ORIGINAL RESEARCH

Improving Delivery of Cardiovascular Disease Preventive Services in Small-to-Medium Primary Care Practices

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Background: **The EvidenceNOW initiative provided smaller primary care practices with external support interventions to implement quality improvement strategies focused on cardiovascular disease prevention. This manuscript reports effectiveness of EvidenceNOW interventions in improving quality metrics.**

Methods: **Seven regional Cooperatives delivered external support interventions (practice facilitation, health information technology support to assist with audit and feedback, performance benchmarking, learning collaboratives, and establishing community linkages) to 1278 smaller primary care practices. Outcomes included proportion of eligible patients meeting Centers for Medicaid and Medicare Services-specified ABCS metrics, that is, Aspirin for those at risk of ischemic vascular disease; achieving target Blood pressure among hypertensives; prescribing statin for those with elevated Cholesterol, diabetes, or increased cardiovascular disease risk; and screening for Smoking and providing cessation counseling. An event study compared prepost changes in outcomes among intervention practices and a difference-in-differences design compared intervention practices to 688 external comparison practices.**

Results: **Mean baseline outcomes ranged from 61.5% (cholesterol) to 64.9% (aspirin). In the event study, outcomes improved significantly (aspirin: +3.39 percentage points, 95% CI, 0.61–6.17; blood pressure: +1.59, 95% CI, 0.12–3.06; cholesterol: +4.43, 95% CI, 0.33–8.53; smoking: +7.33, 95% CI, 4.70–9.96). Difference-in-differences estimates were similar in magnitude but statistically significant for smoking alone. Preintervention trends were significant for smoking, but parallel-trends tests were not significant.**

Conclusions: **EvidenceNOW Cooperatives improved cardiovascular prevention quality metrics among small and medium sized primary care practices across the US. While estimated improvements were small, they reflected average changes across a large and diverse sample of practices. (J Am Board Fam Med 2022;00:000–000.)**

Keywords: **Cardiovascular Diseases, Delivery of Health Care, Hyperlipidemia, Hypertension, Quality Improvement, Primary Health Care**

Introduction

More people die from cardiovascular disease in the United States (US) than any other disease.[1] The 2019 American College of Cardiology and American Heart Association (ACC/AHA) Guideline on the Primary Prevention of Cardiovascular Disease emphasize

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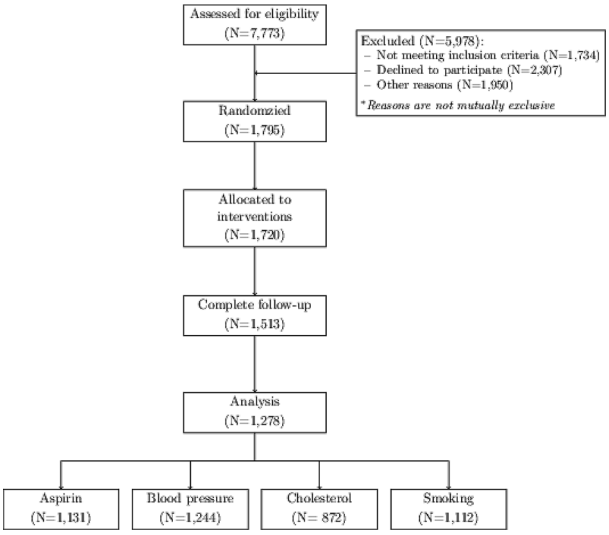
Figure 1. EvidenceNOW consort diagram.



improving delivery of the ABCS of heart health, which included prescribing **A**spirin for those at risk for ischemic vascular disease, achieving target **B**lood pressures for those with hypertension, prescribing statins to those with diabetes, high **C**holesterol, or at risk for atherosclerotic cardiovascular disease, and screening and cessation counseling for **S**moking.[2,3] These strategies have been shown to reduce cardiovascular disease morbidity and mortality.[3,4] Despite substantial clinical evidence, however, national ABCS rates remain suboptimal.[5]

To address this, the Centers for Medicare and Medicaid Services (CMS) and Centers for Disease Control and Prevention (CDC) launched the Million Hearts initiative in 2011.[6–8] Its goal is to prevent 1 million heart attacks by 2022.[6] Most Americans receive primary and secondary preventive care for cardiovascular disease in small to medium-sized primary care practices in their communities.[9] Thus, improving ABCS rates among smaller practices is crucial to realizing the Million Hearts initiative.

