Quality and Efficiency in Small Practices Transitioning to Patient Centered Medical Homes: A Randomized Trial

Judith Fifield, PhD^{1,3}, Deborah Dauser Forrest, PhD^{1,3}, Joseph A. Burleson, PhD^{1,4}, Melanie Martin-Peele, MA^{1,3}, and William Gillespie, MD²

¹University of Connecticut Health Center, Farmington, CT, USA; ²EmblemHealth, New York, NY, USA; ³Ethel Donaghue TRIPP Center, Farmington, CT, USA; ⁴Community Medicine and Health Care, Farmington, CT, USA.

BACKGROUND: There is growing evidence that even small and solo primary care practices can successfully transition to full Patient Centered Medical Home (PCMH) status when provided with support, including practice redesign, care managers, and a revised payment plan. Less is known about the quality and efficiency outcomes associated with this transition.

OBJECTIVE: Test quality and efficiency outcomes associated with 2-year transition to PCMH status among physicians in intervention versus control practices.

DESIGN: Randomized Controlled Trial.

PARTICIPANTS: Eighteen intervention practices with 43 physicians and 14 control practices with 24 physicians; all from adult primary care practices.

INTERVENTIONS: Modeled on 2008 NCQA PPC®-PCMH™, intervention practices received 18 months of tailored practice redesign support; 2 years of revised payment, including up to \$2.50 per member per month (PMPM) for achieving quality targets and up to \$2.50 PMPM for PPC-PCMH recognition; and 18 months of embedded care management support. Controls received yearly participation payments.

MAIN MEASURES: Eleven clinical quality indicators from the 2009 HEDIS process and health outcomes measures derived from patient claims data; Ten efficiency indicators based on Thomson Reuter efficiency indexes and Emergency Department (ED) Visit Ratios; and a panel of costs of care measures.

KEY RESULTS: Compared to control physicians, intervention physicians significantly improved TWO of 11 quality indicators: hypertensive blood pressure control over 2 years (intervention +23 percentage points, control -2 percentage points, $p=0.02$) and breast cancer screening over 3 years (intervention +3.5 percentage points, control -0.4 percentage points, $p=0.03$). Compared to control physicians, intervention physicians significantly improved ONE of ten efficiency indicators: number of care episodes resulting in ED visits was reduced (intervention -0.7 percentage points, control +0.5 percentage points, $p=0.002$), with 3.8 fewer

ED visits per year, saving approximately \$1,900 in ED costs per physician, per year. There were no significant cost-savings on any of the pre-specified costs of care measures.

CONCLUSIONS: In a randomized trial, we observed that some indicators of quality and efficiency of care in general adult primary care practices transitioning to PCMH status can be significantly, but modestly, improved over 2 years, although most indicators did not improve and there were no cost-savings compared with control practices. For the most part, quality and efficiency of care provided in unsupported control practices remained unchanged or worsened during the trial.

KEY WORDS: patient centered care; outcomes; randomized trials; primary care.

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INTRODUCTION

The Patient Centered Medical Home (PCMH) is seen as a method to achieve the triple aim¹ of reducing costs while increasing quality and patient experience in primary care. Strong evidence of the effectiveness of the PCMH model is limited² but growing, according to the evidence review conducted by researchers at the Agency for Healthcare Research and Quality (AHRQ) and Mathematica Policy Research.³ Among the six studies meeting their evidence standards and including at least three of five PCMH characteristics while measuring triple aim, patient or professional experience outcomes, findings included only one report of significant cost savings.⁴ Others reported increased costs,⁵ and suggestive but inconclusive cost savings.^{6,7} Half of the studies reported significant and positive reductions in hospital use,^{5,8,9} while half reported suggestive but inconclusive findings. Only one reported reductions in emergency department visits (ED),^{9,10} and one reported suggestive but inconclusive reductions in ED visits.⁶ Two studies reported significant improvements in quality of care processes¹¹ and/or outcomes.^{9,11} These

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practice redesign support by a dedicated practice redesign facilitator. Facilitators engaged physicians and staff on-site in a series of activities to implement the PCMH model, such as utilizing EHR more effectively, and changing workflow to enhance efficiency and access. Specific changes included coding improvements, same-day scheduling, enhancing use of EHRs, and redesign of office space to enhance workflow.

