Improving Chronic Illness Care in Teaching Practices: Learnings From the I³ Collaborative

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BACKGROUND: Improving the quality of care in residencies is critical for the profession and for our discipline, but how to do this on a large scale is unclear. The purpose of the I³ collaborative was to assess the feasibility of a regional quality improvement collaborative limited to residencies and to improve significantly dramatically the quality of care for diabetes and congestive heart failure.

METHODS: Ten residencies in North and South Carolina with more than 345,000 patient visits/year, 252 residents and 92 faculty participated in an Institute for Healthcare Improvement breakthrough series type collaborative, enriched with additional support for academic settings, over 3 years.

RESULTS: We improved measured quality of care for diabetes modestly and congestive heart failure (CHF) significantly/substantially, including a 380% reduction of hospitalizations for CHF. Success factors include funding from regional foundations, the use of regional approach for recruitment of residencies and active management of the collaborative, regular data submission, and a blended curriculum with a combination of biannual face to face meetings and monthly telephone conferences.

CONCLUSIONS: A regional strategy is feasible and can strongly support quality improvement; investment in residency redesign can reduce total cost of care.

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Improving the quality of care in academic settings must be a part of health care reform, yet how to do this on a large scale is unclear. As a recent Robert Wood Johnson Foundation report emphasized,[1] academic settings face many challenges to quality improvement, including organizational size and complexity, underdeveloped strategic and operational planning, and lack of reward and accountability for performance improvement. In this context, collaboratives may provide a valuable approach for improving quality. Collaboratives have demonstrated improvements in clinical outcomes across a variety of clinical conditions and specialties, including diabetes, chronic renal disease, oncology, and cardiothoracic surgery.[2-5] We decided to test whether a regional collaborative limited to academic practices could improve quality of chronic illness care.

This paper reports the rationale, methods, and key outcomes of a regional academic quality improvement collaborative. We named it the I³ (Improvement Cubed) project to underscore the potential cubic impact of an intervention focused on residencies—improvement in the patient care provided by teaching practices, by practices of residency graduates, and by the practices with which residency faculty consult formally and informally. In contrast to the 2005–2006 national Association of American Medical Colleges (AAMC) Chronic Care Collaborative,[6] we chose a regional approach limited to family medicine residencies to leverage existing relationships between programs, which would facilitate recruitment, management of the collaborative, and shared learnings. The primary focus of the collaborative was to facilitate practice change for improvement of chronic illness care; however, attention was also given to curricular changes and educational best practices related to quality improvement, chronic disease care, and practice redesign.

Methods

Overall Design of Intervention

The I³ Collaborative used the Institute for Health Care Improvement

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Breakthrough Collaborative design[7] with adjustments to address some of the known barriers to quality improvement (QI) in academic settings[1] and to take advantage of our regional geography. We chose diabetes (DM) and congestive heart failure (CHF) as the focus of our improvement efforts because of their prevalence, burden of suffering and cost, and availability of standard outcome measures. Participating residencies were required to form an interdisciplinary team, attend face to face learning sessions, use common quality metrics, share data regularly, and participate in monthly conference calls. The I[3] Collaborative provided a secure Web site using Blackboard to facilitate sharing quality data and documented tests of change. Participating programs were required to sign a data use agreement prohibiting sharing of performance data outside the collaborative. The Collaborative also provided payment for some of the direct costs of participation ($10,000 per residency, in four payments based on participation and data submission), a 2-year time period for improvement, explicit engagement of institutional leadership in the collaborative project, and a dedicated site visit and coaching from both clinical and data systems experts.

Figure 1 depicts the overall timeline. The framework for change in individual residencies was modeled on the North Carolina Improving Performance in Practice (IPIP)[8,9] project, using the Chronic Care Model,[10] with emphasis on key drivers of improvement, such as registries, information at the point of care, standing orders, self-management support, and outreach.[11] Our approach was pragmatic, providing coaching, freely shared outcomes data, and a learning network but with the residency practices driving the choice and priority of interventions.

Financing and Management

Initial support, mostly in kind, was provided by two university departments interested in QI in academic settings and by a small regional foundation that provided $50,000 for project planning. This foundation also funded the first 3 years of the project and then facilitated application to a major regional foundation for additional support. With input from the North Carolina Area Health Education Center (AHEC) and the two foundations, the total budget was approximately $1.2 million dollars over 4 years. In addition, the two founding departments and participating residencies provided in-kind support for travel to meetings as well as time devoted to collaborative activities.