Quality improvement strategies shown to increase ABCS adoption in health systems are available but are often not used widely as standard practice in primary care. For instance, the CDC's Best Practices Guide for Cardiovascular Disease Prevention highlight that the use of team-based care, clinical decision support systems, and self-measured blood pressure monitoring is cost-effective in improving clinical outcomes.[10] However, primary care practices experience significant barriers to routine use of these strategies resulting in suboptimal ABCS rates and approaches to improve care delivery such as the Comprehensive Primary Care Initiative or Patient-Centered Medial Home have not consistently shown improvements in quality of care.[11–14]

Recognizing this gap in ABCS delivery and limited quality improvement resources among smaller practices,[15] the Agency for Health care Research and Quality (AHRQ) funded a national initiative called EvidenceNOW encouraging health systems and health professionals to focus on improving the ABCS and also practice capacity.[16,17] EvidenceNOW funded 7 regional "cooperatives" (the term AHRQ used to reference grantees) spanning 12 US states to provide external support interventions at scale to primary care practices in their region with the goal of implementing quality improvement strategies targeting the ABCS. In this manuscript, we report the overall effectiveness of EvidenceNOW interventions on practice-level change in performance on cardiovascular disease (ABCS) clinical quality metrics.

Methods

EvidenceNOW Cooperatives enrolled over 1500 practices across 7 regions. Appendix Figure 1 shows the geographic distribution of EvidenceNOW Cooperatives. AHRQ also funded an external

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evaluation, Evaluating System Change and Learning to Take Evidence to Scale (ESCALATES), led by our team (Cohen, PI).

Interventions

In its Request for Applications, AHRQ sought applications that proposed multi-component interventions providing quality improvement support to small and medium-sized primary care practices. It strongly encouraged practice facilitation as a central and unifying intervention. Thus, EvidenceNOW Cooperatives established infrastructure to deliver external support to practices recruited in their regions. They all implemented practice facilitation. In addition, each cooperative implemented a distinct package of interventions focused on improving the ABCS of heart health, including providing health information technology support to assist practices with audit and feedback, performance benchmarking, creating learning collaboratives, and establishing community linkages. While Cooperatives targeted interventions at improving ABCS outcomes, practices varied in the extent to which they implemented these interventions based on their motivations, priority, and resources. Each Cooperative evaluated implementation and effectiveness of its own intervention.[18–24] We (ESCALATES) evaluated the effectiveness of the overall initiative.[17]

Study Designs

Because Cooperatives lacked internal practice controls, we used 2 quasi-experimental designs to evaluate the overall effectiveness of interventions: (1) an event study including only intervention practices and (2) a difference-in-differences approach comparing intervention practices with an external comparison group. The study period for both approaches ranged from the last quarter of 2015 (baseline) to the second quarter of 2018.

The event study assessed changes in ABCS relative to intervention start (the event) among all EvidenceNOW practices. The baseline period was the quarter just before the start of intervention for each practice cohort (fourth quarter of 2015 for the first cohort to the fourth quarter of 2016 for the fifth cohort). Across Cooperatives, interventions started in 5 cohorts between the first quarter of 2016 and the first quarter of 2017 and ended on a rolling basis over the next 12 months.

The difference-in-differences design evaluated change in outcomes for the years 2015 (preintervention), 2016 (during intervention) and 2017 (postintervention), comparing EvidenceNOW practices to an external comparison group of primary care practices provided by the DARTNet institute.[25] The baseline period for this analysis was the fourth quarter of 2015. Appendix Figure A2 depicts the outcome measurement time periods.

The difference-in-differences design is generally preferred over other types of pre-post designs (such as the event study) because it does not rely on the assumption that outcomes would not have changed in the absence of the intervention. However, the design requires outcome trends of comparison practices (ie, Dartnet) to accurately reflect those of intervention practices (ie, EvidenceNOW) in the absence of any intervention.[26,27] Because of potential data quality issues for some measures in the Dartnet data, we compared findings across both designs to facilitate interpretation.

Data Sources and Practice Samples

We specified practice samples from 2 data sources: (1) EvidenceNOW (intervention practices), and (2) DARTNet (external comparison group).

Intervention Practices

Cooperatives initially assessed 7773 practices for eligibility and randomized 1795 for interventions (Figure 1). While eligibility criteria varied somewhat, most Cooperatives excluded larger practices (defined by AHRQ as ≥10 FTE clinicians) and those that did not have an electronic health record. However, 2 cooperatives that were experiencing challenges recruiting included a few practices with 11 to 15 FTE clinicians. Additional exclusion criteria were specific to Cooperatives' regional context (eg, using a specific electronic health record (EHR) system) and recruitment strategy (eg, from specific practice networks) and described in detail elsewhere.[18–24] In addition, for our sensitivity analyses described below, we further excluded federally qualified health center (FQHC) practices from the EvidenceNOW sample for comparability with the external comparison group.

ABCS outcome metrics were collected from all practices. We excluded practices with unreliable outcome data, which included practices that (1) did not provide outcomes for at least 1 quarter before the intervention, (2) did not provide

outcomes following the intervention, and (3) had low denominator values during one or more study quarters, defined as fewer than 10 patients in the denominator for the aspirin measure and fewer than 30 patients in the denominator for other measures. Of the 1795 practices randomized to interventions, 1278 (71%) were retained in the final sample. Specific to each outcome, the final sample had between 872 (cholesterol) and 1244 (blood pressure) EvidenceNOW practices.