Care Management Support. Intervention received 18 months of care management support provided by nurse care managers embedded in practice care teams (1.0 FTE care manager per 1,000 EmblemHealth patients, regardless of severity). In addition to general care coordination functions and “hot spotting”^{17,18} with frequent Emergency Department (ED) users, care managers identified, contacted, and engaged complex EmblemHealth patients to educate and provide guideline-based care, both one-on-one and in groups.

Revised Payment. In addition to their EmblemHealth negotiated fees, intervention received 2 years of a revised payment plan including cost of NCQA’s 2008 PPC®-PCMH™¹³ application fee, and Pay-For-Performance (P4P) incentives of up to \$2.50 per member per month (PMPM) for improvements in 2008 PPC®-PCMH™, and up to \$2.50 PMPM for improvements in clinical quality. Using HEDIS¹⁹ definitions of clinical quality, P4P targets were derived from Northeast Business Group on Health, NCQA’s Quality Compass®,²⁰ and EmblemHealth data. Controls received participation payments of \$5,000/year if compliant with data submission requirements.

Measures

Study measures were identified a priori and harmonized with those recommended by Commonwealth Fund PCMH Evaluators’ Collaborative.²¹

Data. As this study evaluates practices’ transition to PCMH status, the providers in each practice are the unit of the intervention. Consequently, aggregated claims data are treated as a characteristic of the physician’s care, and outcomes are evaluated at the level of the intervention physician (i-physician) and control physician (c-physician).²² Claims data were aggregated over yearly intervals to construct each of three study periods: Baseline/Pre-intervention, Time 1/Intervention and Time 2/Post-intervention (see Timeline in Fig. 1).

Efficiency. Efficiency indexes provide a measure of physician performance compared to the benchmark performance of EmblemHealth peers in terms of the dollar cost of an episode of care. Values greater than 1.0 indicate relative physician inefficiency and values under 1.0 indicate relative efficiency. Indexes are created by Thomson Reuters using their *Medical Episode Grouper* (MEG) and MarketScan® Databases to

create comprehensive, severity- and complexity-adjusted costs for episodes of care.²³ In-depth description of this ThompsonReuters methodology is in Appendix 1; available online.

Two additional indicators of efficiency are visit ratios indicating how many of a physician’s episodes of care during a year were linked with an ED visit or a hospitalization. These ratios compare a physician’s ED visits and/or hospitalizations to all of his/her episodes of care in a study period. An episode can have multiple ED visits or hospitalizations that are counted separately. A fourth indicator of efficiency is actual costs, including total, ED, hospitalization, and outpatient costs accrued in each study period.

Clinical Quality. Quality in both the process and outcomes of a physician’s care over a study period is measured using 2009 NCQA Healthcare Effectiveness Data and Information Set (HEDIS) Report Card¹⁹ specifications and EmblemHealth patient claim data, summarized at the physician level. Process measures included: age-relevant, sex-relevant and diagnosis-relevant screening for breast cancer (yearly rates); Chlamydia; diabetic-Low Density Lipoprotein (LDL), HbA1c, and nephropathy; as well as coronary artery disease-LDL-C (CAD). Health outcome measures at the physician level are indicated by “control,” defined as the number of EmblemHealth patients in the physician’s panel meeting HEDIS control definitions on a given indicator reported by CPT-II codes (e.g., hypertensive patients with blood pressure [BP]<140/90) over all of the relevant patients (e.g., all hypertensives) in the panel during the study period of interest (i.e., Time 2/post-intervention). If a CPT-II code was not submitted during the study period, the patient was not included in the numerator or the denominator. Control measures for each study period included: CAD LDL-C<100 mg/dl, diabetic HbA1c<7 %, diabetic LDL-C<100 mg/dl, diabetic BP<130/80, hypertensive BP<140/90. CPT-II codes for BP values were not available for baseline, hence reliabilities were added to account for model violations due to too few repeated measures.^{24–27}

