ORIGINAL RESEARCH

A Multi-Institutional Quality Improvement Initiative to Transform Education for Chronic Illness Care in Resident Continuity Practices

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BACKGROUND: There is a gap between the need for patient-centered, evidence-based primary care for the large burden of chronic illness in the US, and the training of resident physicians to provide that care.

OBJECTIVE: To improve training for residents who provide chronic illness care in teaching practice settings.

DESIGN: US teaching hospitals were invited to participate in one of two 18-month Breakthrough Series Collaboratives—either a national Collaborative, or a subsequent California Collaborative—to implement the Chronic Care Model (CCM) and related curriculum changes in resident practices. Most practices focused on patients with diabetes mellitus. Educational redesign strategies with related performance measures were developed for curricular innovations anchored in the CCM. In addition, three clinical measures—HbA1c <7%, LDL <100 mg/dL, and blood pressure ≤130/80—and three process measures—retinal and foot examinations, and patient self-management goals—were tracked.

PARTICIPANTS: Fifty-seven teams from 37 self-selected teaching hospitals committed to implement the CCM in resident continuity practices; 41 teams focusing on diabetes improvement participated over the entire duration of one of the Collaboratives.

INTERVENTIONS: Teaching-practice teams—faculty, residents and staff—participated in Collaboratives by attending monthly calls and regular 2-day face-to-face meetings with the other teams. The national Collaborative faculty led calls and meetings. Each team used rapid cycle quality improvement (PDSA cycles) to implement the CCM and curricular changes. Teams reported education and clinical performance measures monthly.

RESULTS: Practices underwent extensive redesign to establish CCM elements. Education measures tracked substantial development of CCM-related learning. The clinical and process measures improved, however inconsistently, during the Collaboratives.

CONCLUSIONS: These initiatives suggest that systematic practice redesign for implementing the CCM along with linked educational approaches are achievable in resident continuity practices. Improvement of clinical outcomes in such practices is daunting but achievable.

KEY WORDS: residency training; chronic illness; teaching hospitals; Chronic Care Model.
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INTRODUCTION

The high prevalence of chronic illness, which consumes the majority of health care expenditures in the US[1], calls for residency training that is conducted in clinical settings designed and organized to provide high quality chronic illness care[2–4]. The current approach to physician training reflects a heavy focus on acute disease and inpatient medicine. A gap exists between evidence-based care for the growing burden of chronic illness in the US and the training of physicians who will provide that care.

The Chronic Care Model (CCM), an evidence-based strategy for the care of patients with chronic illness[5–8], has been implemented in hundreds of community clinical settings, generally with associated improvement of chronic illness care[8]. However, the participation of teaching practice settings in quality improvement activities based on the CCM has been limited.

We describe two initiatives—the national Academic Chronic Care Collaborative (ACCC) and a subsequent California Academic Chronic Care Collaborative (CACCC)—that supported resident practices in their efforts to transform their practices and training in accord with the CCM. The overarching goal was twofold: to improve the training for the residents who provide chronic illness care in resident practices and to improve the care delivered to chronically ill patients in those practices. The following were the specific aims: first, redesign resident practices based on the CCM; second, implement and test educational strategies based on the CCM in these settings; and third, evaluate changes in the clinical processes and outcomes of care in such practices.

METHODS

Organization and Support of the Collaboratives

The Collaboratives were conducted by a partnership between the Institute for Improving Clinical Care of the Association of

American Medical Colleges (AAMC), and Improving Chronic Illness Care, a national program based at Group Health Cooperative. The national staff and faculty for both initiatives were supported in large measure by generous grants from the Robert Wood Johnson Foundation and the California HealthCare Foundation.

Residency Practices and Their Patients

Participating resident practices in internal medicine, family medicine or pediatric training programs were affiliated with either traditional research-focused institutions (90% of teams) or community-based residency programs.

The majority of patients were uninsured or supported by Medicaid or Medicare. Patients' social circumstances frequently added impediments to continuity of their care, e.g., limited personal financial means, difficulty finding timely transportation to clinic appointments, cost of medications and disability.

