use of a clinical quality management system to proactively manage patients with chronic conditions and to address prevention/health maintenance issues.¹⁷

Table 4: PCMH Competency Self-Assessment—Baseline Versus Follow-Up Survey Results

| PCMH Component | Pre (n=154) | Post (n=166) | Difference (Effect Size) | P Value |
|---------------------------------|-------------|--------------|--------------------------|---------|
| Personal Physician | 76.3 | 78.2 | 1.9 (.13) | .286 |
| Patient Centeredness | 67.1 | 71.9 | 4.9 (.37) | .004 |
| Team Approach | 68.8 | 73.3 | 4.5 (.29) | .018 |
| Integrated and Coordinated Care | 65.2 | 69.6 | 4.4 (.27) | .025 |
| Population Management | 57.8 | 63.4 | 5.7 (.34) | .007 |
| Access to Care | 62.3 | 67.0 | 4.7 (.32) | .015 |
| Quality Improvement | 60.0 | 66.6 | 5.8 (.33) | .005 |
| Information Systems | 62.5 | 67.9 | 5.3 (.33) | .008 |
| Leadership Skills | 62.9 | 69.4 | 6.5 (.36) | .003 |

Several key issues and lessons learned regarding development and implementation of a PCMH curriculum into family medicine residency education were identified in our project. Intentional and dedicated time is needed to successfully implement the key PCMH components into residency curricula. Experiential learning through active participation on the QI teams and other practice QI efforts are also keys to their learning. Given current family medicine residency requirements, this can be challenging but not impossible to accomplish. Specific training for PCMH leadership skills is also necessary, since this requires a different model of leadership.

Another key to the success of PCMH curriculum implementation was project support for development of PCMH curricular materials and teaching tools. Development of specific PCMH curricular educational materials is time-consuming and something for which faculty may have neither the time nor expertise to accomplish. Consequently, development of the PCMH e-Learning curriculum proved instrumental in enabling programs to implement key PCMH components. Lastly, faculty development for the PCMH is crucial, as many have not been taught these concepts nor do they currently practice them as part of patient care.

This project was funded as a re-design project for all Colorado family medicine residency programs, not as a research project, so that a randomized design was not possible, limiting our ability to ascribe program changes only to the intervention. However, at the time of this project, many PCMH concepts were not part of routine family medicine curricula, and most programs were not working actively on PCMH implementation. A potential limitation of these results is that self-reported levels of competency in or implementation of PCMH components may be artificially inflated in some areas due to a lack of understanding of the intricacies of the PCMH model. This could be particularly evident in concepts such as team-based care and patient centeredness, since most clinicians initially think that they already work well in teams and are patient centered. Corroboration of the key patterns of strengths and weaknesses through interviews helped in overcoming this limitation. An additional limitation is that this evaluation only assessed residencies in one state, and Colorado programs could be different in some ways than those in other states. This is also an evaluation of limited domains and for a short time interval. The long-term goal is to determine if these curricular changes result in different

practices, different approaches to QI, and better patient care.

Conclusions

Results of our evaluation indicate that implementation of key components of PCMH into practice improvement efforts and residency curricula improved residents' routine use of PCMH in patient care and their perceived PCMH competence. Further investigation is needed to fully understand best practices as this field continues to evolve.

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