

ORIGINAL RESEARCH

How Does Prior Experience Pay Off in Large-Scale Quality Improvement Initiatives?

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Introduction: To examine the association of prior investment on the effectiveness of organizations delivering large-scale external support to improve primary care.

Methods: Mixed-methods study of 7 EvidenceNOW grantees (henceforth, Cooperatives) and their recruited practices (n = 1720). **Independent Variable:** Cooperatives's experience level prior to EvidenceNOW, defined as a sustained track record in delivering large-scale quality improvement (QI) to primary care practices (high, medium, or low). **Dependent Variables:** Implementation of external support, measured as facilitation dose; effectiveness at improving (1) clinical quality, measured as practices' performance on Aspirin, Blood Pressure, Cholesterol, and Smoking (ABCS); and (2) practice capacity, measured using the Adaptive Reserve (AR) score and Change Process Capacity Questionnaire (CPCQ). Data were analyzed using multivariable linear regressions and a qualitative inductive approach.

Results: Cooperatives with High (vs low) levels of prior experience with and investment in large-scale QI before EvidenceNOW recruited more geographically dispersed and diverse practices, with lower baseline ABCS performance (differences ranging from 2.8% for blood pressure to 41.5% for smoking), delivered more facilitation (mean = +20.3 hours, $P = .04$), and made greater improvements in practices' QI capacity (CPCQ: +2.04, $P < .001$) and smoking performance (+6.43%, $P = .003$). These Cooperatives had established networks of facilitators at the start of EvidenceNOW and leadership experienced in supporting this workforce, which explained their better recruitment, delivery of facilitation, and improvement in outcomes.

Discussion: Long-term investment that establishes regionwide organizations with infrastructure and experience to support primary care practices in QI is associated with more consistent delivery of facilitation support, and greater improvement in practice capacity and some clinical outcomes. (J Am Board Fam Med 2022;35:1115–1127.)

Keywords: Cardiovascular Diseases, Leadership, Linear Models, Population Health Management, Primary Health Care, Quality Improvement, Surveys and Questionnaires, Workforce

Introduction

Over the past 15 years, multiple initiatives have aimed to help primary care practices keep up with

rapid changes in technology, knowledge, clinical evidence, and policy. These efforts have included local and federal initiatives to support the implementation and use of electronic health records (EHRs)¹ and

This article was externally peer reviewed.
Submitted 2 March 2022; revised 21 June 2022; accepted 23 June 2022.

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improve clinical quality measures (eg, Comprehensive Primary Care Initiative).² There have also been initiatives to assist practices in becoming recognized Patient-Centered Medical Homes.³ Organizations, such as Regional Extension Centers (RECs) and Quality Improvement Organizations (QIOs), have emerged to provide external support to help practices make these changes.^{4,5} The Agency for Health care Research and Quality (AHRQ) has contributed to these efforts in various ways, including with its EvidenceNOW initiatives. These initiatives have funded grantees to develop regional infrastructure to provide external support to practices aimed at improving practice capacity and clinical outcomes, such as cardiovascular preventive care delivery, guidance to identify and address alcohol misuse,⁶ and female urinary incontinence.⁷

External support can span a range of activities: assisting in tailoring new evidence to practice; providing technical expertise to access EHR data to inform quality improvement; and coaching to implement operational changes.^{8,9} External support may benefit practices that lack internal resources for quality improvement, such as smaller clinician-owned practices and some health-system- and hospital-owned practices located in rural communities and at great distances from central office support.¹⁰ External support can ameliorate resource and capacity constraints that make staying current and engaging in ongoing quality improvement challenging.^{11,12} Although there is evidence that elements of external support, such as working with a coach or facilitator, can be beneficial for practices,¹³ the assistance provided by external organizations is often not well defined and measured. Studies of the delivery of large-scale external support are limited.

EvidenceNOW aimed to improve the ABCS of heart health (Aspirin use in high-risk individuals, Blood pressure control, Cholesterol management, and Smoking cessation support) and primary care practice capacity (health information technology, quality improvement, ability to adapt to change). We conducted the national

evaluation of EvidenceNOW – called Evaluating System Change to Advance Learning and Take Evidence to Scale (ESCALATES; Cohen, PI). The EvidenceNOW grantees (henceforth, called Cooperatives) have published the outcomes of their individual grants.^{14–20} This article complements that work by reporting the results of a comparative analysis that examined differences among Cooperatives.

Cooperatives are partnerships. Cooperative leads were Principal Investigators affiliated with academic health centers who partnered with regional experts and organizations with the ability to provide health information technology support and expertise (eg, RECs), a practice facilitator workforce (eg, QIOs, Area Health Education Centers), and educational materials and resources.²¹ Our prior work showed that Cooperatives started EvidenceNOW at different levels of preparedness, with some Cooperatives having partnerships that leveraged a stable facilitator workforce, data infrastructure and a network of relationships with practices, and other Cooperatives that were quite new to this work, and used EvidenceNOW to further develop this experience and infrastructure.^{22,23} In this article, we examine the association between Cooperatives' experience level and delivery of facilitation and clinical outcome change. We tested the following a priori hypothesis:

Cooperatives with high levels of experience (pre-EvidenceNOW) will deliver a higher and more consistent amount of facilitation to their practices, and their practices will make larger improvements in practice capacity and in ABCS outcomes as compared to Cooperatives with low experience levels.

Methods

Setting

AHRQ funded 7 EvidenceNOW Cooperatives that operated in 12 states (see map in Online Appendix), defining their regions as either single state (most common), multi-state, or subregions of a state. Cooperatives developed or leveraged existing infrastructure and relationships to recruit practices²⁴ and then delivered external support within a 3-year time frame.²³ The initiative's intended focus was on supporting smaller primary care practices (≤ 10 clinicians) with limited internal resources for quality improvement.²⁵

Funding: This research was supported by a grant from Agency for Healthcare Research and Quality 1R01HS023940-01 (PI: Cohen).

Conflict of interest: The authors of this manuscript have no conflicts of interest to report.

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Study Design and Conceptual Framework

We evaluated EvidenceNOW through the lens of a natural experiment using an iterative mixed methods design and informed by the Practice Change Model (PCM)²⁶ and the Consolidated Framework for Implementation Research (CFIR).²⁷ Details of the study design have been described elsewhere.²¹ This study was approved by the Oregon Health & Science University (OHSU) Institutional Review Board and was registered as an observational study at clinicaltrials.gov (NCT02560428).

