ORIGINAL ARTICLE

Meaningful Use in Chronic Care:
Improved Diabetes Outcomes Using a Primary Care Extension Center Model

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BACKGROUND The effect of practice facilitation that provides onsite quality improvement (QI) and electronic health record (EHR) coaching on chronic care outcomes is unclear. This study evaluates the effectiveness of such a program—similar to an agricultural extension center model—that provides these services.

METHODS Through the Health Information Technology for Economic and Clinical Health (HITECH) portion of the American Recovery and Reinvestment Act, the North Carolina Area Health Education Centers program became the Regional Extension Center for Health Information Technology (REC) for North Carolina. The REC program provides onsite technical assistance to help small primary care practices achieve meaningful use of certified EHRs. While pursuing meaningful use functionality, practices were also offered complementary onsite advice regarding QI issues. We followed the first 50 primary care practices that utilized both EHR and QI advice targeting diabetes care.

RESULTS The achievement of meaningful use of certified EHRs and performance of QI with onsite practice facilitation showed an absolute improvement of 19% in the proportion of patients who achieved excellent diabetes control (hemoglobin A1c < 7%) compared to baseline. In addition, the percentages of patients with poorly controlled diabetes (hemoglobin A1c > 9%) fell steeply in these practices.

LIMITATIONS No control group was available for comparison.

CONCLUSION Practice facilitation that provided EHR and QI coaching support showed important improvements in diabetes outcomes in practices that achieved meaningful use of their EHR systems. This approach holds promise as a way to help small primary care practices achieve excellent patient outcomes.

Diabetes, especially when poorly controlled, is associated with premature mortality and significant morbidity [1, 2]. Gradations of control, as reflected by moderate reductions in hemoglobin A1c (HGB A1c), can reduce disease burden and death [2]. By adding control of blood pressure (<140/90 mmHg) and low-density lipoprotein cholesterol (LDL-c; <100 mg/dL) to improvements in HGB A1c, patients experience even more profound improvements in overall survival [3]. Despite the obvious benefits, the ability to achieve high percentages of control for these chronic care parameters has remained limited overall and worse among certain demographic groups [4, 5].

The addition of electronic health records (EHRs) to ongoing quality improvement (QI) efforts has been shown to improve chronic care in large health care organizations [6, 7] and in an urban QI collaborative [8]. However, few data document the effects of onsite practice facilitation services that incorporate both QI and the implementation of certified EHRs in small primary care practices, particularly those in rural areas. Further, studies have yet to show the effect on chronic care performance of practices achieving meaningful use of EHRs, as defined by the Centers for Medicare & Medicaid Services (CMS).

Program Description

The North Carolina Area Health Education Centers program (AHEC) began practice-based QI coaching services

as part of the Improving Performance in Practice initiative funded by the Robert Wood Johnson Foundation. QI coaching, also referred to as practice facilitation, involves trained personnel—usually with nursing, practice management, or other ambulatory care experience—who visit practices to teach and engage practice personnel in QI activities. The hallmark of these efforts involve utilization of the Chronic Care Model [9] and the Model for Improvement [10, 11]. The Chronic Care Model explicitly states the need to incorporate guidelines, practice information systems, team-based care, self-management support, communication, coordination, and community outreach to attain high-performance chronic illness outcomes; the Model for Improvement provides a framework for systems change and measurement so practices can achieve these goals. Using the Chronic Care Model as a guide, the practice facilitator works with an inclusive practice team (eg, front desk personnel, nursing personnel, laboratory staff, providers, etc.) to assess practice functions, pinpoint community resources, and design protocols and workflows that assure patients consistently

have opportunities to achieve optimal outcomes.

For example, if only 50% of diabetic patients in a practice demonstrated good diabetes control as defined by the HGB A1c test, the practice team might brainstorm ways to identify patients with poorly controlled disease who had not recently been seen by the practice; they could then design a system to call them in, assess medication adherence, and proceed with medication intensification or application of adherence tools as indicated. In addition, whether incorporating practice or community resources, these patients would be systematically educated about lifestyle and self-management concepts with persistent assessment, coordination, communication, and follow-up. As the process unfolds, the practice could measure phone contacts with the targeted patients, completed appointments, medication changes or adherence issues addressed, educational sessions attended, and, ultimately, improvements in diabetes control per the HGB A1c parameters. These measurements allow the practice to see if the new diabetes care system is working. Using rapid-cycle QI principles, new processes such as those described above are first applied by one provider with a small number of patients in a single work area. Each process change is measured and refined in further small tests, then spread throughout the practice.