Transformations. To create normally distributed measures, clinical quality measures were first recalculated with the arcsine transformation for proportions to adjust the tail ends of the distribution (0 and 1).²⁸ Natural Log (LN) transformations were used only for skewed distributions.²⁹

Analytical Approach

Descriptives and univariate tests of significance, means, standard deviations, medians, minimum and maximum values for descriptive data were produced. To test baseline differences between study groups, we conducted Independent Samples t-tests for normally distributed data, Mann-

Whitney U tests for non-parametric data, and Pearson Chi-Square tests for proportional data.

Hierarchical Linear Models. To assess whether physician change occurs over time differentially by intervention group, the main effect for time x intervention was assessed with Multilevel Models (MLM) using HLM.^{30,31} Refer to Appendix 2 (available online) for MLM model coefficients and confidence intervals.

Weighting. To account for the unequal size of patient panels and to create more precise estimates, weights were created based on physician panel size. Thus, more weight is given to the model estimates for physicians contributing more data.

Cluster Adjustment. We did not apply cluster adjustment for physicians nested within practices, because 74 % of the EmblemHealth physicians are in small practices with two or fewer physicians, and to conduct such analyses, Hox recommends a minimum of 30 within the cluster.³²

RESULTS

Baseline Characteristics

Figure 2 shows enrollment and retention of practices and physicians by condition.¹⁴ Fifteen percent (37/243) of

targeted practices enrolled in the study, 74 % of the recruitment goal (37/50). Five practices (14 %) withdrew prior to providing study data, citing project burden (2), lack of board approval (2), and lack of interest (1). Table 1 shows that at baseline, the only significant difference between intervention and control practices was that intervention practices had significantly more outpatient visits for all episode types than controls ($p=0.02$). Compared with control practices, intervention practices' patients were from zip codes that were not significantly different on U.S. Census population characteristics, including age, sex, race, ethnicity, household size, employment, income, education, US born, or English speaking characteristics (see Appendix 3, available online).

Qualitative assessment of the amount of practice redesign received by practices revealed that most practices (78 %) received the maximum amount, while the other 22 % received some or very little support.

Clinical Quality Measured at the Physician Level

Of 11 Clinical Quality measures, only two had differential change over time by study condition that was significant at the 5 % level. I-physicians increased Hypertensive Blood Pressure control by 23 percentage points, whereas c-physicians reduced

Figure 2. Enrollment and retention. * Differences in the N between clinical quality and efficiency data sets at both the practice and provider level are due to one practice that did not submit required CPT-II data or did not have qualifying patients.

Table 1. Baseline Characteristics of Intervention Versus Control Practices (N=32)