Management of the collaborative was performed by an executive committee of three project leaders from both the University of North Carolina and the University of South Carolina Schools of Medicine. The executive committee monitored participants' improvement, reviewing progress quarterly, and facilitating change with appropriate individuals in each residency. Strategic and operational input was also provided by representatives of participating residencies at face to face meetings and by an advisory committee comprising our funders, key stakeholders (such as the North Carolina Division of Public Health or South Carolina AHEC), and the major commercial insurers in each state at the same time as the I[3] Collaborative meetings. The I[3] Academic Collaborative, with a representative from each residency, focused on best practices for teaching and dissemination of findings.

Recruitment

We used a combination of formal and informal networks to recruit residencies. An initial letter was sent to the residency directors and, where appropriate, department chairs of the 20 family medicine residency programs in North and South Carolina. We also made brief presentations at regularly scheduled meetings of residency directors in the two states. These initial contacts were followed by personal phone calls from the principal investigators to the program directors. Partner organizations in each state—North Carolina AHEC and the North Carolina Division of Public Health, South Carolina AHEC, and the Carolina Center for Medical Excellence provided publicity, financial and in-kind support, and a venue for the initial Capstone meeting. Sixteen residencies expressed interest, and 12 residencies submitted formal applications. Since available funding allowed for only 10 programs, final selection was guided by parity across states, level of organizational support, and readiness for quality improvement.

Figure 1: Collaborative Timeline

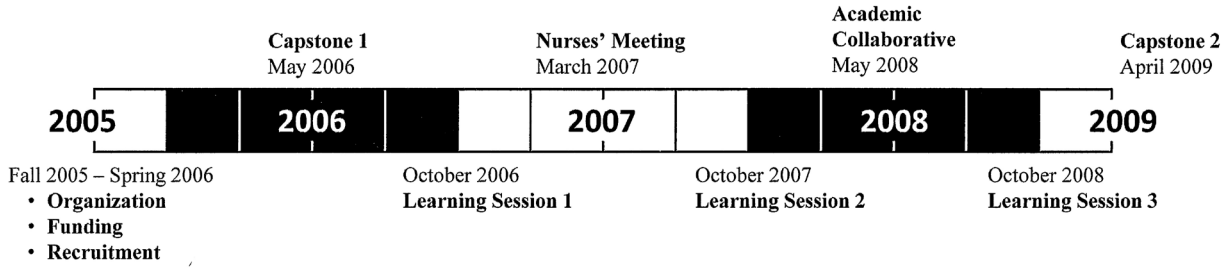


Table 1: Quality of Care Measures and Sampling Methods Chosen by Members of the I³ Collaborative

Congestive Heart Failure (CHF) Quality Indicators
Each month, practices compiled a list of patients who had been seen in the practice at least twice for CHF in the 3 preceding months and chose the smaller of a random sample of 30 or the entire list for record review. Measures for the sample were then entered in a standard spreadsheet (deidentified) and posted to the Collaborative's secure Web site.
Documentation of left ventricular failure assessment
Left ventricular ejection fraction (LVEF)
Documentation of a self-management goal at the most recent visit
Documentation of ACEI or ARB therapy if LVEF ≤ 40%
Documentation of beta blocker therapy if LVEF ≤ 40%
Admission or observation for CHF in the previous 12 months
CHF readmission within 30 days of CHF discharge in the previous 12 months
"Best practice" ACEI or ARB and beta blocker or hydralazine/nitrate therapy if LVEF ≤ 40%
Diabetes Quality Indicators
Each month practices compiled a list of diabetic patients who had been seen in the practice at least twice in the preceding 12 months and chose a random sample of 30 for record review. Measures for the sample were entered in a standard spreadsheet (deidentified) and posted to the Collaborative's secure Web site.
Documentation of at least two HbA1C tests in the previous 12 months
Documentation of a monofilament foot exam in the previous 12 months
HbA1C ≤ 7% (based on most recent HbA1c test)
Blood pressure ≤ 130/80 (based on most recent blood pressure measurement)
Documentation of a self-management goal in most recent visit