"Learners" were defined as all local team participants who intended to change their approach to the care of patients with chronic conditions in the resident practices. A faculty member generally led teams that included residents, other attending physicians, students, nurses, medical assistants, pharmacists, and/or social workers.

While the clinical conditions selected by one or more teams included chronic obstructive pulmonary disease, asthma, or hepatitis C, we report here only the results from the 41 practices that focused on diabetes care.

Planning the Interventions

The CCM[5,8] guided the teaching and improvement activities of the Collaboratives. Implementation of the CCM in these practices required substantial practice redesign, which included the following[7]:

- Redesign the practice microsystem to assure that care was provided by an effective care team, which usually consisted of a physician, nurse, and medical assistant and less frequently included a clinical pharmacist and/or social worker;
- Develop evidence-based clinical decision-making, guided by review and adherence to the published literature for chronic diabetes management;
- Establish a clinical information system with particular attention to a patient registry for tracking clinical measures at both the individual and population level;
- Conduct planned visits that assured that patients received guideline-influenced care;
- Develop effective self-management support to patients; and
- Help patients access and use valuable community resources such as peer support programs for behavioral change, and patient education offerings.

The initiatives employed the Institute for Healthcare Improvement Breakthrough Series Collaborative strategy[9–11] to learn and implement the CCM. Over the course of the Collaboratives, participating residency program teams met together for three, two-day learning sessions, and one all-day virtual web-mediated meeting. Teams learned about the CCM and exchanged program redesign strategies that they conducted between sessions. Every month teams reported their aggregated patient data taken from their electronic registries. Monthly telephone conferences led by national program faculty focused on these reports.

Based on earlier experiences with Chronic Care Collaboratives in non-academic settings[6,7], the national program leadership crafted a recruitment strategy that was designed to identify highly motivated institutions[2,3,12]. The national initiative offered no financial support, but it offered the opportunity to participate with the national faculty in the national interinstitutional program that facilitated change and learning. Institutions provided support for the cost of redesign of local practices.

A similar invitation was issued subsequently for the California Collaborative. Here successful applicant teams were awarded stipends of $12,000 per team to help defray costs of redesign of practices and education, e.g., travel and release time for strategic design meetings. These funds were supplemented by contributions from participating institutions in both Collaboratives.

Study of the Intervention and Methods of Evaluation

Implementation Measures. Implementation of the CCM was measured by the Assessment of Chronic Illness Care (ACIC) Instrument. The ACIC is a previously validated instrument[10], which evaluates success in implementing 7 key components of the CCM—delivery system design, decision support, clinical information systems, patient self-management, integration, healthcare system organization, and community linkages. At the beginning, in the middle and at the end of the initiatives, the residencies used the ACIC to self-evaluate implementation and application of each of the components of the CCM. National faculty reviewed in depth each of the reported measures with teams in open meetings at Collaborative sessions. Teams frequently modified these self-reported measures based on such feedback and discussion, and the process often led to less optimistic self-evaluation.

Education Measures. Because the CCM had not previously been systematically implemented in academic settings, it was necessary to develop measures to assess progress of educational redesign during the national Collaborative. An instrument was developed specifically for this purpose—the Assessment of Chronic Illness Care for Education (ACIC-E), which tracked the extent of educational engagement and redesign that addressed the same 7 components of the CCM described above for the ACIC. This instrument, a direct modification of the ACIC with a focus on specific changes in the education program, is described in detail elsewhere[13]. It was employed in the Collaboratives in the same way as described for the ACIC above.

The national Collaborative faculty and teams developed an additional set of representative, defined educational measures to compare teams. The measures were developed through a consensus process among teams, which prioritized significance and feasibility of proposed measures[14]. The two explicit educational measures that were adopted by this process were: first, "percent of learners who have used a registry to change care," and second, "percent of learners who have developed self-management plans with a patient." Teams also developed their

own optional education measures to help track local progress. Examples of these additional measures included, "percent of learners identifying, learning and teaching others about a clinical question," and "percent of learners appraising literature for clinical guidelines and sharing findings with team members."