External Comparison Practices. Because EvidenceNOW Cooperatives' study designs did not include internal control practices, we assembled a group of practices external to EvidenceNOW to serve as a comparison group. These were derived from the DARTNet Institute, a real-time EHR data repository. The institute provides secure, deidentified datasets of clinical quality metrics from 12 distinct practice-based research networks that includes over 1000 primary care practices. We applied the same exclusion criteria to DartNet practices.[25] The final sample had between 377 (blood pressure) and 688 (smoking) DartNet practices.

As a sensitivity analysis, we defined a subsample of DARTNet practices located in states represented within EvidenceNOW because they might more accurately reflect regional outcome trends. For this sensitivity analysis (but not the main analysis), we excluded federally qualified health center (FQHC) practices from the EvidenceNOW subsample, because DARTNet did not include FQHC practices located in EvidenceNOW states. The EvidenceNOW subsample had between 580 (cholesterol) to 776 (aspirin) practices; the DARTNet subsample had between 75 (blood pressure) to 117 (smoking) practices.

Measures

The ESCALATES team, in collaboration with Cooperatives, harmonized ABCS measure definitions and practice characteristics. Details about data collection are described in previous studies.[28,29]

Outcomes

We used the Centers for Medicaid and Medicare Services (CMS) specifications for the ABCS outcomes in use in 2015 (Table 1). Each outcome measured the proportion of eligible patients prescribed the recommended treatment in each practice. Cooperatives obtained practice-level performance on ABCS outcomes from practices' electronic health records (EHRs) through quality reports, health information exchange reports, or, in some cases, chart audits, and shared with the ESCALATES team.

Covariates

Practice characteristics were obtained through surveys administered to participating practices by Cooperatives; these included: practice size (solo, 2 to 5, 6 to 10, 11 to 15); practice ownership (clinician-owned, hospital/health system-owned, FQHC, and other); practice location (rural, large town, suburban, urban); whether a practice participated in demonstration programs; whether a practice was in a medically underserved area; health insurance distribution (percent of patients with commercial insurance, uninsured, on Medicaid, on Medicare, dually eligible for Medicaid and Medicare, or on other insurance) and race/ethnicity distribution (percent of white, black, Hispanic patients) of practice patient panel. DARTNet data included practice ownership, race and ethnicity and practice characteristics.

Statistical Analysis

We used multivariable linear regression models for both designs. The event study included binary indicators for quarters relative to the last quarter before start of intervention, ranging from -4 to 9, with 0 indicating the quarter intervention began. These indicators measured change in the outcome relative to the last preintervention quarter. We, then adjusted for practice characteristics and included binary indicators for Cooperatives, intervention cohorts and the quarter of first data submission in the regression. After model estimation, we averaged coefficients for the fifth to eighth postintervention quarter, representing changes in the second year of the intervention.

The difference-in-differences approach included indicator variables for postintervention calendar quarters (first quarter of 2016 to second quarter of 2018), a binary indicator for the intervention group (EvidenceNOW compared with DARTNet), and interaction terms between time indicators and the intervention group indicator. Interaction terms measured changes in outcomes of EvidenceNOW practices compared with DARTNet practices. We adjusted for practice characteristics and included binary indicators for intervention cohorts and the quarter of first data submission in the regression.

Table 1. Specification of ABCS Clinical Quality Outcome Measures

Aspirin	Blood Pressure	Cholesterol	Smoking
		Denominator	
Patients 18 years and older with at least one face to face visit who (i) had an active diagnosis of ischemic vascular disease at any time during the current measurement period; (ii) were discharged alive for acute myocardial infarction, coronary artery bypass graft or percutaneous coronary interventions in the 12 months before the measurement period	Patients 18 years and older and 85 years or younger with at least one face to face visit and active diagnosis of essential hypertension at any time before the first date of month 7 of the measurement period and who did not (i) have an active diagnosis of pregnancy at any time during the measurement period; or (ii) have evidence of end stage renal disease, dialysis, or renal transplant before or during the measurement period	Patients 21 and older with at least one face to face visit who have (i) an active diagnosis of clinical atherosclerotic cardiovascular disease during the current measurement period or any time period; (ii) LDL-C result >= 190 mg/dL at any time during or before the measurement period; (iii) aged 40 to 75 years at the beginning of the measurement period with an active diagnosis of diabetes with the highest LDL-C result of 70 to 189 mg/dL during the current measurement period or two years before the beginning of the measurement period; and who (i) did not have adverse effect, allergy or intolerance to statin medication therapy; (ii) did not have an active diagnosis of pregnancy or breastfeeding; (iii) did not receive palliative care; (iv) did not have an active liver disease or hepatic disease of insufficiency; (v) did not have end stage renal disease; or (vi) did not have a most recent LDL-C results < 70 mg/dL for patients with a diabetes diagnosis who are not currently receiving statin medication therapy	Patients 18 years and older as of the first day of the measurement period with at least two visits during the measurement period
		Numerator	
Number of patients who have documentation of use of aspirin or another antithrombotic during the measurement period	Number of patients whose blood pressure at the most recent visit is adequately controlled (systolic blood pressure < 140 mmgHg and diastolic blood pressure < 90 mm Hg) during the measurement period	Number of patients with a statin medication current on the medication list or prescribed a statin medication during the measurement period	Number of patients who were screened for tobacco use at least once within 24 months and who received tobacco cessation intervention if identified as a tobacco user.
		Measurement period (EvidenceNOW practices)	
Data quarter and preceding three quarters	Data quarter and preceding three quarters	Data quarter and preceding three quarters	Data quarter and preceding three quarters

Notes: Measure specifications are based on CMS164v4 (aspirin prescription when appropriate), CMS165v4 (blood pressure control), CMS347v1 (cholesterol management) and CMS138v4 (smoking cessation support counseling).