Study Measures

Independent Variable

The main independent variable was each Cooperative's experience level before EvidenceNOW, which we defined as a sustained track record in delivering large-scale quality improvement to primary care practices. This measure was derived through qualitative analysis, as described below. Cooperatives with high levels of experience had extensive knowledge of conducting quality improvement at scale in primary care practices, had more than a decade of doing this work in their region, and had regions with centralized infrastructure to support large-scale quality improvement. Cooperatives with medium levels of experience had some knowledge in conducting large-scale quality improvement, had 5 or fewer years of doing this work in their region, and had limited centralized infrastructure to support large-scale quality improvement before EvidenceNOW. Cooperatives with low levels of experience started EvidenceNOW with little knowledge of conducting large-scale quality improvement, little experience doing this work in their region, and no regional infrastructure to support large-scale quality improvement. Table 1 shows how we defined and operationalized this variable and includes supporting qualitative data.

Dependent Variables

There were 3 dependent variables for this study; (1) ability to deliver facilitation, (2) practice capacity, and (3) ABCS quality metrics. Ability to deliver facilitation was assessed by measuring facilitation amount, which was the total number of hours and months of facilitation a Cooperative delivered to each practice. Practice capacity included 2 measures; practices' ability to adapt to change, measured using the Adaptive Reserve (AR) composite measure,²⁸ and quality improvement capacity measured using

part of the Change Process Capacity Questionnaire (CPCQ).³⁰ The ABCS quality metrics focused on clinical improvement in cardiovascular preventive and disease care outcomes. Table 2 details these measures, and the online Appendix includes the AR and CPCQ survey items.

Covariates Practice characteristics (for details, see online Appendix) included the following: practice location; practice ownership; practice size; and practice patient characteristics, including age and insurance status.

Data Collection

Qualitative data were collected by our team, as described in Table 3. Cooperatives abstracted practice-level ABCS performance metrics from EHRs. Measures of practice capacity and practice demographic data were collected by Cooperatives via a survey pre- and post-intervention. EHR and survey data were shared with our team. Facilitators tracked the frequency, duration, and mode of their practice visits (phone, virtual, in-person). We worked with Cooperatives to harmonize all measures, but the approaches Cooperatives used to collect data varied. More details about data collection, including methods to collect survey and ABCS data, are described elsewhere.²¹

Analysis

We analyzed qualitative data prospectively using a group analysis process and an inductive approach.^{21,24,29–31} We immersed ourselves in data (interviews, fieldnotes, and artifacts (eg, toolkits and materials)). We discussed these data to identify insights and summarized emerging observations using written case summaries and matrices. One emerging finding was Cooperative experience—before EvidenceNOW—with large-scale quality improvement. In a second analytic cycle, we reviewed raw and summarized data relevant to this issue. Through consensus, we formulated a definition of Cooperative experience level and, based on data describing each Cooperative's prior resources, relationships, and infrastructure, rated Cooperative experience level as high, medium, or low.

For quantitative analyses, we calculated descriptive statistics of practice characteristics overall and by each Cooperative's level of experience, examining baseline and post-intervention outcome performance as well as changes in outcomes between

Table 1. Description and Assignment of Cooperative Level of Prior Experience (Independent Variable)

Operational Definition	Cooperatives	Relationships, Experience and Infrastructure Examples
High experience level – Knowledge of how to do large-scale quality improvement; more than a decade of experience doing this work in a region; centralized durable infrastructure prior to EvidenceNOW to support this large-scale quality improvement	Cooperatives 1 and 7	<ul style="list-style-type: none"> Existing deep relationships with practice support partners; regional resources and state financial support Regionwide facilitator workforce from prior quality improvement (QI) initiatives experienced in practice change and implementing EHR-related improvements Plentiful existing facilitator infrastructure for training and skills assessments with materials such as toolkits, communication platforms, opportunities for peer learning and quality assurance monitoring
<p><i>Supporting Quote:</i> The federal AHEC program was set up off of the Cooperative Extension agricultural program to basically go out and teach the farmers out in their fields because bringing farmers into a conference room doesn't help farming. AHEC is the same concept. You go out and you teach the doctors. [...] We just put an AHEC [facilitator] in a car; we can hit two practices in a county within a half-day. One loves us, one can't stand to see us coming. We don't care. We're there. We provide them educational hours; they keep their license [...] When the state legislature, 35 or 36 years ago, saw what AHEC was setting up in infrastructure from this federal funding, they really invested in it, and they decided that if we were going to fix what was then a physician shortage problem, that it was going to be through AHEC. Practice Facilitation Lead, Cooperative 1</p>		
Medium experience level – Some knowledge of how to do large-scale quality improvement; five or fewer years doing this work in a region; little centralized durable infrastructure to support this large-scale quality improvement	Cooperatives 3, 4 and 6	<ul style="list-style-type: none"> Expand relationships with practice support partners; broaden connections to regional resources Broaden facilitator workforce size and build on existing skills Some existing infrastructure for training and toolkits, expand communication, improve ongoing training and quality assurance monitoring
<p><i>Supporting Quote:</i> I'm sure [our state] is not unique this way but there's so many opportunities for practice facilitation now. It's built into so many different things that it was hard for us and we're still struggling. Where does our responsibility end and the responsibility of the [practice facilitation organization] begin? We get a lot of feedback that we haven't done enough to support new practice facilitators as they're onboarding to be able to deliver support for things like EvidenceNOW. [...] [Practice Facilitation Organization] has a curriculum for training practice facilitators that they've had up and running for, I don't know, 5 to 10 years? They've revamped and expanded and played with what works and it's a solid training opportunity. [...] We subcontracted with [them] for practice facilitators who were new. Practice Facilitation Manager, Cooperative 6</p>		
Low experience level – Little knowledge (prior to EvidenceNOW) of how to do large-scale quality improvement; little to no prior experience or funding doing this work in a region, including infrastructure for large-scale quality improvement	Cooperatives 2 and 5	<ul style="list-style-type: none"> Develop connections with practice support partners to build facilitator workforce; develop regional resources Large expansion of facilitator workforce size and developing new skills Need to create most of the infrastructure for training, communication and monitoring, in addition to toolkits and materials
<p><i>Supporting Quote:</i> When this opportunity came up, we thought, "This fits really well with where the state wants to go." [...] We went to our state quality improvement organization, knew that they had experience with practice coaching, knew that they had been the regional extension center, so had particularly been working on EHR issues with practices- Meaningful Use. We're able to broker a deal, truthfully, among faculty of academic medical centers that don't traditionally work together, and that was difficult. [...] We don't have a good history of playing together. [...] We've really been working, and this has been a nice opportunity to try to change. Co-investigator, Cooperative 5</p>		

Abbreviations: AHEC, Area Health Education Centers; EHR, electronic health record.