ACEI—Ace inhibitor therapy
ARB—angiotensin receptor blocker

Implementation and Data Collection

At the Capstone meeting (see Figure 1) participating residencies selected quality measures, starting from a set of well-established national measures and specifications.[12,13] Table 1 describes the quality measures and sampling methods chosen by the collaborative. Measures were reported monthly by each program and compiled into run charts that were maintained on the secure Web site. At the close of the collaborative, cumulative data for each measure were tested for statistical significance using the χ^2 test for trend. A 5-month "run-in" period followed the Capstone meeting. During this period, sites developed their data collection processes, and the Collaborative Executive Committee conducted assessments and site visits with each program in the collaborative. Site visits calibrated the process for collecting quality data in each setting and gave project leadership an introduction to the culture and organization of each residency. We initially scheduled a total of five face to face meetings over 3 years. At participants' request, however, we organized two additional meetings; one focused on nurses involved in practice improvement activities and the other to work on academic outputs of the collaborative.

During the run-in phase, we surveyed each residency regarding practice and patient population characteristics. We also assessed practices' baseline quality of care using the Assessment of Chronic Illness Care (ACIC)[14] scale. Site visit team notes provided a useful adjunct to survey data.

Data for program evaluation were obtained from measured quality of care, baseline assessments of organizational structure by both the residencies and the site review team, records of participation in and evaluations of phone calls and conferences, final survey of collaborative leaders and concurrent qualitative assessment of process by the members of the Executive Committee and collaborative leaders, analyzed by an immersion/crystallization technique[15] and reviewed for validity regularly by collaborative members, leadership, the Advisory Committee, and the Academic Collaborative. Baseline data and initial assessment protocols were approved by the University of North Carolina Institutional Review Board. Data shared among the collaborative were exempted from review, since they were extracted from existing records and contained no personal identifiers.

Results

Table 2 describes the 10 participating residencies and their patient populations. In aggregate, the I³ Collaborative residencies represented a wide range of family medicine

practices, including urban academic medical center practices, small rural practices affiliated with community hospitals, and large private practices. They were distributed across North and South Carolina and represented a total of nearly 350 physicians. Based on payer mix, nearly two thirds of patients in this population are underserved. The residencies varied significantly in their infrastructure for clinical care. Most practices averaged a 1:1 nursing to physician ratio, with medical office assistants providing the bulk of the nursing support. Three residencies had a 2:3 nursing to physician ratio, and one had a 1:2 ratio. One practice had an exclusively RN staff mix, and three had a full- or part-time case manager on site. More than half the teams had active quality improvement programs; for the remaining teams, Collaborative participation provided a way to initiate a quality improvement program. Nine of the 10 participating programs used an electronic health record (EHR) in their clinical practice, but none had a functioning registry; the 10th used a paper chart with a standalone registry.

Table 2: Practice Characteristics of the I³ Collaborative Residencies

Patient Population (Total)	**Median**
Annual visits: 345,000	25,000
Payer Mix (Average)	**Range**
Medicare: 26%	18%–38%
Medicaid: 24%	10%–35%
Uninsured: 13%	5%–21%
Commercial: 36%	17%–63%
Physicians (Total)	**Range**
Residents: 249	8–30
Faculty:92	4–31
Nursing (Mode)	**Range**
1:1	1:1–2:3
Electronic Health Record Use	
None: 1	
Partially implemented: 1	
Fully implemented: 8	
Residency Setting	
University department: 4	
Urban community hospital: 3	
Rural track: 2	
Urban private practice: 1	

Table 3 summarizes baseline measured quality of care. Members of our Advisory Committee noted that the measured care quality for these residencies was better than that reported for many non-academic practices at the time.[16-19] There was no relationship between nursing or medical staffing to measured quality of care.

Participation in I³ activities was very high. All programs participated in each face to face meeting and the large majority of phone meetings; each sent residents and nursing staff to at least one of the face to face meetings. All programs submitted data at baseline and at the end; data were submitted in more than 90% of the months over the 2 years of the collaborative. Conferences were evaluated highly, with almost all evaluations indicating the conference met or exceeded expectations, and attendance was excellent and stable. Participants especially valued networking, learning from each others' successes and failures and the revival of enthusiasm for the hard work of practice transformation. Indeed, participants requested two additional face to face meetings, devoted to developing the nursing role and the academic collaborative (see Figure 1). At the conclusion of the collaborative, participating programs unanimously agreed to participate in a future I³ collaborative.