Early in the AHEC program, these efforts were often limited by dependence on manual chart reviews and the inability to obtain frequent measurements to support rapid-cycle change. In February 2010, however, North Carolina AHEC was designated as the state's Regional Extension Center for Health Information Technology (REC), part of a technical assistance program funded by the Health Information Technology for Economic and Clinical Health (HITECH) portion of the American Recovery and Reinvestment Act. In this role, AHEC expanded its practice support function by helping small primary care practices implement certified EHR systems and achieve meaningful use according to the definition set by CMS [12]. This definition requires practices to use their EHR system for simple tasks like recording patients' race, ethnicity, and language preference; clinical tasks such as documenting problem lists, medications, allergies, smoking status, and blood pressure; and calculation of a limited set of quality measures, such as blood pressure control and diabetes control. Note that the incentives are not tied to improvement or optimization of any of these measures, only the ability to report them. A practice's commitment to implementing an EHR system and achieving meaningful use can result in federal incentives as high as $63,000 per provider. Serving as the state's REC, AHEC supported practices in this effort by providing tools to help inform decisions regarding EHR selection, serving as a vendor liaison to improve EHR functionality after implementation, and promoting a workflow analytic process (similar to the QI process described previously) to ensure that workflows and practice teams were geared to achieve meaningful use specifications.

Given that federal incentives do not require that EHR use intentionally optimize chronic care, AHEC made the commitment to offer every practice, as part of the meaningful use process, the opportunity to partner with practice coaches in order to address chronic care using QI principles and the Chronic Care Model. As part of the design of AHEC's practice facilitation delivery model, practices that attained meaningful use could voluntarily advance to services that incorporate rapid-cycle QI. This blend of practice support services specifically meets the definition of a primary care extension center [13, 14]. Similar to the agricultural extension model, a primary care extension center provides support to small, rural, and otherwise organizationally isolated practices that do not have the resources or expertise to maximally use electronic records and associated analytic data. These practices also lack the QI skills to improve the value and quality of care—especially preventive and chronic disease care. Because of the potential health impact associated with improved diabetes care, diabetes measures were selected as our initial target.

Methods

This analysis was limited to the full cohort of practices that engaged North Carolina's REC for EHR services and then reported at least 6 months of diabetes chronic care measures by the end of 2013. The diabetes cohort represents a small subset of the initial 500 practices that were working on EHR implementation through the REC. The 50 practices included in this study progressed to various levels of QI and meaningful use proficiency in the 2 years of interest. Given that this report pertained to a QI program, our analysis did not require institutional review board approval.

This study excluded practices that had participated in previous QI programs. This allowed us to focus on the effect of initiating QI while also pursuing meaningful use of an EHR system. Our initial experience in the Improving Performance in Practice program indicated that a 6-month interval was the average time needed for practices to start showing improvements [10]. Note that the CMS definition of Stage 1 meaningful use includes more than just using the EHR to consistently record elements of care such as medications, problem lists, and allergies; it also requires the ability to report clinical quality measures, create disease-specific patient lists, use clinical decision support, and provide patients with clinical summaries of their visits. Full meaningful use criteria are published elsewhere [15].

The dose of practice facilitation—defined as QI coach and practice team engagement at the practice site or, occasionally, via web-based communication—averaged 4–6 hours per practice per month.

Outcomes and Explanatory Variables

Primary outcome measures for our project included the percentage of diabetic patients who achieved excellent control manifested by HGB A1c < 7% and the percentage who remained in poor control manifested by

HGB A1c > 9% for each practice site. Cholesterol control (defined by LDL-c <100 mg/dL) was also assessed. These measures were derived from the 2011 Healthcare Effectiveness Data and Information Set (HEDIS) Comprehensive Diabetes Care Measures. Explanatory variables included several practice characteristics: location (rural versus nonrural), practice payer mix (Medicaid, Medicare, privately insured, or uninsured), and number of providers per practice. This report is based on the first 50 practices that signed up for REC services and agreed to implement a certified EHR system, perform QI through onsite practice facilitation using diabetes chronic care measures, and work toward achievement of CMS-defined meaningful use of their certified EHR.

