PREVENTING CHRONIC DISEASE

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About the Journal

Preventing Chronic Disease (PCD) is a peer-reviewed public health journal sponsored by the Centers for Disease Control and Prevention and authored by experts worldwide. PCD was established in 2004 by the National Center for Chronic Disease Prevention and Health Promotion with a mission to promote dialogue among researchers, practitioners, and policy makers worldwide on the integration and application of research findings and practical experience to improve population health.

PCD's vision is to serve as an influential journal in the dissemination of proven and promising public health findings, innovations, and practices with editorial content respected for its integrity and relevance to chronic disease prevention.

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PREVENTING CHRONIC DISEASE
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GUEST EDITORIAL

Health Systems Approaches to Preventing Chronic Disease: New Partners, New Tools, and New Strategies

J. Lloyd Michener, MD[1]; Peter Briss, MD[2]

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The shift from acute to chronic illness as the major source of premature death in the United States and recent developments in health care, such as payments based on results rather than volume alone, are driving fundamental changes in public health and health care. Chronic diseases account for the bulk of morbidity, mortality, and health care costs in the United States. Risk factors for chronic illness are multiple and interrelated; have roots in individuals, families, and communities; and require coordinated strategies across multiple levels and sectors for improvement. These issues are driving substantial change in how health care systems, public health, and other sectors are addressing the chronic disease epidemic. Evolving approaches include coordinating care for people with complex illness; extending the scope of health care systems to new settings; addressing health behaviors and social determinants of health in health care settings and in partnerships with community organizations; using social media to quickly test and disseminate health messages; providing financial incentives and feedback to motivate behavior; and building larger partnerships between public health, health care, and other sectors. Although there are no best practices yet, there are “better practices.”

This *Preventing Chronic Disease* collection highlights some of these evolving practices, drawing from a diverse set of health care systems and public health agencies that submitted articles in response to a call for papers in June 2018. The accepted articles document new approaches for improving systems and addressing upstream causes, intriguing early findings of changes in behavior and outcomes, and changes in workflows that can ease implementation and sustain the improvements.

Health care providers and systems, especially those in primary care, generated multiple examples of systems of care innovations, such as coordinating care for those with HIV infection (1), expanding screening for colorectal cancer through a Medicaid accountable care organization primary care learning collaborative (2), and linking primary care patients with farmers markets (3). A partnership between the American Medical Association and the YMCA, a Center for Medicare and Medicaid Innovation demonstration project, tested increased screening, testing, and referral of Medicare patients with prediabetes seen in primary care practices in 17 US communities to diabetes prevention programs at local YMCAs, supported by a toolkit of workflows and process maps (4). The team was able to achieve a 19% enrollment rate, noting higher referral rates for practices that used a prediabetes registry — an emerging better practice.

Collaborative efforts can be even more powerful when they expand to include the community, as Hearts of Sonoma County demonstrated with its multi-stakeholder campaign to reduce hypertension across its community (5). Similarly, a partnership between the Washington State Department of Health, public and private health care systems, other community organizations, and a supermarket chain launched a fruit and vegetable voucher program. The redemption rate was 54%, and 88% of those surveyed reported an increase in fresh fruit and vegetable consumption (6). People can change their behaviors — but doing so may require that clinicians and public health practitioners first change how we work together and include partners (such as grocery stores, in this case) that traditionally have been seen as outside the scope of influence of either public health or health care.

A substantial challenge in these partnerships is the need for collaborative planning and action, especially given that public health and health care have little history of working together in sustained, coordinated ways. But growing rates of chronic disease, funding challenges within public health, and the shift in health care reimbursement from models based on volume to new models based on value have provided incentives for health care to move upstream.

This has also created an opportunity to establish local coalitions that include public health and health care and other critical groups with a common goal of improving health in their communities. Such coalitions are growing rapidly; one recent assessment (7) found almost 600 partnerships for health under way across the United States, with a range of areas of members, focus and structure, and key roles for public health in convening groups and in sharing results and lessons learned (8).

But partnerships do not just happen, nor does having partners guarantee success. The Hearts of Sonoma County program (5) found that the key elements were starting small, building trust, having a framework, and providing long-term backbone support. The larger Heart Disease and Stroke Prevention Learning Collaborative, a cooperative agreement between the Association of State and Territorial Health Officials and the Centers for Disease Control and Prevention (CDC) (9), used a systems change framework, teams, and expanded self-management options and found them effective, including in rural settings. CDC supported state collaboratives with child care resource and referral networks in 10 states (10), tested methods of supporting adoption of best practices, and found improvements overall, suggesting that it may be the partnerships themselves, in addition to the programs, that make a difference. Over time, linkages can become extensive and strong, as has been the case in Nebraska (11), requiring effective management and continued attention to ensure community priorities remain paramount.