Variables	Intervention (N=18)	Control (N=14)	P value
Physicians per Practice, Median (IQR)	2 (9)	2 (5)	0.729
Locations per Practice, Median (IQR)	1 (2)	1 (2)	0.706
EmblemHealth Patients per Practice, Mean (SD)	407 (221)	409 (185)	0.776
EmblemHealth Patients per Physician, Mean (SD)	203 (89)	246 (151)	0.360
Household Income of Practice Zip Code, Mean (SD)	\$61,752 (\$15,873)	\$61,746 (\$24,196)	0.999
Practices with Federally Qualified Health Center Status, % (n)	6 % (1)	0 % (0)	1.000
Practices with Electronic Health Record, % (n)	50 % (9)	50 % (7)	1.000
EmblemHealth Patients with Diabetes per Practice			
Mean (\$D)	8 (4)	9 (7)	0.905
Median ^{*,†}	8	7	
Emergency Room Visits for All Procedure Types			
Mean (\$D)	81 (43)	68 (52)	0.135
Median ^{*,‡,§,}	75	45	
Hospital Admission Visits for All Procedure Types			
Mean (\$D)	32 (17)	29 (21)	0.065
Median ^{*,‡,§}	32	25	
Outpatient Visits for All Procedure Types			
Mean (\$D)	4,161 (2,685)	2,750 (1,581)	0.022
Median ^{*,‡,§}	3,037	2,346	
Emergency Room Visits for Cardiovascular Procedure Types			
Mean (\$D)	11 (7)	11 (9)	0.491
Median ^{*,‡,§,}	8	8	
Hospital Admission Visits for Cardiovascular Procedure Types			
Mean (\$D)	9 (5)	9 (10)	0.119
Median ^{*,‡,§,}	9	6	
Outpatient Visits for Cardiovascular Procedure Types			
Mean (\$D)	571 (451)	496 (259)	0.539
Median ^{*,‡,§,}	368	452	

*Independent Samples Mann-Whitney U test for non-parametric data

[†]Missing N: Intervention = 4 total (3 with no diabetic patients identified by claims), and 1 physician who submitted no data); and Control = 1 with no diabetic patients identified by claims

[‡]Count of visits over baseline year, 2007

[§]Patient level data aggregated to practice level and weights applied to adjust for volume of episodes at each practice

^{||}Limited to cardiovascular procedure type episodes only

HBP control by roughly 2 percentage points over 2 years (i-physicians: 179 %, c-physicians: -83 % change, $P=0.02$) (Table 2). I-physicians increased Breast Cancer screening by 3.5 percentage points, whereas c-physicians reduced Breast Cancer screening by 0.4 percentage points over 3 years (i-physicians: 9 %, c-physicians: -1 % change, $P=0.03$).

Efficiency at the Physician Level

Of ten efficiency measures, only one had a differential change over time by study condition that was significant at the 5 % level. I-physicians decreased ED visit count ratio by seven-tenths (0.7) of a percentage point, whereas c-physicians increased ED visit count ratio by half (0.5) of a percentage point over 3 years (i-physicians: -18 %, c-physicians: 10 % change, $P=0.002$) (Table 3). This improvement resulted in a reduction of 3.8 ED visits per physician per year, which corresponds to savings of \$1,900 per physician per year.

In addition, two trends showed that i-physicians decreased the ED efficiency index (i.e., improved their efficiency) for all episode types by 3.3 percentage points, whereas c-physicians increased the ED efficiency index (i.e., reduced their efficiency) by 1.2 percentage points over 3 years (i-physicians: -23 %, c-

physicians: 9 % change, $P=0.07$). I-physicians also decreased the ED efficiency index (improved efficiency) for cardiovascular episode types by 3.8 percentage points, whereas c-physicians increased the ED efficiency index (reduced efficiency) by nine-tenths (0.9) of a percentage point over 3 years (i-physicians: -33 %, c-physicians: 10 % change, $P=0.07$).

There was no cost savings observed on any cost-of-care measures, including total, ED, hospital admission or outpatient episodes over 3 years (Table 3). Both study conditions experienced a significant increase in ED costs over 3 years (36.5 % change, $P<0.00$), though this change was not different by study condition.