Clinical Measures. Six clinical measures were tracked in patient registries for each practice and were reported monthly to the Collaborative director: three patient health indicators—percent of patients with HbA1c <7%, LDL <100 mg/dL, and blood pressure ≤130/80; and three process measures—percent of patients with up to date retinal and foot examinations, and who had established patient self-management goals. Improvement scores were calculated as the difference between baseline and final reports. The national faculty aggregated and plotted the three patient health indicators using statistical process control with upper and lower limits set at 3 sigma in a Shewhart p chart[15]. Statistical process control has been used to track defined processes since its introduction by Shewhart and Deming in the 1920s[15]. It was employed in this instance to determine whether special cause variation—the term that describes variation that is unlikely to occur by chance—occurred during participation in the collaboratives.

Ethical Issues. Review of the ACCC was obtained through the Institutional Review Board of the AAMC at the American Institute for Research, which granted a waiver because it was determined that the project was a quality improvement initiative. IRB approval stipulated that clinical data could not be identifiable at the patient level, but could be aggregated to reflect team performance. In addition, public identification of institutions was not permitted, to maintain the opacity of patient identifiers.

RESULTS

Collaborative Participation and CCM Implementation

An invitation was extended in 2004 to the approximately 400 teaching hospitals that were members of the AAMC Council of Teaching Hospitals. Of the 400, 36 teams from 22 institutions

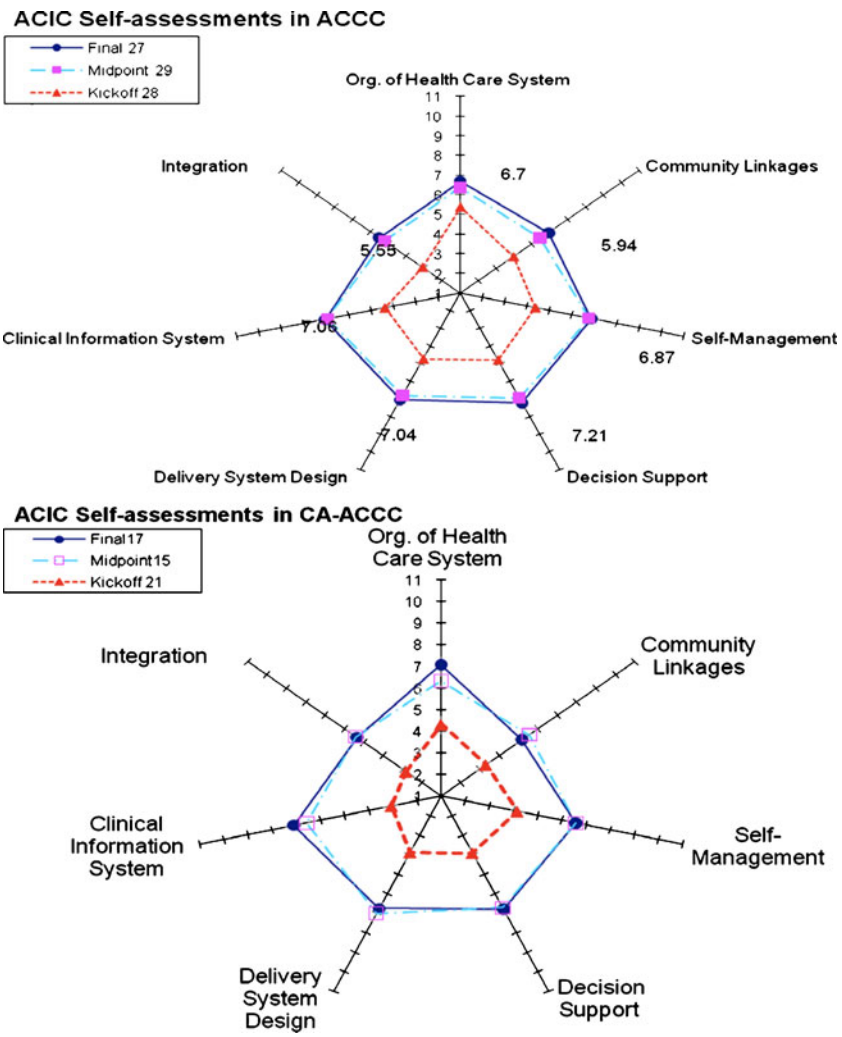

Figure 1. Spider diagrams depict self-assessment by teams of seven CCM components using the ACIC (Text Ref 10) at the kickoff (triangles), midpoint (squares), and conclusion (circles) of the National and the California Collaboratives.