Table 2. Measures of Effectiveness (Dependent Variables)

Concept/Definition	Measure/How Scored	How and when collected
Ability to deliver Facilitation		
Amount of facilitation delivered	Total number of hours and months of facilitation a Cooperative delivered to each practice	Collected by each Cooperatives' facilitators. Collected from facilitators first contact with practices to their last contact.
Clinical Capacity		
Adaptive Reserve (AR)	14-item measure assessing practice capacity for adapting to change; individual practice members assessed experience of organization's communication, teamwork, mindfulness, leadership, heedful interaction, sensemaking, work environment, learning culture and trust. Scores from (0 to 1).	Collected by survey distributed to clinical practice members by Cooperatives. Collected at baseline and at end of the intervention
Change Process Capacity Questionnaire (CPCQ)	14-items of CPCQ; we selected the measures focused on the extent to which practices used different types of quality improvement strategies for cardiovascular disease prevention. Scores from (−28 to 28).	Collected by survey that was completed by lead clinician or office manager. Collected at baseline and at end of the intervention.
Clinical Quality		
Aspirin Therapy (CMS164v4)	Percentage of patients 18 years of age and older with ischemic vascular disease with documented use of aspirin or another antithrombotic. Scored from (0 to 100%).	Collected by Cooperatives through EHR-generated reports, EHR chart review, and health information exchange reports. Quarterly rolling 12-month performance on each measure at the practice level
Blood Pressure Management (CMS165v4)	Percentage of patients 18 to 85 years of age with a diagnosis of hypertension whose BP was adequately controlled (<140/90 mm Hg). Scored from (0 to 100%).	
Cholesterol Management (CMS347v1)	Percentage of adult patients at high risk for a cardiovascular event who were using or prescribed statin therapy. Scored from (0 to 100%).	
Smoking Cessation (CMS138v4)	Percentage of patients aged 18 years and older who were screened for tobacco use one or more times within 24 months AND who received cessation counseling, if identified as a tobacco user. Scored from (0 to 100%).	

For the ABCS data, we reviewed data, including trajectories of change over time, computing descriptive statistics related to variability and removing practices that exhibited extreme, implausible jumps or otherwise implausible trajectories that could not be addressed by Cooperatives. Practices were also removed that had submissions with non-standard measurement periods. For all other variables and outcomes, data quality checks were performed in an iterative manner, with our team identifying anomalies or irregularities (e.g., excessive missingness, implausible or non-sensical inputs) and Cooperatives addressing those on their end and resubmitting corrected data.

Abbreviations: ABCS, Aspirin, Blood Pressure, Cholesterol, and Smoking; EHR, electronic health record.

baseline and follow-up. We defined baseline as the first round of practice surveys (for AR; CPCQ) or last quarter before intervention began in each practice (for ABCS). We measured changes in AR and CPCQ as the difference between the first (baseline) and second round (immediately after the intervention) survey responses. For the ABCS, we measured change as the difference between baseline and post-intervention, where post-intervention was the quarter immediately after the end of intervention. For facilitation, we reported total hours as well as number of months with some facilitation provided to practices during interventions.

We compared the influence of Cooperatives' level of experience on study outcomes using 3 ordinary least squares (OLS) linear regression models. First, we measured unadjusted mean changes in each outcome by each Cooperative's level of experience (low experience serving as the reference group). Second, we adjusted for practice characteristics in all models. For models where ABCS change was the outcome, we also adjusted for baseline AR because we hypothesized that initial levels of AR might be associated with changes in clinical performance. Third, we reran covariate-adjusted regression models stratified by outcome performance at baseline

Table 3. Qualitative Data Elements and Their Collection

Qualitative Data Collected	What Was Collected	How Were Data Obtained	When Were Data Collected
Artifacts	Documents related to Cooperatives' work (e.g., grant application, training materials)	Obtained from Cooperatives	Throughout initiative
Online Diaries	Platform to share real-time implementation experiences	Online text entries from Cooperative teams prompted by ESCALATES	Throughout initiative
Field Observation	Visits to learn about each Cooperative team, and understand the work they were doing (e.g., startup, recruitment, implementation activities, including observing facilitators work with practices)	Fieldnotes, including observation of 41 facilitators with 54 unique practices	August 2015 – March 2016; July 2016 – April 2017
Semi-structured Interviews	Interviewed Cooperative leadership, members of partner organizations, and facilitators to explore start-up and implementation experiences	39 interviews with Cooperative leadership and partners; 89 unique facilitator interviews; 66 interviews with practice members	Throughout the initiative
Context Assessments	Cooperatives completed assessments to provide information about their local contexts, including team's experience, regional attributes, experiences with recruitment and implementation of external support	Two written assessments; Cooperative teams answered 5 to 6 broad questions	Recruitment and implementation phases

Abbreviations: ESCALATES, Evaluating System Change to Advance Learning and Take Evidence to Scale.

(below and above the median). This set of analyses assessed if Cooperatives were effective at improving clinical and capacity measures among clinics with low performance (below the median) at baseline. We clustered standard errors at the Cooperative level using bootstrapping with 1000 repetitions to account for correlated response at the Cooperative level.³² All quantitative analyses were performed using R version 3.6.0.

Results

Each EvidenceNOW Cooperative recruited between 209 and 315 practices in their region. Table 4 shows that Cooperatives tended to recruit practices with 10 or fewer clinicians, which was the initiative's target. Low experience Cooperatives tended to recruit practices from urban settings, near where the academic health center or their partner organizations were located. High experience Cooperatives recruited a more regionally dispersed (see Appendix Figure 2 for visual examples) and demographically diverse group of practices than low experience Cooperatives.

Delivery of Facilitation

Overall, facilitators delivered an average of 18.1 hour of facilitation over an average of 7.2 months

(see Table 5). Practices from Cooperatives with high levels of experience received significantly more hours (+20.3 hours, $P=.040$) and months (+4.3 months, $P=.001$) of facilitation than practices from Cooperatives with low levels of experience. After adjusting for practice characteristics, differences in facilitation amount by level of Cooperative experience persisted (Table 6). Qualitative data showed that facilitators of high experience Cooperatives were living across their regions and in closer proximity to practices. In addition, these Cooperatives had experience supporting a remote facilitator workforce.

I think the structured system that we have with the communication and the collaboration amongst the [facilitators] is very strong. . .having that structured system and having the library that we have to just go in and access. . .there's a whole list of resources on there that we can use. (Facilitator Interview, Cooperative 1)

The combination of organizational infrastructure (eg, toolkits, resource libraries, peer support) to inform and support facilitator work and less travel time translated into more frequent visits.