The measures for the practice's diabetic population were recorded for each practice at 3 stages: at baseline; after implementation of a certified EHR (cEHR) combined with onsite practice facilitation (PF) for diabetes care improvement, but prior to achievement of meaningful use (PF+cEHR); and after full meaningful use (MU) was achieved (PF+cEHR+MU). All 50 practices were included at baseline, but 5 practices did not implement a certified EHR within the timeframe of the analysis, so the PF+cEHR report was limited to 45 of the initial 50 practices. Only 29 practices reached PF+cEHR+MU and qualified for inclusion in the last data point. The last report in each program cycle (baseline, PF+cEHR, then PF+cEHR+MU) was used for all analyses.

In addition to the improvements in EHR usage, we were interested in whether empiric observation of a practice's progress in developing key QI skills influenced outcome measures. Therefore, the QI coaches providing practice facilitation used the Key Driver Implementation Scale to rate their assigned practices. This scale and component subscales were specifically developed by AHEC for this purpose. The relevant anchored subscales include intrinsic QI leadership (range, 0–3), use of practice-based protocols (range, 0–5), and provision of self-management education (range, 0–5).

Statistical Analysis

Descriptive statistics were calculated for primary outcomes and practice characteristics. Given the marked non-normal distribution of Key Driver Implementation Scale scores, the most recent scores were dichotomized to identify high- and low-performing practices for each category. Bivariate analyses were performed to identify relationships between practice characteristics and clinical results. To adjust for possible confounders, linear regression models were constructed using the latest reported proportions of practice control of the 3 diabetes measures as continuous variable outcomes. Practice demographics, facilitator ratings, and group status were used as the independent variables for each model. Since the outcome variable for each practice was the percentage of the entire practice's diabetic population that met the outcome parameters, and none of

the practices were associated with one another, there was no need to account for clustering effects.

Results

There were 50 practices with 209 providers that met the inclusion criteria. Participating practices cared for a total of 26,279 diabetic patients. Table 1 provides practice characteristics of the 50 participating sites. Note that over half of the practices were located in rural communities, and payer mix showed wide variations. Ratings of the practices by the facilitation team showed that 54% of the participating practices were assigned the highest QI leadership score, 48% of practices were deemed good or excellent at utilizing practice-based protocols, and 36% were rated as providing good or excellent self-management teaching. Diabetes outcome results according to group status are shown in Table 2. Note that all 3 diabetic outcomes were greatly improved in the 29 practices that achieved meaningful use and were designated as PF+cEHR+MU practices.

In bivariate comparisons, variables associated with higher percentages of diabetic patients attaining HGB A1c < 7% were receipt of a good self-management teaching rating (58% versus 46%; P = .03) and receipt of practice facilitation for QI and achievement of all EHR milestones (PF+cEHR+MU; 60% versus 42%; P < .001). Continuous variables that significantly correlated with higher percentages of HGB A1c control were a lower number of providers per practice (r = 0.34; P = .03), a lower percentage of Medicaid patients (r = 0.42; P = .01), a lower percentage of uninsured patients (r = 0.58; P < .001), a higher percentage of Medicare patients (r = 0.34; P = .04), and a higher percentage of privately insured patients (r = 0.55; P < .001). When linear regression was performed, a lower number of providers per practice (P = 0.04) and achievement of PF+cEHR+MU (P = .001) remained significant predictors for this diabetes control outcome. See Table 3 for a full summary of regression results. Simply adding consistent EHR quality reports resulted in better diabetes control than at baseline, but this improvement was not as good as that achieved by practices that attained MU. The adjusted r-squared for this model was 0.58, suggesting a strong association of these variables to reported outcomes. The referent data for the model groups in these analyses are those collected at baseline. The large coefficients reported

TABLE 1.
Practice Characteristics (N = 50)

Variable	Value (± standard deviation)
Rural practice location	52%
Payer mix	
Uninsured	14% (25)
Medicaid	12% (10)
Medicare	24% (17)
Privately insured	44% (27)
Number of providers per practice	4.2 (3.6)

TABLE 2.
Achievement of Diabetes Care Components by Progression With Practice Facilitation (PF), Implementation of a Certified Electronic Health Record (cEHR), and Achievement of Meaningful Use (MU)

Practice status	HGB A1c < 7% % of practices (SD)	HGB A1c > 9% % of practices (SD)	LDL-c < 100 mg/dL % of practices (SD)
Baseline (N = 50)	41.6 (16.7)	21.6 (11.8)	44.7 (14.7)
PF+cEHR (N = 45)	51.3 (16.0)	20.1 (13.3)	47.6 (14.5)
PF+cEHR+MU (N = 29)	60.0 (11.6)	15.4 (6.2)	49.8 (20.6)

Note. HGB, hemoglobin; LDL-c, low-density lipoprotein cholesterol; SD, standard deviation.

for PF+cEHR compared to baseline and for all milestones (PF+cEHR+MU) compared to baseline are consistent with the large jump in the proportion of diabetic patients under control shown in Table 2.