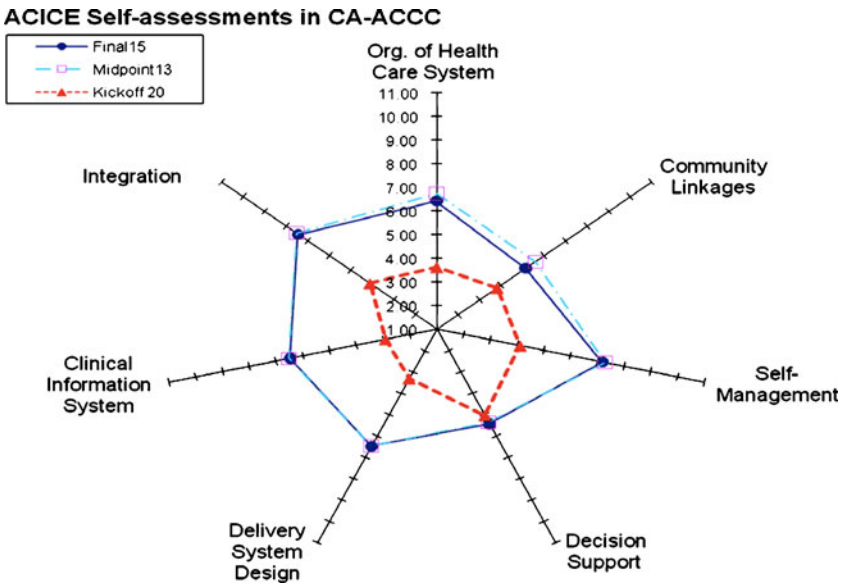

Figure 2. Spider diagram depicts self-assessment by teams of 7 components ACIC-E (Text Ref 13) at the kickoff (triangles), midpoint (squares), the conclusion (circles) of implementation of the California Collaborative.

initially agreed to participate. Of these, 26 teams focused on diabetes improvement and successfully completed the Collaborative as reflected by consistent reporting of process, educational, and clinical outcomes. Subsequently a similar invitation was extended in 2006 to a cohort of 21 teaching hospitals in California; 21 teams from 15 institutions demonstrated readiness to participate. Fifteen of these teams focused on diabetes and completed the Collaborative.

The ACIC measurements, obtained at the beginning, midpoint and end of the initiatives, provide evidence of the progressive implementation of the components of the CCM. These results are described using a spider diagram (Fig. 1).

The teams and their sponsoring institutions were self-selected from the 400 teaching hospitals. Most sites had strong commitment by senior leadership, as reflected by financial and moral support, and the teams were led by local champions[16] who were often program directors and/or division chiefs. Implementation of the electronic patient registry was an early administrative challenge for many of the practices, but ultimately served as a vital tool for tracking change.

The Collaborative strategy was effective for team learning. For example, high-performing teams developed benchmarks and implementation strategies that have been reported elsewhere as the AHRQ web-based "Tool kit for developing the Chronic Care Model in an academic environment[12]."