In contrast, Cooperatives with low levels of experience lacked regionwide facilitator infrastructure and learned – during the EvidenceNOW

Table 4. Characteristics of the EvidenceNOW Cooperatives' Participating Practices

Experience Level	Low		Medium			High	
Cooperative	2	5	4	6	3	7	1
Number of Practices	226	251	209	211	315	263	245
Practice Characteristics, n (col %)							
Location ¹							
Rural	10 (4.4)	30 (12.0)*	40 (19.1)	46 (21.8)	0 (0.0)	72 (27.4)	37 (15.1)*
Large Town	18 (8.0)	5 (2.0)*	54 (25.8)	16 (7.6)	0 (0.0)	76 (28.9)	33 (13.5)*
Suburban	3 (1.3)	22 (8.8)*	21 (10.0)	13 (6.2)	0 (0.0)	20 (7.6)	28 (11.4)*
Urban Core	195 (86.3)	151 (60.2)*	94 (45.0)	136 (64.5)	315 (98.4)	90 (34.2)	91 (37.1)*
Practice Ownership							
Clinician owned	84 (37.2)	63 (25.1)*	96 (45.9)	72 (34.1)	144 (45.7)*	104 (39.5)	93 (38.0)*
Hospital/Health System	59 (26.1)	118 (47.0)*	81 (38.8)	31 (14.7)	1 (0.3)*	75 (28.5)	30 (12.2)*
Safety Net ²	58 (25.7)	25 (10.0)*	32 (15.3)	90 (42.7)	16 (5.1)*	71 (27.0)	42 (17.1)*
Other ³	1 (0.4)	2 (0.8)*	0 (0.0)	15 (7.1)	1 (0.3)*	8 (3.0)	5 (2.0)*
Practice Size							
Solo	67 (29.6)	13 (5.2)*	19 (9.1)	43 (20.4)	101 (32.1)*	78 (29.7)	36 (14.7)*
2 to 5 clinicians	103 (45.6)	123 (49.0)*	105 (50.2)	124 (58.8)	34 (10.8)*	137 (52.1)	73 (29.8)*
6 to 10 clinicians	34 (15.0)	33 (13.1)*	36 (17.2)	34 (16.1)	13 (4.1)*	29 (11.0)	26 (10.6)*
11 + clinicians	22 (9.7)	28 (11.2)*	49 (23.4)	4 (1.9)	7 (2.2)*	14 (5.3)	35 (14.3)*
Patient Characteristics							
≥50% patients over 40 years old	136 (60.2)	129 (51.4)*	119 (56.9)*	0 (0.0)*	113 (35.9)*	160 (60.8)	174 (71.0)*
≤50% patients classified as white	91 (40.3)	57 (22.7)*	16 (7.7)*	33 (15.6)	87 (27.6)*	54 (20.5)	43 (17.6)*
≤30% Medicaid patients	77 (34.1)	13 (5.2)*	45 (21.5)*	78 (37.0)	51 (16.2)*	72 (27.4)	15 (6.1)*
>10% uninsured patients	59 (26.1)	41 (16.3)*	27 (12.9)*	68 (32.2)	10 (3.2)*	63 (24.0)	43 (17.6)*

Notes: Percentages may not add up to 100% due to missing data. Variables with >15% missing data indicated with an.* ¹Location designation determined using rural-urban commuting area codes. ²Safety net includes Federally Qualified Health Centers, rural health clinics, Indian Health Services clinics, and other federally owned clinics. ³Other ownership includes nonfederal, private/non-clinician, and those indicating "other" without specifying an ownership type.

initiative – that they needed tools and processes to continuously support and monitor facilitators: “Training-wise, yeah, it was really experience in practice. It was not really anything formalized. [We were] thrown in the fire.” (Facilitator Interview, Cooperative 2). Low experience Cooperatives also set overly ambitious and unachievable timelines for practices and facilitators, and they engaged many practices from large health systems to meet recruitment targets. For example, we heard during a site visit with one low experience Cooperative that their recruitment leader asked a large health system to sign-up half of their 100 practices for EvidenceNOW. The other low experience Cooperative also reached targets by recruiting 36% of their practice cohort (n = 76) from two health systems (43 and 33 practices from each system). Health system practices tended to have in-house data analytics and quality improvement teams, and in some cases, leadership volunteered their practices for EvidenceNOW, which affected participation in facilitation.

Change in Practice Capacity and Clinical Quality

Overall, Cooperatives' practices made small improvements in clinical quality measures during the intervention ranging from 1.9% improvement in the blood

pressure metric to a 5.6% improvement in the smoking cessation metric. All capacity measures also improved, AR increased by 0.018 and CPCQ by 6.1 points. For details see Table 5.

Table 5 also shows that practices recruited by Cooperatives with high levels of experience were more likely to have lower average clinical quality metrics at baseline for aspirin (difference: -18.8%, $P=.083$), blood pressure (difference: -2.8%, $P=.04$), cholesterol (difference: -17.3%, $P=.007$) and smoking (difference: -41.5%, $P=.005$) than practices from Cooperatives with low levels of experience. The 2 high experience Cooperatives used EvidenceNOW funding to expand regional health information exchanges. They intentionally recruited practices that were untethered to health systems and, therefore, did not have “in-house” data teams working on abstracting and cleaning ABCS metrics. For example, their practices might lack the capacity to abstract a metric, which was the case with the cholesterol metric (eg, 37 practices produced this metric in Cooperative 7). This difference in focus and recruitment approach likely explains the low baseline ABCS among the practices in the 2 high-experience Cooperatives.

Table 5. Facilitation Outcomes, Cardiovascular Disease Preventive Services Delivery Performance, and Practice Capacity Outcomes at Baseline and Post-Intervention, Overall, and by Level of Cooperatives' Experience