We then averaged coefficients for the year 2017, which approximated the second intervention year. We used bootstrapping with 1000 repetitions to cluster standard errors at the Cooperative level (for the event-study) or at the state levels (for the EvidenceNOW-DARTNet comparison).

To test the assumption that outcomes would not have changed without intervention in the event study, we calculated average preintervention outcome change based on estimates for the fourth to second preintervention period. We note that most practices did not submit data starting 4 quarters before intervention begin due to a staggered recruitment process. For the differences-in-differences analysis, we assessed differential trends between EvidenceNOW and DARTNet practices for the first 2 quarters of 2016. We selected these two quarters because we lacked a true preintervention

period for this analysis and because interventions were unlikely to have immediate effects on outcomes. When preintervention trends or parallel-trends test were significant, we estimated trend-adjusted models.[30,31] Trend adjusted models assumed that trends before the intervention would have continued at the same rate during the intervention period absent treatment. All analyses were conducted using R version 3.5.1. The Institutional Review Board of Oregon Health & Science University approved this study.

Table 2. Characteristics of the EvidenceNOW and DARTNet Practice Sample

Practice and patient characteristic	EvidenceNOW Practices	DARTNet Practices
Practice size		
Solo	22.7	
2 to 5 clinicians	46.7	
6 to 10 clinicians	14.0	
11 to 15 clinicians	10.6	
Missing	5.9	
Practice ownership		
Clinician	42.1	46.0
Hospital/health system/ HMO	22.7	46.0
FQHCs	19.6	3.0
Other	11.4	4.9
Missing	4.2	0.0
Practice location		
Rural area	12.8	
Large town	10.8	
Suburban	6.3	
Core urban	59.5	
Missing	10.6	
Insurance status: Fraction of patients		
Uninsured	9.9	
Medicaid	23.0	
Medicare	22.9	
Dually eligible	7.1	
Commercially insured	34.5	
Other insurance	2.7	
Race/ethnicity: Fraction of patients classified as		
White	59.8	49.1
Black	15.6	6.0
Unknown race	7.8	0.0
Hispanic	19.1	6.7
Unknown ethnicity	9.3	0.0
Practice participated in demonstration program		
No	53.7	
Yes	19.7	
Missing	26.6	
Practice has MUA HER		
No	44.5	
Yes	18.4	
Missing	37.1	

Notes: Numbers in the table are percentage values for practice characteristics and mean percentage values for patient characteristics. The sample includes all practices with at least one valid ABCS outcome measure during the study period (n = 1278 for EvidenceNOW practices; n = 613 for DARTNet practices). Practice location is based on the rural-urban commuting areas using 2010 Census data. Numbers for insurance status and race/ethnicity are average percentage values. They do not sum to 100 percent because practices were not required to report estimates that did so. Dual eligible insurance status includes patients receiving both Medicaid and Medicare. Demonstration programs include State Innovation Models Initiative, Comprehensive Primary Care Initiative, Transforming Clinical Practice Initiative–Support and Alignment Network, Community Health Worker training program, Blue Cross/Blue Shield patient-centered medical home program, Association of State and Territorial Health Officials' Million Hearts State Learning Collaborative, Million Hearts: Cardiovascular Disease Risk Reduction Model, and any other program identified by the practice. HMO: Health Management Organization; FQHC: Federally Qualified Health Center; EHR: electronic health records; MUA: Meaningful Use. Sources: EvidenceNOW practice survey; DARTNet practice data.

Results

Most EvidenceNOW practices (83.4%) had ≤10 clinicians (Table 2). While EvidenceNOW's focus was on smaller practices, about 10% of the practices recruited were slightly larger (11 to 15 clinicians). Sixty percent of practices were in urban core areas. DARTNet practices were more than twice as likely to be health system-owned compared with EvidenceNOW practices.

Very few DARTNet practices (3%) across all states were FQHCs (none of the DARTNet practices in EvidenceNOW states were FQHCs). EvidenceNOW and DARTNet practices had a similar percentage of white patients. EvidenceNOW practices had a higher proportion of black and Hispanic patients compared with DARTNet practices. Mean baseline ABCS performance among EvidenceNOW practices were 64.9% (aspirin), 63.6% (blood pressure), 61.5% (cholesterol), and

62.0% (smoking) with wide variation across practices. Among DARTNet practices, mean baseline ABCS levels were 29.6% (aspirin), 64.7% (blood pressure), 39.4% (cholesterol), and 12.6% (smoking). Except for blood pressure, outcome levels for DARTNet practices at baseline were much lower than EvidenceNOW practices.