Education Measures

Participating programs designed and implemented extensive modifications in their teaching processes. Examples included didactic sessions on strategies for practice implementation of the Model and use of quality improvement techniques such as the Plan-Do-Study-Act rapid cycle improvement model. Other components included sessions that addressed evidence to support diabetes treatment decisions, and attention to team building. Experience was gained with electronic patient registries for population-based outcome analysis[12]. Health care team meetings generally included residents' input in planning for care delivery. Structured mentored experiences were developed for selected components of the CCM that are not usually

Table 1. Education Outcomes for the California Academic Chronic Care Collaborative. Data from June 2007 Constitute the Baseline for Comparison to April 2008. Weighted Average is the Percent Learners who Participated in the Activity Described in the First Column

CA-ACCC Collaborative	Education Outcomes for 19 Teams				
	June, 2007		April, 2008		
Measure: % of Learners:	Total Learners (n)	Weighted Average	Total Learners (n)	Weighted Average	Change in Average
Reviewing a Registry	264	18.6	429	66.7	48.1
Setting a Self-mgt goal	256	19.5	420	53.3	33.8
Conducting a Planned Visit	256	13.3	338	53.6	40.3
Managing a Clinical Question	47	19.1	39	87.2	68.1
Doing a PDSA Cycle	136	27.2	122	91.0	63.8
Participated on a Quality Improvement Team	67	38.8	117	38.5	-0.3

Table 2. Clinical Outcomes for 26 Teams in the National Academic Chronic Care Collaborative. Data from October 2005 Constitute the Baseline for Later Comparison to September 2006. Weighted Average is the Percent Patients with Clinical Measures in Column 1

	October, 2005		September, 2006		
Measure: % of Patients with:	Total Registry Size (n)	Weighted Average	Total Registry Size (n)	Weighted Average	Change in Average
HbA1c <7%	6200	34.8	5909	38.5	3.7
LDL< 100 mg/dL	6400	37.8	6670	50	12.2
BP< 130/80	6350	34.7	7271	38.1	3.4
Retinal Exam	5164	29.3	5936	44.9	15.6
Foot Exam	5682	40.3	7271	55.9	15.6
Documented Self-Mgt goal	4656	7.7	7271	33.9	26.2

employed for care in resident practices such the planned visit and group visit.

The educational techniques that were developed by the national Collaborative faculty and teams laid the groundwork for their use by the California Collaborative. The national Collaborative developed the curriculum and assessment instruments[13,14], and they were implemented in the latter half of the assessment period of the national Collaborative, while the California Collaborative employed the ACIC-E and the two educational measures to track their progress from the outset of the assessment period. The results for the California initiative are presented as change scores from baseline in the ACIC-E (Fig. 2), and changes in percent of residents who participated in specific CCM learning experiences (Table 1). By the end of both Collaboratives, the majority of residents had worked with registries, practiced self-management support, and conducted planned visits.

Clinical Measures

The aggregated clinical outcomes are presented in Tables 2 and 3. Teams in both Collaboratives showed improvement in process measures. Changes in measures of disease control were more modest, especially for the percentage of the population with HbA1c <7%. Nevertheless, tracking aggregate data by means of Shewhart p charts[15] showed special cause variation reflecting improvement in blood pressure and LDL control in the late stages of the California Collaborative. Significant changes were not seen in HbA1c levels.

DISCUSSION

The participating practices adopted most elements of the CCM, including development of inter-professional teams, delegation of provision of care by appropriate team members, implementation of patient self-management strategies, group visits, proactive patient management—anticipating the needs of patients as opposed to providing reactive management—and use of an information system to track individual patient measures. In addition, resident training programs successfully incorporated educational strategies for learning the elements of evidence-based chronic illness care.

Resident practices, by their nature, facilitated practice redesign to implement the CCM. For example, residents, as frontline caregivers, were effective and active participants in redesign and CCM implementation. In addition, evidence-based practice was highly valued and readily adopted in these training settings[8]. Similarly, residents are by nature competitive in their commitment to providing good patient care[17]; hence, teams both competed and readily learned from each other as change strategies were adopted across the diverse Collaborative settings[19]. The need to address ACGME competencies for accreditation purposes[17,18]—particularly practice-based learning and systems-based practice—provided an opportunity to address multiple demands on learners and academic institutions.

Nevertheless, implementation of the CCM in these settings required a substantial redesign effort even for these highly motivated practices[20–22]. The progression during the collaboratives of ACIC average scores to 5-8 (out of a possible 11), while reflecting change in the practices, speaks candidly to the challenge of achieving full implementation of the CCM in these resident practices.