Figure 2 depicts run charts for each of the quality measures over the course of the collaborative. For diabetes, there was significant improvement in monofilament foot exams and Hba1c testing among process measures and modest but not statistically significant improvement in the percentage of patients with glycosylated hemoglobin (HbA1c) ≤7.0%, but no improvement in other clinical outcome measures and blood pressure ≤130/80. For congestive heart failure, there was significant substantial improvement from already high baseline usages of beta blockers, ace inhibitors, and self-management rates. These changes were accompanied by a statistically significant 38% reduction of hospitalizations, with 156 fewer admissions per quarter. An assumed average cost of $23,000 per admission[22] yields a quarterly cost reduction of nearly $3.6 million.

With respect to the Academic Collaborative, I³ member programs gave a total of 16 national presentations, with all participating residencies presenting at least once. A total of

Table 3: Baseline Quality of Care Measure Goals (Percentages Indicate the Proportion of Patients Meeting the Goal)

	Collaborative Sites					
Congestive heart failure	1	2	3	4	5	Average
LVF assessment	82%	50%	100%	87%	91%	82%
LVEF ≤ 40%	27%	20%	67%	33%	28%	27%
ACEI/ARB therapy	100%	0%	86%	62%	83%	66%
Beta-blocker therapy	100%	100%	82%	69%	65%	83%
"Best practice" care	75%	0%	68%	46%	56%	49%
Self-management goal	0%	0%	0%	N/A	9%	2%
Diabetes						
HbA1c ≤ 7	53%	57%	34%	14%	37%	39%
Two HbA1c tests in 12 months	47%	46%	55%	3%	57%	42%
Monofilament foot exam	73%	50%	40%	34%	63%	52%
Blood pressure ≤ 130/80	37%	52%	42%	31%	37%	40%
Self-management goal	0%	71%	0%	7%	43%	24%

four papers have been developed, with two accepted so far. Most residencies sent at least one resident to a face to face meeting; this experience was uniformly rated as very positive by the residents, and program directors reported that residents who attended became leaders of the change process within their residencies. Best practices in curriculum will be reported in a separate manuscript. Program directors were enthusiastic about meeting "scholarship" RC requirements.

These improvements occurred despite substantial personnel leaves. Over the 3 years of the collaborative, there were substantial changes in the key personnel involved with the project. Nine of 10 residencies lost their data managers, and there were numerous other changes in other key personnel, including residency directors, clinical champions, and lead nursing staff.