In the event study, all ABCS outcomes improved. (Table 3). Average outcome change 2 years after the intervention (between baseline and the fifth to eighth quarter) was +3.39 percentage points (95% CI: 0.61 to 6.17, $P < .05$) for aspirin, +1.59 percentage points (95% CI: 0.12 to 3.06, $P < .05$) for blood pressure, +4.43 percentage points (95% CI: 0.33 to 8.53, $P < .05$) for cholesterol and +7.33 (95% CI: 4.70 to 9.96, $P < .001$) for smoking. All outcomes improved gradually during the first 4 postintervention quarters, and then remained at the same level for aspirin, blood pressure and cholesterol, while further increasing for smoking (Figure 2). Preintervention trend estimates for the event study were not statistically significant, except for a positive pretrend for the smoking outcome in the event study (pretrend estimate: 2.03, $P < .01$, Table 3). Adjusting for this pretrend resulted in a significant negative estimate for smoking (see Appendix Table B5).

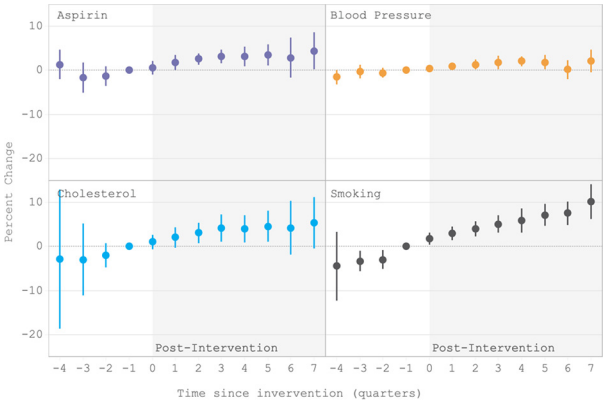
In the difference-in-differences design, parallel-trends test was not statistically significant for any of the outcomes. As shown in Table 3, EvidenceNOW practices showed higher performance on all measures as compared with DARTNet controls but with varying levels of statistical significance (Aspirin +3.75 percentage points, $P = .0875$; Blood pressure +2.76 percentage points, $P = .0556$; Cholesterol +3.87 percentage points, $P = .2990$; and Smoking +8.32 percentage points, $P = .0027$). Outcomes for DARTNet practices between 2016 and 2017 did not show any clear trends (Appendix Figure A2) and aspirin and cholesterol outcomes for the first and second quarter of 2018 were much larger than for other quarters. Estimates from sensitivity analysis using the subsample of DARTNet

Table 3. Baseline ABCS Levels and Estimates of Effectiveness of EvidenceNOW

Approach	Aspirin	Blood Pressure	Cholesterol	Smoking
		Event study		
Baseline level, % (SD)	64.9 (23.5)	63.6 (15.0)	61.5 (19.4)	62.0 (30.7)
Change estimate	3.39	1.59	4.43	7.33
95% CI	0.61, 6.17	0.12, 3.06	0.33, 8.53	4.70, 9.96
P value	0.0167	0.0337	0.0342	0.0000
Pre-intervention trend test estimate (*P* value)	0.58 (0.37)	0.41 (0.19)	1.46 (0.27)	2.03 (0.002)
		Difference-in-differences, DARTNet comparison (all states)		
Baseline level, % (SD) (EvidenceNOW)	65.1 (23.2)	63.1 (15.2)	62.5 (19.2)	64.9 (30.2)
Baseline level, % (SD) (DARTNet)	29.6 (20.3)	64.7 (20.4)	39.4 (19.2)	12.6 (9.1)
Change estimate	3.75	2.76	3.87	8.32
95% CI	−0.56, 8.06	−0.06, 5.58	−3.44, 11.18	2.89, 13.75
P value	0.0875	0.0556	0.2990	0.0027
Parallel trend test estimate (*P* value)	0.65 (0.50)	0.49 (0.46)	1.49 (0.26)	1.49 (0.35)
		Difference-in-differences, DARTNet comparison (EvidenceNOW states)		
Baseline level, % (SD) (EvidenceNOW)	64.9 (23.6)	62.9 (15.3)	62.0 (19.0)	61.4 (30.5)
Baseline level, % (SD) (DARTNet)	31.0 (19.6)	63.6 (16.9)	40.9 (21.4)	15.9 (10.7)
Change estimate	4.88	2.87	3.81	11.54
95% CI	−3.33, 13.09	0.07, 5.67	−6.46, 14.08	3.56, 19.52
P value	0.2444	0.0447	0.4680	0.0046
Parallel-trends test estimate (*P* value)	−0.54 (0.46)	−0.55 (0.74)	0.53 (0.72)	2.67 (0.28)

Notes: For the event study, baseline levels correspond to the last quarter before intervention begin (fourth quarter of 2015 for the first cohort to fourth quarter of 2016 for the fifth cohort). Estimates of the effect of interventions correspond to average estimates of the fifth to eighth post-intervention quarters. Pre-intervention trend estimates are based on the fourth to second pre-intervention period. For the difference-in-difference analysis, baseline levels correspond to the fourth quarter of 2015. Estimates of the effect of the intervention correspond to average estimates of the interaction term between an indicator for EvidenceNOW practices and 2017 quarters. Parallel-trends tests are based on the first and second quarter of 2016.
Abbreviations: SD, standard deviation; CI, confidence interval.