Reducing the percentage of patients with poor diabetes control (HGB A1c > 9%) was also examined. In bivariate analyses, good self-management teaching trended toward reduction of the percentage of patients with poorly controlled diabetes. Practices with good self-management teaching had only 17% of their patients with HGB A1c > 9%; in comparison, 24% of patients had HGB A1c > 9% in practices with an average/poor self-management rating (P = .06). Practices that were judged as using practice-based protocols well also fared better (17% with good protocol use compared to 26% with average or poor use; P = .02). For fully functioning practices (PF+cEHR+MU), the percentage of patients with poorly controlled diabetes was significantly reduced; in these practices, only 15% of patients had HGB A1c > 9% (P < .001). The only continuous variable that correlated with poor diabetes control was a high percentage of Medicaid patients in the practice. When all these factors were controlled for in the regression model for the analysis of HGB A1c > 9%, PF+cEHR+MU functionality had the strongest association with a better outcome. See Table 4 for the full model results.

The bivariate results for better LDL-c control demonstrated that a good self-management teaching program was again significant (53% versus 42%; P = .03). No other variable reached statistical significance. Although population control for LDL-c rose from 45% in practices during the pre-intervention stage to nearly 50% in practices that achieved PF+cEHR+MU, the regression model for LDL-c (which used the same variables as the models for HGB A1c < 7% and HGB A1c > 9%) did not demonstrate a significant predictor for improved LDL-c control.

Discussion

Primary care extension centers have been proposed as a mechanism of support for small practices, particularly those in rural communities [13, 14]. As policy makers and practice leaders think ahead to paying for performance, especially for chronic disease care, it is reassuring that extension center–like service resulted in substantial progress. Previous reports have shown better chronic care by coupling QI programs and EHR systems in large integrated organizations [6, 7, 16], but to our knowledge this is the first report that describes the effect in small, independent, and predominantly rural primary care. The chronic care results attained by PF+cEHR+MU practices exceeded averages for all 3 measures as reported for commercially insured patients and for national Medicaid data [17].

In our study, practices in the group that had certified EHRs, received onsite practice facilitation for QI, and fulfilled meaningful use criteria (PF+cEHR+MU) performed better in diabetes chronic care than did practices that had certified EHRs, received practice facilitation, and could produce regular quality reports but did not fulfill criteria for meaningful use (PF+cEHR). A possible explanation is that in order to reach meaningful use standards and receive incentive payments, practice staff need to work as a team, develop workflows with defined roles, and repeatedly and reliably fulfill these roles. Although practice facilitation emphasizes team factors, the financial risk that a small practice assumes by purchasing an EHR system, coupled with the reward of HITECH incentive dollars to attenuate this risk, likely added to the urgency of an inclusive team-based approach that could later be harnessed for systematic chronic care efforts. In addition, meaningful use criteria include elements likely to improve chronic care such as the creation of population lists, use of clinical decision support, production of clinical

TABLE 3.
Factors Associated With Higher Percentages of Diabetic Patients Who Achieved Hemoglobin A1c < 7%

Outcome: Percentage of diabetic practice population with hemoglobin A1c < 7%
Adjusted R-squared = 0.58

Variable	Coefficient	P-value	95% confidence interval
Number of practice providers	–1.40	.04	–2.73, –0.626
Rural location	4.33	.36	–5.28, 14.0
High QI leadership score	–1.55	.74	–10.8, 7.74
High self-management teaching score	2.01	.72	–9.41, 13.4
High utilization of practice-based protocols	–3.78	.54	–16.1, 8.56
Percentage of patients insured by Medicare	0.11	.78	–0.68, 0.904
Percentage of patients insured by Medicaid	–0.466	.92	–0.998, 0.905
Percentage of patients with private insurance	0.452	.25	–0.334, 1.24
Percentage of uninsured patients	0.329	.35	–0.381, 1.04
Practice status: PF+cEHR	17.6	.03	1.71, 33.6
Practice status: PF+cEHR+MU	35.7	.001	15.6, 55.7
Constant	5.53	.88	–67.9, 79.0

Note. cEHR, certified electronic health record; MU, meaningful use; PF, practice facilitation; QI, quality improvement.

summaries for patients, and provision of directive patient education materials.