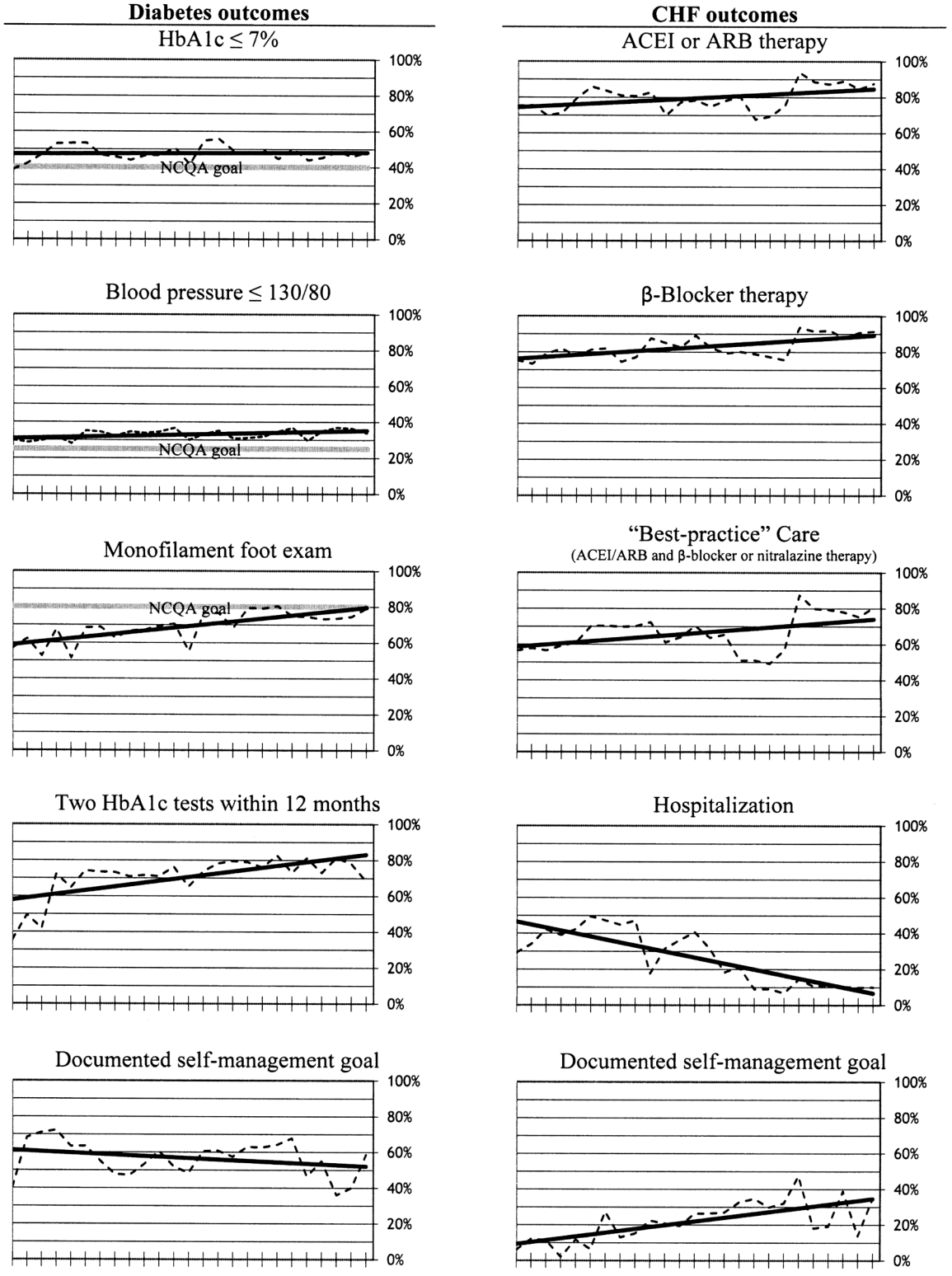
Discussion

Our results demonstrate that a regional quality improvement collaborative limited to residencies is feasible and can significantly improve measured quality of care. We obtained substantial funding from local foundations committed to improving quality of primary care; recruitment yielded 10 residencies in two states with substantial numbers of patients, residents, and faculty. Data submission and participation in phone calls and conferences were excellent; conferences were highly rated; and, at the end of the collaborative, all participating residencies expressed a desire to continue in another collaborative. Improvement in measured quality of care was notable in processes of care for diabetics; for CHF, while improvement in processes of care were of moderate degree and reduced hospitalizations substantially. In the parallel academic collaborative, every residency presented at a national conference, and the group made a total of 16 national presentations, with four manuscripts developed.

It is important to keep in mind the limitations of our study. Designed as a quality improvement project rather than pure research, our approach was pragmatic, adapting to residencies' current systems and priorities. We used clinical practice data without independent verification, and there was no control group nor control for other coincident statewide and national quality initiatives. We mitigated this risk, however, by spending substantial time with each site developing the data collection plan, calibrating the measurement across residencies, reviewing data manually, rechecking final measures, and ensuring that data collection and analysis and reporting were done independently. Our advisory board indicated that there was no significant ongoing secular change in quality of care for diabetes or CHF in our region. Finally, generalizability may be limited by the customization of the intervention at each of the residencies. This study is a test of a dynamic intervention in a learning network but with consistent regular measurement of outcomes and a process reviewed regularly by participants in a variety of multiple ways.

As expected, we documented substantial challenges to quality improvement within these residencies—indeed, we were surprised by the extent of the personal and organizational turmoil participating residencies experienced. Challenges included EHRs without functional registries, substantial activity cost of collecting data, and remarkable turnover of leadership and data systems personnel over the 2.5 years of the project. We do not believe these difficulties were related to participation in the collaborative or that the I^3 residencies were unusually at risk. We believe, rather, that these challenges reflect the complexity of improving primary care and especially in current family medicine

Figure 2: Collaborative Outcomes for Diabetes and CHF Over the 24 Months of the Collaborative (X Axis) Showing Proportion of the Entire Collaborative Population Meeting the Measure (Y Axis)*



* Where available, NCQA goal is indicated and shown in gray.

residencies. The institutions responsible for producing the foundation of the nation's health care system are quite fragile and are highly dependent on support from their organizations and outside. The primary care training foundation for health care reform needs more support.