	Overall Mean (SD)	Level of Cooperatives' Experience		
		Low Mean (SD)	Medium Mean (SD)	High Mean (SD)
Hours of Facilitation	18.1 (18.4)	6.2 (5.1)	18.9 (17.0)	26.5 (21.9)
Difference Between Groups		Reference	+12.7	+20.3
Months of Facilitation	7.2 (3.5)	4.0 (2.1)	8.2 (3.2)	8.4 (3.3)
Difference Between Groups		Reference	+4.2	+4.3
Aspirin (%)				
Baseline	63.9 (24.2)	67.5 (23.9)	69.6 (19.2)	48.7 (26.5)
Follow-up	66.6 (22.8)	69.4 (24.1)	71.8 (17.2)	53.5 (25.4)
Difference from baseline to follow-up	+2.7 (8.5)	+1.9 (6.7)	+2.2 (9.3)	+4.8 (8.5)
Blood pressure (%)				
Baseline	64.7 (13.7)	64.8 (15.6)	66.1 (13.2)	62.0 (12.1)
Follow-up	66.5 (13.6)	67.2 (14.6)	67.5 (13.4)	64.1 (12.4)
Difference from baseline to follow-up	+1.8 (6.5)	+2.4 (5.6)	+1.4 (6.8)	+2.1 (6.9)
Cholesterol (%)				
Baseline	61.9 (19.3)	65.7 (19.8)	66.4 (13.0)	48.3 (21.3)
Follow-up	65.8 (17.7)	68.2 (19.3)	68.9 (12.5)	56.8 (19.9)
Difference from baseline to follow-up	+3.9 (7.4)	+2.5 (6.2)	+2.5 (6.2)	+8.5 (8.8)
Smoking (%)				
Baseline	60.0 (32.4)	79.4 (21.2)	61.2 (30.9)	37.9 (30.8)
Follow-up	65.6 (30.8)	82.0 (20.5)	66.6 (29.2)	47.0 (32.3)
Difference from baseline to follow-up	+5.6 (11.3)	+2.6 (6.9)	+5.4 (11.8)	+9.1 (12.9)
Adaptive Reserve (AR) (score)				
Baseline	0.703 (0.118)	0.678 (0.118)	0.710 (0.117)	0.715 (0.117)
Follow-up	0.721 (0.124)	0.705 (0.129)	0.734 (0.115)	0.719 (0.128)
Difference from baseline to follow-up	+0.018 (0.117)	+0.027 (0.122)	+0.024 (0.112)	+0.004 (0.118)
CPCQ (score)				
Baseline	8.8 (12.6)	10.7 (12.1)	7.9 (12.7)	8.3 (12.7)
Follow-up	14.9 (9.3)	15.7 (10.2)	14.0 (8.8)	15.3 (9.1)
Difference from baseline to follow-up	+6.1 (13.8)	+5.0 (14.5)	+6.1 (13.4)	+7.0 (13.7)

Notes: The table shows mean baseline and post-intervention levels, and standard deviations of ABCS, AR, and CPCQ as well as levels of hours and months of facilitation during the intervention for all practices in the sample as well as stratified by Cooperative level of experience. For clinical measures, preliminary data quality assessment revealed large increases or decreases for some practices. To eliminate the influence of such outliers, we excluded practices with outcome change below the 5th percentile or above the 95th percentile from all our analysis. For overall pre-post ABCS, AR, and CPCQ changes, bold denotes statistical significance at the 5% level.

Sources: EvidenceNOW EHR records.

Abbreviations: SD, standard deviation; CPCQ, Change Process Capacity Questionnaire; ABCS, Aspirin, Blood Pressure, Cholesterol, and Smoking; EHR, electronic health record.

Improvements in clinical quality metrics by Cooperatives' level of experience varied (Table 6). Although practices from Cooperatives with high levels of experience showed larger improvements in cholesterol (+5.99%, $P = .0141$), smoking (+6.43%, $P = .0030$), and aspirin (+2.89%, $P > .05$), change in blood pressure was similar between Cooperatives with different experience levels.

With respect to capacity measures, changes in quality improvement capacity were larger for practices from Cooperatives with high levels of experience compared with practices from Cooperatives with low levels (CPCQ difference: 2.04, $P < .001$), but this was not the case for capacity to adapt to change (AR difference: -0.02, $P = .27$).

Adjusting for practice characteristics did not substantially affect change estimates for clinical quality and practice capacity, but these changes were no longer statistically significant except for the smoking metric (Table 6). Further stratification by baseline ABCS performance resulted in muted effects for aspirin, cholesterol, and smoking with significant differences observed only for the smoking metric.

Discussion

Cooperatives that had a sustained track record with large-scale quality improvement before EvidenceNOW, which included leaders with the knowledge, regional partnerships, and infrastructure

Table 6. Changes in Outcomes from Baseline to Follow-up by Level of Cooperative Experience

	Level of Cooperatives' experience		
	Low	Medium	High
	Coef. (p-Value)	Coef. (p-Value)	Coef. (p-Value)
Hours of Facilitation			
Unadjusted: Difference Between Groups	Reference	+12.68 (0.180)	+20.33 (0.039)
Adjusted: Difference Between Groups	Reference	+13.96 (0.205)	+24.12 (0.022)
Months of Facilitation			
Unadjusted: Difference Between Groups	Reference	+4.20 (0.036)	+4.33 (0.002)
Adjusted: Difference Between Groups	Reference	+4.37 (0.029)	+4.86 (<0.001)
Aspirin (%)			
Unadjusted	Reference	+0.33 (0.885)	+2.89 (0.081)
Adjusted: Full Sample	Reference	−0.29 (0.897)	+2.14 (0.179)
Adjusted: Practices <u>below</u> the median at baseline	Reference	+2.59 (0.604)	+2.05 (0.683)
Adjusted: Practices <u>above</u> the median at baseline	Reference	−1.67 (0.054)	−0.16 (0.848)
Blood pressure (%)			
Unadjusted	Reference	−0.99 (0.270)	−0.19 (0.852)
Adjusted: Full Sample	Reference	−0.87 (0.560)	+0.64 (0.582)
Adjusted: Practices <u>below</u> the median at baseline	Reference	−1.02 (0.684)	+0.61 (0.791)
Adjusted: Practices <u>above</u> the median at baseline	Reference	−0.96 (0.155)	+0.02 (0.978)
Cholesterol (%)			
Unadjusted	Reference	−0.02 (0.991)	+5.99 (0.014)
Adjusted: Full Sample	Reference	+0.40 (0.842)	+4.59 (0.142)
Adjusted: Practices <u>below</u> the median at baseline	Reference	+1.85 (0.682)	+3.33 (0.527)
Adjusted: Practices <u>above</u> the median at baseline	Reference	−1.07 (0.570)	+2.78 (0.069)
Smoking (%)			
Unadjusted	Reference	+2.73 (0.277)	+6.43 (0.003)
Adjusted: Full Sample	Reference	+3.33 (0.245)	+7.07 (0.007)
Adjusted: Practices <u>below</u> the median at baseline	Reference	+5.16 (0.462)	+3.97 (0.524)
Adjusted: Practices <u>above</u> the median at baseline	Reference	−0.16 (0.953)	+5.55 (0.019)
Adaptive reserve (score)			
Unadjusted	Reference	+0.00 (0.898)	−0.02 (0.267)
Adjusted: Full Sample	Reference	+0.00 (0.907)	−0.02 (0.260)
Adjusted: Practices <u>below</u> the median at baseline	Reference	+0.021 (0.356)	−0.016 (0.513)
Adjusted: Practices <u>above</u> the median at baseline	Reference	−0.006 (0.812)	−0.017 (0.286)
CPCQ (score)			
Unadjusted	Reference	+1.18 (0.367)	+2.04 (<0.001)
Adjusted: Full Sample	Reference	+1.93 (0.248)	+1.32 (0.346)
Adjusted: Practices <u>below</u> the median at baseline	Reference	−2.23 (0.493)	−2.29 (0.317)
Adjusted: Practices <u>above</u> the median at baseline	Reference	+1.15 (0.589)	+2.92 (0.092)

Notes: The table shows unadjusted and adjusted regression estimates and p-values (in parentheses) of differences in outcome changes between Cooperative groups. Practices from Cooperatives with low experience are the reference group. Adjusted estimates are based on regressions that include practice characteristics (practice location; practice ownership; practice size; practice patient characteristics). Bold denotes statistical significance at the 5% level. All standard errors are clustered at the Cooperative level using bootstrapping.