Figure 2. Event study estimates.



Notes: The figure shows event study estimates and 95% confidence intervals. The last preintervention period is the reference period. Source: EvidenceNOW electronic health records.

practices from EvidenceNOW regions were similar in magnitude to the full sample, with 2 coefficients (blood pressure and smoking) reaching significance (Table 3).

Discussion

EvidenceNOW was one of the largest primary care quality improvement initiatives focused on improving cardiovascular disease preventive care by providing external support interventions to smaller practices. Overall effectiveness of these interventions in improving ABCS outcomes is best evaluated from trials that incorporate a robust comparison group of practices, either through randomization or through external comparisons. EvidenceNOW projects were pragmatic trials with varying designs; thus, in the absence of control practices, quasi-experimental study designs can help in making causal inference.[32] We employed 2 such designs to evaluate effectiveness of interventions and the results were largely complementary. We found that EvidenceNOW interventions were associated with small improvements in the ABCS quality metrics 2 years after the intervention (event study). When comparing with an external group of practices (difference in differences), EvidenceNOW practices demonstrated improvements for all quality metrics, but statistically significant improvements were observed only for the smoking screening/cessation counseling metric.

Overall, there was consistency of findings across the 2 designs except for the smoking outcome metric. The difference in differences design showed an almost 8 percentage point improvement in smoking among EvidenceNOW practices compared with Dartnet comparison practices. Importantly, the parallel trends test was nonsignificant, suggesting that our estimate of the smoking improvement might be appropriate and valid. Thus, observed estimates of smoking outcome improvement were likely associated with intervention effects. While the event study also showed a 7.3 percentage point improvement, we observed a positive pretrend, possibly suggesting a secular effect. We did not observe such a trend in the Dartnet comparison practices and other studies have also not demonstrated such improvements in `smoking and other outcomes over time.[33–35] It is possible that practices motivated to improve smoking outcomes may have self-selected into EvidenceNOW or implemented changes in anticipation of receiving the intervention. If that were the case, observed improvements may not be completely attributable to EvidenceNOW interve-ntions.

Supporting practices by providing facilitation, expert consultation, and health information technology in implementing quality improvements has been shown to improve a range of practice outcomes.[36–40] However, most of these findings come from small practice samples enrolled in controlled research studies.[19,20,22] This study is one of the first to assess effectiveness in improving quality metrics at a large scale when diverse primary care practices were provided with external support through primary care extension infrastructure. We observed

small improvements in all ABCS outcomes, with the smoking metric demonstrating statistical significance for both research designs. While observed changes were small, it is important to note that benefits in cardiovascular disease outcomes may be observed, for instance, even with minor reductions in blood pressure or just by appropriately prescribing statins to those at increased risk.[1–3]

The Affordable Care Act mandated that Health and Human Services establish a primary care extension program to provide practices with external support. However, the program was never funded.[41,42] Our study suggests that such an extension program could help practices improve ABCS clinical quality metrics. While improvements in the outcome metrics were small, they were observed across a large and diverse sample of practices suggesting that external support interventions provided to practices may have population-level benefits perhaps even for other chronic conditions such as diabetes and mental health. If such benefits are to be adopted more widely and sustained, more research is needed identifying strategies to mitigate the influence of practice-level barriers to implementing quality improvements, such as competing demands and a challenging reimbursement environment for primary care.

Using two statistical methods including the inclusion of an external comparison group of practices is a strength of this evaluation of pragmatic EvidenceNOW interventions. However, our study also had several limitations. First, practices had different capabilities in extracting data on ABCS quality metrics from EHRs, which might have affected data quality. We minimized this concern by working collaboratively with cooperatives to ensure data quality and by excluding practices with unreliable data. Second, effect estimates might be affected by practices' first data submission, either relative to the time since the intervention or relative to the baseline quarter. We addressed this concern by including indicators for intervention cohorts and the first quarter of data submission in regressions. Third, practices submitted baseline data at different points before intervention start. Therefore, preintervention trends may not have been precisely estimated. Fourth, the DARTNet sample was relatively small limiting power of our difference-in-differences analysis. Unfortunately, we did not have access to other suitable external data sources and had to exclude some practices due to data quality concerns. Fourth, there may be potential for self-selection bias as practices that chose to enroll may be more likely to be motivated to make changes and engage in facilitation. The relatively high mean baseline outcome levels may, in part, be because of this reason. However, we also observed wide variation in baseline ABCS rates across practices demonstrating that EvidenceNOW Cooperatives also reached practices with lower performance on these metrics. Fifth, data on other confounders (eg, age, race/ethnicity) were not available and therefore not included in our analysis. Finally, DARTNet practices showed large changes in outcomes in 2018 that likely reflect data quality or coding issues. Although we were unable to identify the underlying reason for those changes, our analysis is based on change in outcomes using 2017 postintervention data and thus, these issues did not affect our findings.