Picking effective methods helps, too. Clinical groups can provide needed services outside clinic walls, as is well demonstrated by the success of mobile mammography units in reaching under- served women (12). Public health (among others) can use social media to test the effectiveness of different messages at low cost, permitting highly tailored health messaging (13). Working togeth- er, public health, health care, and other agencies can use vouchers and feedback to help achieve public health goals, such as redu- cing radon exposure (14).

The evaluation methods reported are striking for the predominance of mixed methods; the use of diverse data sources, including commercial health claims data sets (15,16), electronic health records (4), geotags (16), and new measures such as Facebook click-through rates (13); the use of well-established frameworks such as RE-AIM (Reach, Effectiveness, Adoption, Implementation, Maintenance) (4); and for their high level of sophistication (10). Although it is possible to use simple evaluation methods when assessing the value of single components of a larger program (such as the comparative value of different social media methods [13]), evaluation of large, complex programs requires considerable expertise, planning time, and funding.

These are early reports, and much work remains. Most of the reports address system changes and upstream causes one person at a time, which is welcome progress but far from addressing root causes. Many of these reports focus on disparities and underserved populations, but more work is needed in this area so that we learn how to effectively partner with the wide range of people, cultures, and settings across our states and communities. Despite the near ubiquity of data on health outcomes and risk factors by county and census tract, such as County Health Rankings (17) and 500 Cities (18), few use such data to target their efforts. Rates of use of preventive services remain low, requiring continuing experiments to find what works in what setting (19) as well as what issues (such as cost to participants) must be considered in planning (15). Expanding partnerships to include businesses, elected officials, and other actors can help reframe perspectives on cost and benefit, as stakeholders learn that the health of the communities is of value far beyond costs and outcomes of health care (16).

What does that mean for public health? First, public health cannot reduce chronic disease rates alone, and neither can health care. Each has an essential and complementary role, with public health engaged in establishing and supporting partnerships and health care contributing its resources, including data, and powerful voice in advocacy. Second, voices of the community must be present and heard in all their diversity, especially in communities in which trust in government, health care, and other sectors has been lost. Third, partnerships are hard work and require infrastructure and support (which need not always come from public health funds!). Last is the need for a sense of both humility and excitement as we learn to work together to help free our communities of the burdens of chronic disease. We hope the articles in this special collection mark both some of the early successes and lessons learned in our journey together.

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IMPLEMENTATION EVALUATION

The Open Arms Healthcare Center's Integrated HIV Care Services Model

Sandra C. Melvin, DrPH[1]; June Gipson, PhD[1]

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PEER REVIEWED

Summary

What is already known about this topic?

Mississippi has the seventh highest rate of people newly diagnosed with HIV infection, and the city of Jackson — the capital and largest metropolitan area of Mississippi — has the third highest rate of AIDS diagnoses among all metropolitan areas in the nation.

What is added by this report?

This intervention demonstrates that an integrated model of HIV care involving rapid initiation of treatment combined with wrap-around services results in increased viral load suppression and antiretroviral therapy adherence rates.

What are the implications for public health practice?

A comprehensive, evidence-based approach to HIV care that includes access to social support services can result in improved health outcomes for HIV-positive patients.

Abstract

Introduction

Mississippi has the seventh highest rate of people newly diagnosed with HIV infection, and the city of Jackson — the capital and largest metropolitan area of Mississippi — has the third highest rate of AIDS diagnoses among all metropolitan areas in the nation. Linking patients to care and proper adherence to antiretroviral therapy is important for achieving viral load suppression and reducing transmission of the virus. However, many HIV-infected patients have social and clinical barriers to achieving viral suppression. To overcome these barriers the Open Arms Healthcare Center has implemented an integrated HIV care services model.

Purpose and Objectives

The purpose of this study was to determine whether an integrated model of HIV care influenced linkage to health care, adherence to antiretroviral therapy, and viral load suppression.

Intervention Approach

The integrated HIV care services model consisted of 5 care coordination components: 1) case management, 2) HIV health care (primary health care), 3) behavioral health care (mental and substance abuse screening and treatment), 4) adherence counseling (a pharmacist-led intervention), and 5) social support services (transportation, emergency food assistance, housing, and legal assistance).

Evaluation Methods

We used a cross-sectional research design to examine Open Arms electronic health record data collected from 231 patients from January 2015 through December 2017 to determine if an integrated model of HIV care resulted in increased linkage to health care, higher adherence rates, and improved viral load suppression.