The baseline findings in the national Collaborative—only about one-third of patients in these highly committed resident practices were initially within accepted guidelines for six clinical and process measures—reflects the challenge that good diabetes management presents in these teaching settings and emphasizes the imperative for improvement. Similar baseline findings for diabetes control have been observed in

Table 3. Clinical Outcomes for 15 Teams in the California Academic Chronic Care Collaborative. Data from June 2007 Constitute the Baseline for Comparison to May 2008. Weighted Average is the Percent Patients with Clinical Measures in Column 1

	June 2007		May 2008			
Measure: % of Patients with:	Total Registry Size (n)	Weighted Average	Total Registry Size (n)	Weighted Average	Change in Average	% Change in Average
HbA1c <7%	1302	42.4	1559	44.7	2.3	5.4
LDL< 100 mg/dL	1034	50.9	1351	59.5	8.6	16.9
BP< 130/80	1302	36.4	1559	47.4	11	30.2
Retinal Exam	1178	25.5	1437	41.1	15.6	61.2
Foot Exam	1178	30.4	1437	56	25.6	84.2
Documented Self-Mgt goal	1300	10.7	1559	41.4	30.7	286.9

studies of chronic illness care in Community Health Centers in the US[23], while observations in private practice settings generally show higher baseline levels of control[24].

Previous reports suggest the importance of continuity experience both for residents and their patients in the improvement of diabetes outcomes. Warm and colleagues reported the ability to effect change in clinical outcomes using the CCM[17]. Of note, these observed changes occurred in a residency program that included a yearlong ambulatory block. Dearinger and colleagues also demonstrated that extensive commitment to continuity was required to have a significant impact on clinical outcomes in patients with diabetes in residency settings[25]. While the CCM emphasizes strategies for continuity of care, timely and continuous care is a challenge for most resident practices and may have played a role in the modest improvements in clinical outcomes in this report. Such continuity is made difficult, for example, by the obligations for residents to meet regularly changing assignments that include demands for acute care of seriously ill hospitalized patients, and the effects of regular turnover in resident clinic staffing.

Limitations

There are several limitations to interpretation of the findings that we report here. First, we cannot say with certainty that improvement observed in the care of the patients in these initiatives was due solely to adoption of the CCM. There was no control group. Moreover, the trends in healthcare delivery that increasingly give attention to good chronic illness care were unfolding during the time that these Collaboratives took place. This was particularly true in California where considerable support already existed for change of this type[26]. This is also suggested by the higher scores for clinical outcomes both at the outset and conclusion of the California Collaborative compared to the national Collaborative. At least some of the benefit may result from the greater attention provided patients simply because they were the focus of these redesign initiatives. Second, while we cannot determine that implementation of the CCM will result in long-term reduction in morbidity and mortality based on the changes in these 18-month Collaboratives, control of the principal clinical measures in the CCM (blood pressure, LDL and HgbA1C) has been documented to reduce over time the prevalence of microvascular disease in persons with diabetes as reflected in cardiac disease and stroke. Third, whether the changes observed in these programs can be replicated in other settings depends on the presence of many of the leadership and cultural characteristics that were found in these participating institutions[3,4]. Nevertheless, these early adopter institutions may possess other inherent characteristics that were not readily apparent. Insights may be found in this regard by examining further the differences between the institutions that initially joined these Collaboratives but were unable to sustain their participation. Finally, whether these changes can be sustained over time in these institutions will depend on additional resources along with continued strong leadership and a supportive culture.

CONCLUSIONS

These initiatives suggest that both the practice redesign required for implementation of the CCM and linked educational strategies are achievable in resident continuity practices. However, the modest improvement in clinical outcomes observed in these practices in comparison with initiatives from single site initiatives reported in the literature suggests that effective care of patients with chronic illness may require prolonged continuity of care that poses a challenge in many resident practices, even in those committed to implementation of the CCM. Durable implementation of the CCM in resident practices necessitates substantial commitment from local institutional, clinical and academic leadership.

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Conflict of Interest: *None disclosed.*

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