It is important to note that external support strategies implemented in EvidenceNOW were based on the best clinical evidence available at the time of the initiative. Therefore, changes in guidelines (such as for aspirin use in 2021) would not be reflected in this work.

Notwithstanding these limitations, our study provides valuable lessons for future studies seeking to evaluate effectiveness of external support interventions in primary care. First, they should construct a valid comparison group of practices that follows the same data collection protocols as intervention practices. Second, they should include a sufficient number of preintervention data points to reliably attribute outcome change to interventions. Finally, they should consider using experimental approaches in allocating practices to interventions to minimize self-selection bias (eg, cluster-randomized trial or randomized stepped-wedge trials).

Conclusion

Our findings suggest that providing external support interventions in implementing quality improvement strategies may improve ABCS quality metrics among smaller primary care practices. While estimated improvements were small, they reflected average changes across a large and diverse sample of practices. Future research examining number of cardiovascular events

prevented as a result of these complex, multicomponent interventions is needed to justify investments in such large-scale primary care quality improvement programs.

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To see this article online, please go to: http://jabfm.org/content/35/5/000.full.

References

1. Arnett DK, Blumenthal RS, Albert MA, et al. 2019 ACC/AHA guideline on the primary prevention of cardiovascular disease: a report of the American College of Cardiology/American Heart Association Task Force on Clinical Practice Guidelines. Circulation 2019;140:e596–e646.
2. American Heart Association. Erratum. Circulation 2019;140(11):e649–e650.
3. Benjamin EJ, Muntner P, Alonso A, et al. Heart disease and stroke statistics–2019 update: A report from the American Heart Association. Circulation 2019;139(10):e56–e528.
4. Lloyd-Jones DM, Huffman MD, Karmali KN, et al. Estimating longitudinal risks and benefits from cardiovascular preventive therapies among Medicare patients. J Am Coll Cardiol 2017;69:1617–36.
5. Karmali KN, Lloyd-Jones DM, Berendsen MA, et al. Drugs for primary prevention of atherosclerotic cardiovascular disease. JAMA Cardiol 2016;1:341–9. Available from: https://doi.org/10.1001/jamacardio.2016.0218.
6. US Department of Health and Human Services [Internet]. Million hearts 2022: Snapshots of progress; 2018 [Accessed 15 February 2021]. Available from: https://millionhearts.hhs.gov/files/MH-Snapshots-of-Progress-2022-508.pdf.
7. Frieden TR, Berwick DM. The "million hearts" initiative—preventing heart attacks and strokes. N Engl J Med 2011;365:e27.
8. Centers for Disease Control and Prevention. Million hearts: Strategies to reduce the prevalence of leading cardiovascular disease risk factors—United States, 2011. Morbidity and Mortality Weekly Report 2011;60:1248–51.
9. Hing E, Rui P, Palso K. [Internet]. National ambulatory medical care survey: 2013 state and national summary tables; 2013 [Accessed 15 February 2021]. Available from: https://www.cdc.gov/nchs/data/ahcd/namcs_summary/2013_namcs_web_tables.pdf.
10. Centers for Disease Control and Prevention [Internet]. Best practices for cardiovascular disease prevention programs: a guide to effective health care system interventions and community programs linked to clinical services. CDC; 2017 [Accessed 15 February 2021]. Available from: https://www.cdc.gov/dhdsp/pubs/docs/Best-Practices-Guide-508.pdf.
11. Dale SB, Ghosh A, Peikes DN, et al. Two-year costs and quality in the comprehensive primary care initiative. N Engl J Med 2016;374:2345–56.
12. Peikes D, Dale S, Ghosh A, et al. The comprehensive primary care initiative: effects on spending, quality, patients, and physicians. Health Aff 2018;37:890–9.
13. Stange KC, Nutting PA, Miller WL, et al. Defining and measuring the patient-centered medical home. J Gen Intern Med 2010;25:601–12.
14. Sinaiko AD, Landrum MB, Meyers DJ, et al. Synthesis of research on patient-centered medical homes brings systematic differences into relief. Health Aff 2017;36:500–8.
15. Cohen DJ, Dorr DA, Knierim K, et al. Primary care practices' abilities and challenges in using electronic health record data for quality improvement. Health Aff 2018;37:635–43.
16. Meyers D, Miller T, Genevro J, et al. EvidenceNOW: Balancing primary care implementation and implementation research. The Ann Fam Med 2018;16:S5–S11.
17. Cohen DJ, Balasubramanian BA, Gordon L, et al. A national evaluation of a dissemination and implementation initiative to enhance primary care practice capacity and improve cardiovascular disease care: The Escalates study protocol. Implement Sci 2016;11:86
18. Persell SD, Liss DT, Walunas TL, et al. Effects of 2 forms of practice facilitation on cardiovascular prevention in primary care. Med Care 2020;58:344–51.
19. Cykert S, Keyserling TC, Pignone M, et al. A controlled trial of dissemination and implementation of a cardiovascular risk reduction strategy in small primary care practices. Health Serv Res 2020;55:944–53.
20. Parchman ML, Anderson ML, Dorr DA, et al. A randomized trial of external practice support to improve cardiovascular risk factors in primary care. Ann Fam Med 2019;17:S40–9.
21. Shelley DR, Gepts T, Siman N, et al. Cardiovascular disease guideline adherence: An RCT using practice facilitation. American Journal of Preventive Medicine 2020;58:683–90.
22. Dickinson WP, Nease DE, Rhyne RL, et al. Practice transformation support and patient engagement to improve cardiovascular care: From EvidenceNOW Southwest (ENSW). J Am Board Fam Med Med 2020;33:675–86.
23. Weiner BJ, Pignone MP, DuBard CA, et al. Advancing heart health in North Carolina primary care: the Heart Health NOW study protocol. Implementation Science 2015;10:160.
24. Chou AF, Homco JB, Nagykaldi Z, et al. Disseminating, implementing, and evaluating patient-centered