DISCUSSION

This study confirms the small but growing evidence from rigorously designed and evaluated demonstrations that implementing features of the PCMH may result in limited but significant improvements in both efficiency and quality outcomes with proper incentives and support. Importantly, it confirms in a *general adult population* previous findings from earlier studies employing at least three PCMH characteristics, of significant reductions in ED visits among

Table 2. Provider Level Clinical Quality Process and Outcome Measures

Measures	Time 0 Mean Percentage (n)*	Time 1 Mean Percentage (n)*	Time 2 Mean Percentage (n)*	Difference from Time 0 to Time 2†	% Difference‡	Change Over Time by Group P Value§
Breast Cancer Screening						
Intervention	36.5 % (36)	38.2 % (38)	40.0 % (40)	+3.5 %	+9 %	0.029
Control	38.6 % (24)	38.3 % (24)	38.2 % (24)	−0.4 %	−1 %	
Cardiovascular Lipid Screening						
Intervention	93.1 % (27)	93.2 % (31)	93.3 % (34)	+0.2 %	+0 %	0.401
Control	95.1 % (18)	93.5 % (19)	91.6 % (20)	−3.5 %	−4 %	
Nephrology Screening						
Intervention	95.2 % (33)	93.4 % (35)	91.3 % (37)	−3.9 %	−4 %	0.474
Control	93.3 % (23)	92.3 % (23)	91.2 % (23)	−2.1 %	−2 %	
Chlamydia Screening						
Intervention	40.8 % (30)	48.3 % (35)	55.7 % (35)	+14.9 %	+36 %	0.323
Control	39.9 % (20)	42.5 % (20)	45.0 % (21)	+5.1 %	+13 %	
Diabetic Lipid Screening						
Intervention	92.3 % (33)	91.5 % (35)	90.7 % (37)	−1.6 %	−2 %	0.757
Control	93.1 % (23)	91.9 % (23)	90.5 % (23)	−2.6 %	−3 %	
Diabetic HbA1C Screening						
Intervention	87.7 % (33)	86.8 % (35)	85.8 % (37)	−1.9 %	−2 %	0.957
Control	90.6 % (23)	89.8 % (23)	89.0 % (23)	−1.6 %	−2 %	
Hypertensive Blood Pressure Control§						
Intervention	—	12.9 % (31)	36.1 % (32)	+23.2 %	+179 %	0.020
Control	—	2.3 % (21)	0.4 % (20)	−1.9 %	−83 %	
Cardiovascular Lipid Control						
Intervention	55.1 % (26)	56.2 % (30)	57.2 % (32)	+2.1 %	+4 %	0.127
Control	61.8 % (17)	73.1 % (17)	83.0 % (19)	+21.2 %	+34 %	
Diabetic Blood Pressure Control§						
Intervention	—	3.2 % (35)	5.9 % (37)	+2.7 %	+84 %	0.385
Control	—	0.2 % (23)	0.1 % (22)	−0.1 %	−50 %	
Diabetic Lipid Control						
Intervention	50.5 % (33)	51.9 % (35)	53.8 % (37)	+3.3 %	+7 %	0.306
Control	52.1 % (19)	57.5 % (23)	62.9 % (22)	+10.8 %	+21 %	
Diabetic HbA1C Control						
Intervention	47.7 % (31)	48.4 % (35)	49.2 % (37)	+1.5 %	+3 %	0.568
Control	47.1 % (19)	49.0 % (23)	50.1 % (23)	+3.0 %	+6 %	

*Estimated mean from multilevel model coefficients

†Differential Clinical Quality score change from Baseline to 18-month follow-up between Intervention and Control groups

‡Time X group P Value; § Time 0 (2007) baseline data unavailable; Data reflects Time 1 and Time 2 periods only

||Percent increase calculated as (Time 2 − Time 1)/Time 1; Percent decrease calculated as (Time 1 − Time 2)/Time 1

high-risk elderly randomized to home-based, interdisciplinary care including PCP, specialty care, and a care manager;^{9,10} significant increases in quality of both processes and outcomes of care among depressed elderly randomized to collaborative care including care management, PCP and a specialist;¹¹ and trends in ED cost reductions seen among older patients at high risk of heavy use of health care services randomized to PCP-led team care with care management.⁶ It also increases confidence in reports of positive outcomes from demonstrations with design and evaluation limitations.^{33–35} In addition, our design, which included multiple elements needed to achieve full recognition of Physician Practice Connections®-Patient-Centered Medical Home™ 2008 (PPC®-PCMH™)¹⁴ status awarded by the National Committee for Quality Assurance (NCQA), offers insight into change *during* and *immediately following* introduction of supports, and aligns with results of other large but non-interventional reports that change is real but modest.³⁶