Sources: EvidenceNOW EHR records and practice survey.

Abbreviations: EHR, electronic health record; CPCQ, Change Process Capacity Questionnaire.

to support this work, recruited a more diverse group of practices to this initiative and delivered significantly more facilitation (hours and months) to their practices than Cooperatives with low experience levels. In addition, the level of improvement observed among the high experience Cooperatives' practices was greater for all clinical outcomes (except for blood pressure), as well as for quality improvement capacity. These results remained significant for facilitation, quality improvement capacity, and smoking cessation improvement after adjusting for differences

in practice characteristics and stratifying for baseline capacity and ABCS levels. What did not change was practices' adaptive capacity, and this is likely because Cooperatives did not focus on improving the organizational aspects of AR (eg, communication, teamwork, mindfulness) with their practices.

Cooperatives with a sustained track record and investment in large-scale quality improvement support, before EvidenceNOW, had a number of important resources that low-experience Cooperatives lacked. This included robust regionwide facilitator

infrastructure (ie, having facilitators located geographically throughout the region) and the knowledge of how to support and deploy a facilitator workforce effectively. Studies show that the ability to support a facilitator workforce is connected to facilitator effectiveness,^{33,34} and when combined with network infrastructure this likely explains the association we see between Cooperative experience level and facilitation amount; facilitators visited practices more when they lived in closer proximity to their practices, and when they had the tools to be helpful. Practices likely wanted more facilitator visits from effective facilitators.

Cooperatives with high experience levels also had leaders with the confidence and ability to reach recruitment targets without recruiting large numbers of practices from single health systems,²³ and this explains why they were comparatively more successful at recruiting a more diverse and dispersed group of smaller, clinician-owned practices that were in need of quality improvement capacity-building and assistance in improving clinical quality metrics, as baseline metrics indicate. Cooperatives with high experience levels recruited precisely the types of practices AHRQ wished to target. In contrast, Cooperatives with low experience levels reached their targets by recruiting large numbers of practices from single hospitals and health systems. This was an important departure from the aim of EvidenceNOW. System-owned practices had data and quality improvement resources in-house. Their clinical teams also had less autonomy and more burn-out than clinician-owned practices.^{35,36} Ownership changed how EvidenceNOW Cooperatives and their facilitators worked with practices,³⁷ and the amount of facilitation and the types of changes practices needed to make to improve clinical outcomes.³⁸ This combination of factors contributes to explaining the association between facilitation amount and Cooperative experience level, and, although not easily mutable, practice ownership must be considered when implementing and evaluating the value of large-scale quality improvement initiatives that involve external support. Our findings suggest that efforts to reach a broad range of practices that may benefit from external support require developing the experience and resources of Cooperative or Cooperative-like organizations.

For clinicians and clinical teams, particularly clinician-owned practices that see a need to improve practice capacity and clinical quality, working with a

facilitator who is supported by an experienced Cooperative can help the practice work through an improvement process.³⁴ The benefit of working with an external facilitator is less clear for hospital- and health-system-owned practices or those practices that have internal quality improvement support. This is a novel finding worthy of further investigation.

For researchers, it is important to note that the characteristics for which we adjusted in our statistical models are the same characteristics that our qualitative data suggest made the high experience Cooperatives more successful. Typically, unadjusted findings are not very informative to final results. But in the context of understanding Cooperative experience-level differences with practices nested within Cooperatives, comparing unadjusted and adjusted findings allows us to observe and identify the complexity of these relationships and the influence of Cooperative experience separately from variations by practice types. Thus, we report unadjusted and adjusted results, but more consideration of the best ways to blend and report mixed methods data from natural experiments is needed.³⁹ For researchers in the field of dissemination and implementation science, high-experience Cooperatives were more effective in some aspects of their work because they started this initiative with a developed network of relationships with regional practices and because they worked collaboratively with the people in these practices—on the ground—to foster change. This effort was observable on a large scale and should be considered in future dissemination and implementation study designs and analyses.

This study's findings must be interpreted in light of some key limitations. First, changes in clinical outcomes are evaluated as prepost changes and do not control for concurrent changes in clinical outcomes in a region. For more on how EvidenceNOW practices changed in relation to an external comparison group see Balasubramanian et al.⁴⁰ This work shows that EvidenceNOW practices, on average, made small improvements in the ABCS among a large, diverse sample of practices with potential for population-level impact on cardiovascular events avoided. Future researchers could use simulation modeling techniques to estimate the population impact of this level of change on cardiovascular events avoided. Second, none of the EvidenceNOW Cooperatives or their partners could produce a list of all the primary care practices in their region. Although not having these data readily available is an important deficiency for

our nation, it meant that we could not assess the regional representativeness of primary care practices that participated in each EvidenceNOW Cooperative. Third, although Cooperatives implemented a range of different external support strategies (eg, audit and feedback, performance benchmarking), facilitation amount was the only strategy that we could harmonize and measure across Cooperatives.^{41,42} Thus, we could not assess the full impact of Cooperatives' external support on practices. In addition, facilitation amount was collected by Cooperatives and shared with our team; thus, some of the differences we observe in facilitation amounts may reflect different recording practices. Fourth, our study design does not fully align with the standards of randomized comparative effectiveness trial designs. However, a randomized trial is not the standard for studying broad-based real-life change. Looking at EvidenceNOW through the lens of a natural experiment allowed us to observe some important naturally occurring patterns and relationships that might be obscured using more traditional trial methods, and we have taken care to not overstate this study's findings. Fifth, low baseline levels⁴³ and changes might partially reflect initial data quality issues that were subsequently addressed by Cooperatives and practices as part of quality improvement.²² We cannot rule out this possibility. However, we eliminated outliers from our analysis of ABCS changes to account for possible data quality concerns.