outcomes to improve cardiovascular care using a stepped-wedge design: healthy hearts for Oklahoma. BMC Health Services Research 2018;18:1–3.
25. Pace WD, Fox C, White T, et al. The DARTNet Institute: Seeking a sustainable support mechanism for electronic data enabled research networks. eGEMs 2014;2(2):1063.
26. Lechner M. The estimation of causal effects by difference-in-difference methods estimation of spatial panels. Foundations and Trends in Econometrics 2010;4:165–224.
27. Angrist JD, Pischke J-S. Mostly harmless econometrics: An empiricist's companion. Princeton University Press; 2008.
28. Balasubramanian BA, Marino M, Cohen DJ, et al. Use of quality improvement strategies among small to medium-size US primary care practices. Ann Fam Med 2018;16:S35–43.
29. Lindner S, Solberg L, Miller W, et al. Does ownership make a difference in primary care practice? J Am Board Fam Med 2019;32:398–407.
30. Roberts ET, McWilliams JM, Hatfield LA, et al. Changes in health care use associated with the introduction of hospital global budgets in Maryland. JAMA Internal Medicine 2018;178:260–8.
31. Lindner S, Kaufman MR, Marino M, et al. A Medicaid alternative payment model program in Oregon led to reduced volume of imaging services. Health Affairs 2020;39:1194–201.
32. Shadish WR, Cook TD, Campbell DT. (2002). Experimental and quasi-experimental designs for generalized causal inference. Houghton Mifflin.
33. Salami JA, Warraich H, Valero-Elizondo J, et al. National trends in statin use and expenditures in the US adult population from 2002 to 2013: insights from the Medical Expenditure Panel Survey. JAMA Cardiology 2017;2:56–65.
34. Yao X, Shah ND, Gersh BJ, et al. Assessment of trends in statin therapy for secondary prevention of atherosclerotic cardiovascular disease in US adults from 2007 to 2016. JAMA Network Open 2020;3:e2025505.
35. Muntner P, Hardy ST, Fine LJ, et al. Trends in blood pressure control among US adults with hypertension, 1999–2000 to 2017–2018. JAMA 2020;324:1190–200.
36. Baskerville NB, Liddy C, Hogg W. Systematic review and meta-analysis of practice facilitation within primary care settings. Ann Fam Med 2012;10:63–74.
37. Deri Armstrong C, Taljaard M, Hogg W, Mark AE, Liddy C. Practice facilitation for improving cardiovascular care: secondary evaluation of a stepped wedge cluster randomized controlled trial using population-based administrative data. Trials 2016;17:434.
38. Dickinson WP, Dickinson LM, Nutting PA, et al. Practice facilitation to improve diabetes care in primary care: a report from the EPIC randomized clinical trial. Ann Fam Med 2014;12:8–16.
39. Due TD, Thorsen T, Kousgaard MB, Siersma VD, Waldorff FB. The effectiveness of a semi-tailored facilitator-based intervention to optimise chronic care management in general practice: a stepped-wedge randomised controlled trial. BMC Fam Pract 2014;15:65.
40. Harris MF, Parker SM, Litt J, Preventive Evidence into Practice Partnership Group, et al. Powell Davies G. Implementing guidelines to routinely prevent chronic vascular disease in primary care: the Preventive Evidence into Practice cluster randomised controlled trial. BMJ Open 2015;5:e009397.
41. Grumbach K, Mold JW. A health care cooperative extension service: transforming primary care and community health. JAMA 2009;301:2589–91.
42. Phillips RL, Kaufman A, Mold JW, et al. The primary care extension program: a catalyst for change. Ann Fam Med 2013;11:173–8.