Physicians in intervention practices demonstrated real improvements in BP control among hypertensives and real reductions in ED visit rates relative to the episodes of care during the year. While seemingly modest (3.8 ED visits

saved per year) compared to savings among high-risk elderly^{9,10} and in large integrated health systems,⁶ the savings are substantial when considered over a large number of physicians. For instance, if panels were similar in size and complexity across the 142,000 in-network physicians in EmblemHealth's Group Health Incorporated (GHI) plan, a supported PCMH transition across all physicians would be expected to save \$270 million each year from ED visit reductions alone.

We expect that patient outcomes, such as the increase in BP control among hypertensives, are related to the intervention through the embedded care managers working as part of the PCP-led team, using EHRs to identify complex EmblemHealth patients, such as those with hypertension, for targeted care and education. Additionally, care managers engaged in targeted contact with high frequency ED users, which contributed to the significant reduction in ED visits per episode of care among intervention physicians' patients. We have previously reported that many control practices were able to obtain practice redesign advice and EHRs during the study, but to our knowledge, only intervention practices had access to embedded care managers.¹⁴

Table 3. Provider Level Efficiency Measures

Measures	Time 0 Mean Percentage (n)*	Time 1 Mean Percentage (n)*	Time 2 Mean Percentage (n)*	Difference from Time 0 to Time 2†	% Difference‡	Change Over Time by Group P Value‡
ED Efficiency Index (All Episode Types)						
Intervention	14.3 % (37)	12.5 % (39)	11.0 % (39)	−3.3 %	−23 %	0.069
Control	14.1 % (22)	13.5 % (23)	12.9 % (22)	+1.2 %	+9 %	
Hospital Adm. Efficiency Index (All Episode Types)						
Intervention	3.3 % (36)	3.7 % (35)	4.1 % (34)	+0.8 %	+24 %	0.212
Control	2.5 % (22)	3.4 % (24)	4.6 % (23)	+2.1 %	+84 %	
ED Efficiency Index (Cardiovascular Episodes Only)						
Intervention	11.5 % (30)	9.4 % (18)	7.7 % (28)	−3.8 %	−33 %	0.068
Control	8.9 % (21)	9.3 % (10)	9.8 % (20)	+0.9 %	+10 %	
Hospital Adm. Efficiency Index (Cardiovascular Episodes Only)						
Intervention	3.2 % (28)	3.2 % (27)	3.1 % (24)	−0.1 %	−3 %	0.109
Control	1.9 % (20)	2.9 % (21)	4.3 % (18)	+2.4 %	+126 %	
ED Visit Count Ratio						
Intervention	3.8 % (37)	3.5 % (39)	3.1 % (39)	−0.7 %	−18 %	0.002
Control	5.1 % (22)	5.3 % (24)	5.6 % (23)	+0.5 %	+10 %	
Hospital Adm. Count Ratio						
Intervention	1.4 % (37)	1.1 % (35)	0.9 % (34)	−0.5 %	−36 %	0.218
Control	1.8 % (22)	1.7 % (24)	1.5 % (23)	−0.3 %	−17 %	
Total Costs§						
Intervention	\$33,854,512 (41)	\$33,726,675 (42)	\$33,599,081 (42)	−\$255,431	−0.7 %	0.952
Control	\$39,106,708 (23)	\$38,757,819 (24)	\$38,410,494 (24)	−\$696,214	−1.8 %	
ED Costs						
Intervention	\$16,681 (37)	\$18,570 (39)	\$20,672 (39)	+\$3,991	+24 %	0.214
Control	\$21,044 (22)	\$25,659 (23)	\$31,287 (23)	+10,243	+49 %	
Hospital Adm. Costs						
Intervention	\$304,820 (36)	\$279,346 (35)	\$256,000 (34)	−\$48,820	−16 %	0.578
Control	\$276,396 (22)	\$240,090 (24)	\$208,553 (23)	−\$67,843	−24 %	
Outpatient Costs						
Intervention	\$16,981,528 (41)	\$17,621,731 (42)	\$18,273,780 (42)	+\$1,292,252	+8 %	0.657
Control	\$20,228,713 (23)	\$20,083,857 (24)	\$19,939,522 (24)	−\$289,191	−1 %	