How were the I[3] residencies able to improve quality despite these challenges? Our outcomes suggest that the added support and time provided by the collaborative were important in the transformation—contributions to the "adaptive reserve" of the residencies.[23] Moreover, several other drivers to quality improvement and sustainability were apparent and consistent with what is known about sustainability of practice transformation. Residency educational and clinical leadership were critical in responding to adversity; consistency of personnel is also important. Moreover, standing orders for nurses—a reflection of team care—were helpful; in one residency, standing orders allowed continued improvement of process measures despite major changes in leadership in the clinic, the residency, and the department. Prior experience with QI was also important; some of the residencies had learned "how to learn" and were able to quickly adapt and use best practices developed by other residencies. We believe this may explain in part the relatively greater improvement in the CHF group quality indicators, which included practices with more QI experience.

What elements of the collaborative were key to its success? The regional approach had great strengths. In practical terms, personal knowledge of residency directors, as well as social networking events like state academy and residency director meetings, facilitated recruitment. Moreover, when combined with the insight gained during site visits, local knowledge facilitated management of the collaborative. Quarterly review of collaborative member performance by the Executive Committee allowed early identification of problems—for example, lack of data submission—and facilitated targeted appropriate intervention with specific residency personnel. The monthly phone calls also provided regular accountability for submitting and responding to data.

In terms of collaborative methods, the initial site visits helped us design a common data reporting system to work across the collaborative and gave us detailed knowledge of the personalities and organizations—greatly facilitating ongoing active management of the collaborative. Data submission, for all of its challenges, provided a framework for ongoing work and increased investment in the process. The face to face sessions revived enthusiasm and spread ideas. We did not systematically assess the social network functioning, but it was clear that ideas spread through both personal and organizational relationships. For example, one residency's successful approach to teaching patient self management was identified as an early best practice and then picked up by many other residencies and then became the focus of a separate face to face meeting for nurses. A final key success factor was the Academic Collaborative. While our focus was always on clinical redesign, the participants were faculty members and keenly interested in how to improve residency teaching. Residents attending the conferences were extremely positive about their participation and the lessons learned: in future collaboratives, we will require all participating residencies to bring residents. We will also add more staff support for evaluation and more emphasis on written academic products of the collaborative.

Our experience underscores the value of investment in quality improvement in residencies. A relatively modest investment can improve care and prevent hospitalizations. Indeed, assuming an average cost of CHF hospitalization of $23,000, the entire cost of the collaborative was saved tenfold, with a huge return on investment. Under the current system, the return goes to the payers and to the hospital for uninsured patients. As we move toward health care reform, we believe there is a potent argument for investment in primary care residencies to reduce costs of care.

Finally, what is the relationship of the I[3] collaborative to the P[4] project[22] and the Colorado Family Medicine Residency PCMH project?[23] We view them as complementary to I[3]. Our focus has been on transforming the clinical practice of residencies, with the focus on curriculum per se being secondary. The I[3] Collaborative can inform the discipline's consideration of what residency training is necessary for—supporting the Patient-centered Medical Home. What we have demonstrated is that, with moderate investment, residencies working together can improve care substantially. We believe that much of residency education is what goes on in the practice; therefore, our focus has been on clinical redesign of the teaching practices in which residents provide continuity care. The redesigned practice is the experimental curriculum. By contrast, P[4]'s[24] focus has been primarily on novel curricula. Ultimately, we believe we will need both redesigned residency practices and a new formal curriculum. The Colorado project[25] represents another major contrast to I[3]. Colorado has focused on helping residencies become PCMHs and developing curriculum focused on PCMH. Again, the lessons are complementary. All share a collaborative structure: we move further by working together.

Conclusions

A regional quality improvement collaborative focused on residency practices is feasible and effective in improving clinical outcomes and reducing the cost of care. The design and implementation of the

I³ collaborative can serve as a template for efforts to improve family medicine care residency clinical practice training.