Conclusion

The recent National Academies of Sciences, Engineering, and Medicine report, *Implementing High-Quality Primary Care: Rebuilding the Foundation of Health Care*,⁴⁴ sets forth a plan for rebuilding the US health care system, with a focus on primary care stakeholders. One of the key objectives is to ensure that high-quality comprehensive primary care is implemented and available to every person in the US. Findings from EvidenceNOW suggest that 1 step toward accomplishing this objective⁴⁵⁻⁴⁷ could be funding regional infrastructure to develop organizations with the experience, resources, and relationships to deliver external support to primary care practices at a large scale, particularly if the efforts are directed to enhancing quality improvement more generally, rather than at a narrow disease-oriented target. This will take a level of sustained investment that cannot be achieved solely through grant funding but must be built into state and federal budgets.

We are grateful to all the EvidenceNOW Cooperatives and their practices who made this work possible. In addition, the entire ESCALATES study team willingly contributed their thoughtful feedback, particularly Kurt C. Stange, MD, PhD, Andrew Bazemore, MD, MPH, Robert L. Phillips Jr. MD, MSPH, and Larry A. Green, MD, three of our study advisors, generously shared creative thoughts and feedback that informed and improved this work. Thank you to Carrie Tillotson, MPH, with Data Drawn Consulting, LLC, who assisted with data visualization.

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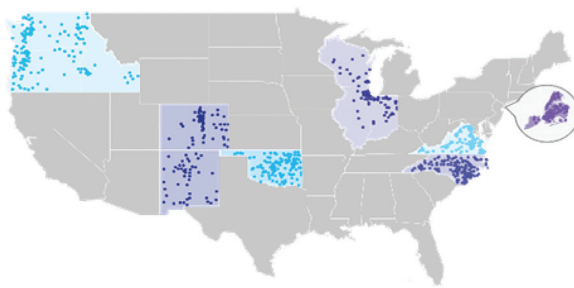
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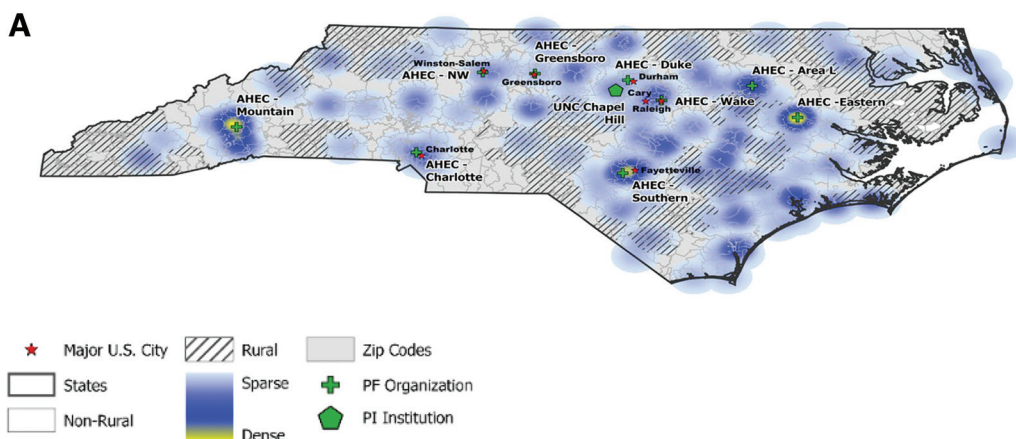
Appendix.

Appendix Figure 1. Map of EvidenceNOW cooperatives.

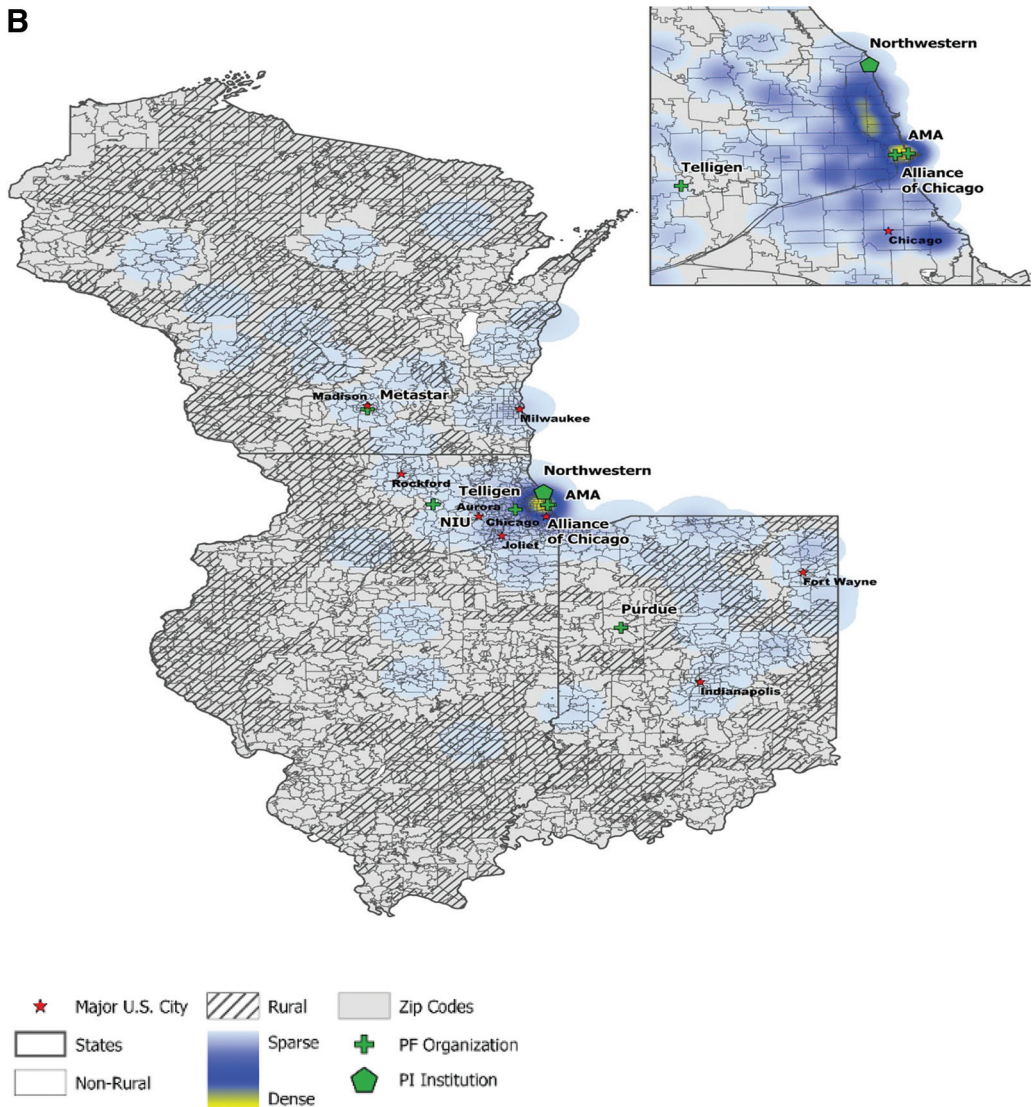


Appendix Figure 2. EvidenceNOW recruitment heat maps comparing two cooperatives, (A) One with high and (B) One with low experience and prior infrastructure investment.