*Estimated mean from multilevel model coefficients

†Differential Clinical Quality score change from Baseline to 18-month follow-up between Intervention and Control groups

‡Differential Slopes by Study Conditions P value

§Total Costs include Emergency Room, Hospital Admission, Outpatient, Medical Office, Prescription, Laboratory Costs

||P=0.000 change over time in ER costs for both Study Conditions

¶Percent increase calculated as (Time 2 − Time 1)/Time 1; Percent decrease calculated as (Time 1 − Time 2)/Time 1

Despite these improvements, we did not observe significant cost savings, and ED costs continued to rise over time, even with the significant reduction in visits observed. We attribute this to the rising cost of ED visits reported by EmblemHealth and the relatively modest reduction in ED visits. While modest, the reduction in ED visits is promising, and if increased, the difference in costs seen between control and intervention sites may become significant.

In addition to our significant findings, we report trends that suggest significant change on some dimensions may take longer, but that physicians in intervention practices are beginning to *bend the curve*. The relative cost of ED visits across all illness episodes compared to their peers ($p=0.07$) showed a trend toward lower costs among intervention physicians.

Despite these significant findings, we were unable to report significant improvements in other HEDIS quality measures, such as Chlamydia screening; diabetes HbA1C or LDL-C screening and control; diabetes nephropathy screening or blood pressure control; and CAD LDL-C screening

and control. We cannot explore the reasons for this lack of improvement, due to our lack of access to identified patient data, or to information on disease severity by patient. Therefore, we can only report on physicians' panels over time, and cannot assess likely improvement among those exposed to the care manager's interventional activities over time. It is also possible that our ED visit ratio results would be different if we could adjust for disease severity. However, we know that practices were not different at baseline on anything other than outpatient volume, so we suspect no difference in the severity of the patient panels. In addition, because we do not have access to patient level data, we are unable to assess the degree to which the CPT-II data are representative of all patients (e.g., all hypertensives). Nor can we provide results that are relevant to general adult primary care in non-urban locations. Finally, we did not find differences in hospitalization rates, and were unable to conduct sub-analyses among sicker and/or older patients, where savings are more likely to be found.^{3,5,8,9}

This paper provides important evidence that practice redesign and embedded care management in community-based practices using the PCMH model results in a modest but promising reduction in ED visits and improved quality of care. However, unanswered questions remain. Can this model be enhanced to obtain real cost savings without sacrificing quality? Perhaps adopting more targeted strategies aimed at short-term cost reductions, as described in highly efficient practices³⁷ or in the Clinical Microsystems approach,³⁸ would yield more impressive results. Is this approach “scalable” to many similar practices? This issue remains a challenge with no easy answers. Additional research that explores alternative approaches, such as a “public utility model”³⁹ or “hovering,”⁴⁰ that leverage shared local and remote services could solve many of the scalability barriers.

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Conflict of Interest: Judith Fifield, PhD, reports having received two honoraria from Zimmer in the last 3 years. All other authors declare no conflict of interest.

Corresponding Author: Judith Fifield, PhD; Ethel Donaghue TRIPP Center, 263 Farmington Ave. MC6229, Farmington, CT 06030, USA (e-mail: fifield@nso1.uchc.edu).

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