Rural practices will necessarily remain small because of population density, remote geography, and limited interest from young providers [18, 19]. If medical home and accountable care models are to be successful in rural environments, these practices will need support structures similar to those of practices in larger organizations. Even as payment reform evolves, it is unlikely that smaller practices will be able to summon enough resources to invest in infrastructure such as technology teams, quality coaches, health educators, care managers, pharmacists, and others needed to boost practice function and allow for fully coordinated, population-based care.

Through a shared services approach, primary care extension centers could meet this need. As shown by our group and by others, tailored practice facilitation for QI and EHR support works [20-22]. At the very least, practices could update their EHR capabilities, get help with data analytics, and receive assistance in developing advanced workflows and protocols that align with fresh evidence and best practices. By adding further comprehensive services to these primary care centers—such as care managers and health educators, as has been done successfully for the North Carolina Medicaid population [23, 24]—enhanced care coordination, improved outcomes, and cost savings could be attained through more integrated care, despite practices' small size and geographic separation from large delivery networks.

TABLE 4.
Factors Associated With a Higher Percentage of Patients Who Had Poorly Controlled Diabetes (Hemoglobin A1c > 9%)

Outcome: Percentage of diabetic practice population with hemoglobin A1c > 9%
Adjusted R-squared = 0.47

Variable	Coefficient[a]	P-value	95% confidence interval
Number of practice providers	0.595	.32	–0.608, 1.80
Rural location	–0.437	.92	–8.72, 7.85
High QI leadership score	0.911	.83	–7.38, 9.20
High self-management teaching score	0.414	.94	–9.88, 10.7
High utilization of practice-based protocols	–6.04	.21	–15.7, 3.60
Percentage of patients insured by Medicare	–0.479	.19	–1.20, 0.245
Percentage of patients insured by Medicaid	0.108	.80	–0.758, 0.973
Percentage of patients with private insurance	–0.252	.44	–0.911, 0.406
Percentage of uninsured patients	–0.619	.051	–1.24, 0.002
Practice status: PF+cEHR	–26.2	.001	–41.1, –11.3
Practice status: PF+cEHR+MU	–41.5	<.001	–60.5, –22.5
Constant	82.2	.01	17.5, 146.9

Note. cEHR, certified electronic health record; MU, meaningful use; PF, practice facilitation; QI, quality improvement.
[a]A negative coefficient correlates with better diabetes care.

Rather than starting de novo, a primary care support program should take advantage of organizations that have local infrastructure and trust. AHECs could be an option in some states, as these centers already support rural practices by providing continuing education programs, information resources, and other services. These functions could be tailored to combine traditional continuing education with a collaborative meeting structure that could interweave skill building in areas such as workflow redesign, team care, QI, and change management. Capacity for education through onsite practice facilitation could gradually be developed. A unique aspect of this structure would be the ability to combine continuing education with practice measurement in order to correlate educational outcomes with improvements in care.

An alternative extension center home could be the REC. Established through a $677 million investment by the federal government through the HITECH portion of the American Recovery and Reinvestment Act [25, 26], these organizations already house technical support services and would just have to add QI expertise. These entities have already worked intimately with practice sites to ease the difficult tasks of implementing EHR systems and achieving meaningful use. Over 140,000 providers are currently engaged with RECs and over 120,000 are actively using EHRs [26], indicating that a large and timely impact on chronic care improvement may be attainable. As shown by our study, a logical next step is to leverage new electronic infrastructure and the quality reporting requirement of meaningful use to help practices incorporate QI and population management proficiencies.

A major limitation of our study is that it describes a select group of practices that sought EHR assistance from North Carolina's REC and were willing to report diabetes metrics. However, these practices were scattered across North Carolina and were generally small, with over half located in rural communities. These practices worked with different coaches, and in their reports of real-time data, they showed accelerated progress at different time points. The large improvements demonstrated in this study might be partially explained by a mix of innovator and early majority practices; however, the evaluation includes a broad range of practices in a community environment affected by a policy-relevant federal program augmented by proven QI coaching techniques. This work essentially serves as an effectiveness pilot that shows measurable progress in a reasonable timeframe (about 2 years), in community practices, and using measures that are associated with substantial long-term health impacts [2, 27-30].

Conclusion

We combined the meaningful use of EHR systems with onsite practice facilitation for QI—analogous to a primary care extension center model—and showed important improvements in diabetes care in practices that utilized this

model. This approach holds promise to help small primary care practices achieve excellent patient outcomes. NCMJ

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