The figures below depict two Cooperative regions with major cities marked with a red star. Light grey areas depict regions classified as non-rural; hatched lines depict regions classified as rural. Cooperative organizational locations are also indicated – the home institution of the Principal Investigator is marked with a green hexagon and the location of each Practice Facilitator Organization is marked with a green cross. These maps also overlay the density of practices recruited by each Cooperative – with regions where fewer practices were engaged indicated in light blue and regions where more practices were engaged indicated in yellow.



Appendix Figure 2. Continued



Appendix Table 1. Description of Practice Level Covariates

Measure	Description
Practice location	We used information given on zip code to classify practice locations as either Rural, Large Town, Suburban, or Urban Core, based on Rural-Urban Commuting Areas (RUCA) using 2010 Census data.
Practice ownership	The survey question was “Which of the following best describes your practice’s ownership? (Check all that apply)” The following categories were possible responses: clinician-owned solo or group practice; hospital/health system owned; Health Maintenance Organization (e.g., Kaiser Permanente); Federally Qualified Health Center or look-alike; non-federal government clinic (e.g., state, county, city, public health clinic, etc.); academic health center / faculty practice; federal (military, Veterans Administration, Department of Defense); Rural Health Clinic; Indian Health Service; other (please specify). Based on a hierarchical logic using these responses, including the other-specify response, and in some cases soliciting additional information from cooperatives, we recoded each practice into one of the following: Clinician-owned, Hospital/Health System, Safety Net (including FQHCs, academic health centers, federal, RHS, and IHS) or Other.
Practice size	The survey asked respondents to choose which of the following best describes their practice’s size: solo practice, 2 to 5 clinicians, 6 to 10 clinicians, 11 to 15 clinicians, or 16 or more clinicians. We recoded the 11 to 15 clinicians and 16 or more clinicians’ categories into one, 11 + clinicians.
≥50% patients over 40 years old	The survey asked for the percent of patients at the practice who fell into the following age categories: 0 to 17, 18 to 39, 40 to 59, 60 to 75, and 76 and over. We grouped percentages for the latter three groups into one 40 + percentage, then recoded this summed value into an indicator variable for whether this percentage was at least 50%.
≤50% white patients	The survey asked for the percent of patients at the practice who were white, and we recoded this percent into an indicator variable for whether this percentage was at least 50%.
>30% Medicaid patients	The survey asked for the percent of patients at the practice receiving Medicaid, including those eligible for both Medicaid and Medicare, and we recoded this percent into an indicator variable for whether this percentage was above 30%, representing a high proportion of Medicaid beneficiaries.
>10% uninsured patients	The survey asked for the percent of patients at the practice who had no insurance, and we recoded this percent into an indicator variable for whether this percentage was above 10%, representing a high proportion of uninsured patients.
Number of hours	Total number of facilitation hours
Number of encounters	Total number of facilitation encounters
Months with encounter	Number of months with a facilitation encounter

Abbreviations: FQHCs, Federally qualified health centers; RHS, Rural health services; IHS, Indian health services.

Appendix Table 2. Adaptive Reserve (AR) Questionnaire

Please rate your level of agreement with the following statements about your practice

Strongly disagree. 1
 Disagree. 2
 Neutral. 3
 Agree. 4
 Strongly agree. 5

AR1	Mistakes have led to positive changes here
AR2	I have many opportunities to grow in my work
AR3	People in our practice actively seek new ways to improve how we do things
AR4	People at all levels in this office openly talk about what is and isn't working
AR5	Leadership strongly supports practice change efforts
AR6	After trying something new, we take time to think about how it worked
AR7	Most of the people who work in our practice seem to enjoy their work
AR8	It is hard to get things to change in our practice
AR9	This practice is a place of joy and hope
AR10	This practice learns from its mistakes
AR11	Practice leadership promotes an environment that is an enjoyable place to work
AR12	People in this practice operate as a real team
AR13	When we experience a problem in the practice, we make a serious effort to figure out what's really going on
AR14	Leadership in this practice creates an environment where things can be accomplished

Question 8 was reverse-coded, then responses were rescaled to range from 0 to 1 and averaged to produce the practice-level AR score, ranging from 0 to 1.

Appendix Table 3. Change Process Capacity Questionnaire (CPCQ)

Indicate the extent to which you agree or disagree that your practice has used the following strategies to improve cardiovascular preventive care

Strongly disagree. 1
 Disagree. 2
 Neutral. 3
 Agree. 4
 Strongly agree. 5

CPCQ1	Providing information and skills-training
CPCQ2	Using opinion leaders, role modeling, or other vehicles to encourage support for changes
CPCQ3	Changing or creating systems in the practice that make it easier to provide high quality care
CPCQ4	Removal or reduction of barriers to better quality of care
CPCQ5	Using teams focused on accomplishing the change process for improved care
CPCQ6	Delegating to non-clinician staff the responsibility to carry out aspects of care that are normally the responsibility of physicians
CPCQ7	Providing to those who are charged with implementing improved care the power to authorize and make the desired changes
CPCQ8	Period measurement of care quality for assessing compliance with any new approach to care
CPCQ9	Reporting measurements of practice performance on cardiovascular disease prevention measures (such as aspirin for patients at risk for ischemic vascular disease) for comparison with their peers
CPCQ10	Setting goals and benchmarking rates of performance quality on cardiovascular disease prevention measures at least yearly
CPCQ11	Customizing the implementation of cardiovascular disease prevention care changes to the practice
CPCQ12	Using rapid cycling, piloting, pre-testing, or other vehicles for reducing the risk of negative results for introducing organization-wide change in care
CPCQ13	Deliberately designing care improvements so as to make clinician participation less work than before
CPCQ14	Deliberately designing care improvements to make the care process more beneficial to the patient

Responses were rescaled to range from -2 to 2 and summed to produce the practice-level CPCQ score, ranging from -28 to 28 .