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References

1. Blumenthal D, Jennison GK, Causion N. Promoting quality improvement at academic health centers: building on pursuing perfection. www.rwif.org/reports/grr/047103.htm. Accessed November 20, 2010.
2. Mills PD, Weeks WB. Characteristics of successful quality improvement teams: lessons from five collaborative projects in the VHA. Jt Comm J Qual Saf 2004;30(3):152-62.
3. Kosseff AL, Niemeier S. SSM health care clinical collaboratives: improving the value of patient care in a health care system. Jt Comm J Qual Improv 2001;27(1):5-19.
4. Kilo CM. Improving care through collaboration. Pediatrics 1999;103(1 Suppl E):384-93.
5. Plsek PE. Collaborating across organizational boundaries to improve the quality of care. Am J Infect Control 1997;25(2):85-95.
6. Baxley EG, Stanek M, Association of Departments of Family Medicine. The AAMC academic chronic care collaborative: family medicine's participation and lessons learned. Ann Fam Med 2007;5(2):183-4.
7. The Breakthrough Series: IHI's collaborative model for achieving breakthrough improvement. IHI Innovation Series white paper. www.ihi.org.
8. Newton WP, Lefebvre A, Donahue KE, Bacon T, Dobson A. Infrastructure for large-scale quality improvement projects: early lessons from North Carolina Improving Performance in Practice. J Contin Educ Health Prof 2010;30(2):106-13.
9. Margolis PA, Halfon N. Innovation networks: a strategy to transform primary health care. JAMA 2009;302(13):1461-2.
10. Wagner EH, Austin ET, Davis C, Hindmarsh M, Shaefer J, Bonomi A. Improving chronic illness care: translating evidence into action. Health Aff (Millwood) 2001;20:64-78.
11. Margolis PA, DeWalt DA, Simon JE, et al. Designing a large-scale multilevel improvement initiative: the improving performance in practice program. J Contin Educ Health Prof 2010;30(3):187-96.
12. National Committee for Quality Assurance Diabetes Measures. www.ncqa.org/tabid/784/Default.aspx. Accessed March 15, 2011.
13. Institute for Clinical Systems Improvement CHF Guidelines. www.icsi.org/guidelines_and_more/gl_os_prot/cardiovascular/heart_failure_2/heart_failure_in_adults__guideline_.html. Accessed March 15, 2011.
14. Assessment of Chronic Illness Care Survey. www.ihi.org/IHI/Topics/ChronicConditions/AllConditions/Tools/ACICSurvey.htm. Accessed November 20, 2010.
15. Crabtree BF, Miller WL. Doing qualitative research, second edition. Thousand Oaks, CA: Sage, 1999.
16. Beich J, Scanion DP, Boyce PS. A community-level effort to motivate physician participation in the National Committee for Quality Assurance Diabetes Physician Recognition Program. Population Health Management 2010;13:131-8.
17. Holmboe ES, Wang Y, Meehan TP, et al. Association between maintenance of certification examination scores and quality of care for Medicare beneficiaries. Arch Intern Med 2008;168(13):1396-403.
18. Saaddine JB, Cadwell B, Gregg EW, et al. Improvements in diabetes processes of care and intermediate outcomes: United States, 1988–2002. Ann Intern Med 2006;144:465-74.
19. Ma J, Stafford RS. Quality of US outpatient care temporal changes and racial/ethnic disparities. Arch Intern Med 2005;165:1354-61.
20. Bursi F, Weston SA, Redfield MM, et al. Systolic and diastolic heart failure in the community. JAMA 2006;296:2209-16.
21. Zallman L, Ma J, Xiao L, Lasser KE. Quality of US primary care delivered by resident and staff physicians. J Gen Intern Med 2010;25(11):1193-7.
22. Wang G, Zhang Z, Ayala C, Wall HK, Fang J. Costs of heart failure-related hospitalizations in patients aged 18 to 64 years. Am J Manag Care 2010;16(10):769-76.
23. Crabtree BF, Nutting PA, Miller WL, Stange KC, Stewart EE, Jaen CR. Summary of the National Demonstration Project and recommendations for the Patient-centered Medical Home. Ann Fam Med 2010;8:S80-S90.
24. P4: Preparing the Personal Physician for Practice. www.transformed.com/p4.cfm. Accessed November 20, 2010.
25. Colorado Family Medicine Residency PCMH Project. www.pcpcc.net/content/colorado-family-medicine-residency-pcmh-project. Accessed November 20, 2010.