Results

Findings showed a 38.0% increase in the viral load suppression rate, a 12.8% increase in antiretroviral therapy adherence rate, and an 11.0% increase in retention rates among Open Arms patients receiving integrated HIV care.

Implications for Public Health

A comprehensive, holistic approach helps to effectively identify and connect HIV-positive patients to care and relink patients who may have fallen out of care.

Introduction

Data from the Centers for Disease Control and Prevention (CDC) (1) show that HIV diagnoses are not evenly distributed by region in the United States. In 2017, the rate of people who received an HIV diagnosis was highest in the South at 16.1 per 100,000 people, followed by the US 6 dependent areas (American Samoa, Guam, the Northern Mariana Islands, Puerto Rico, the Republic of Palau, and the US Virgin Islands) (12.3/100,000), the Northeast (10.6/100,000), the West (9.4/100,000), and the Midwest (7.4/100,000).

Although the South accounts for only 37% of the US population, 50% of all people living with HIV reside in the South (2). The rate of HIV infection in Mississippi surpasses the rates for 6 of the 50 states. According to the Mississippi State Department of Health (3), black residents make up 37.3% of the state population but account for 72.6% of all Mississippians with HIV (2). Mississippi also has the seventh highest rate of new HIV diagnoses in the nation. Compounding the problem are government policy issues (eg, insufficient program funding), socioeconomic issues (eg, widespread poverty, housing insecurity, lack of access to care), and cultural issues (eg, homophobia, social stigma). Mississippi State Department of Health data (4) show 78% viral suppression among HIV-positive patients, 94% use of antiretroviral therapies, a 65% patient retention rate, and a 17% failure to link into care within the first 6 months of diagnosis.

Purpose and Objectives

In 2011, researchers (5) observed that for people with HIV infection to fully benefit from antiretroviral therapy, they need to know that they are infected, be engaged in regular HIV care, and receive and adhere to effective antiretroviral therapy. These 3 elements are commonly referred to as the HIV treatment cascade. On the basis of this model, the key measures of the success of any HIV care intervention are linkage to care, retention rate, adherence rate, and viral suppression rate. Therefore, the purpose of our integrated HIV care services model intervention was to evaluate whether a modified integrated model of HIV care would improve linkage to care, retention in care, viral load suppression rates, and antiretroviral therapy adherence rates.

Intervention Approach

The Open Arms Healthcare Center (Open Arms) is a nonprofit health care organization established in 2013 to provide innovative, holistic, health care services to underserved, underinsured, and underrepresented populations in Mississippi with emphasis on lesbian, gay, bisexual, transgender, and intersex populations. Open Arms links all patients with a preliminary diagnosis of HIV to care on the same day as the HIV diagnosis. Patients are seen by an infectious disease physician and started on antiretroviral therapy during the first visit. The modified HIV care services — the integrated HIV care services model — was implemented by Open Arms in 2015 to provide a holistic, comprehensive approach to HIV care.

The Open Arms program consists of 5 care coordination components: 1) case management, 2) HIV care (primary health care), 3) behavioral health care (mental and substance abuse screening and treatment), 4) adherence counseling (a pharmacist-led intervention), and 5) social support services (transportation, emergency food assistance, housing, and legal services). These components work together to achieve retention in HIV care, antiretroviral therapy adherence, and viral suppression.

Case management. The clinical case manager assesses the patient's medical and psychosocial needs. The completed assessment is designed to give the manager a comprehensive picture of the patient's complete health care and social support needs. The manager works with patient navigators to coordinate all referrals internal to and external to Open Arms and facilitates all HIV and behavioral health care linkage within 24 hours. Referrals to social support services are made on the same day and are based on the patient's needs.

Rapid linkage to HIV care. Linkage to care is an important first step in successful HIV treatment and is typically defined as the completion of a first medical clinic visit after an HIV diagnosis. It plays a crucial role in the HIV care continuum, because it is a necessary precursor to retention in care, antiretroviral therapy initiation, and viral suppression (6). Therefore, antiretroviral therapy is initiated by the physician at the preliminary diagnosis of HIV infection.

As part of the initial visit, the patient undergoes laboratory testing, which includes a complete blood count, comprehensive metabolic profile, lipid profile, urinalysis, viral load, and genotyping for HIV resistance and testing for CD4, hepatitis (including hepatitis A, B, and C), quantiFERON-TB, G6PD (glucose-6-phosphate dehydrogenase), HLA-B5701 (human leucocyte antigen-B5701), toxoplasmosis, RPR (rapid plasma reagin), and sexually transmitted diseases (syphilis, chlamydia, and gonorrhea). The results are discussed during the initial HIV care visit. Each patient is assigned a case manager who works with the patient to schedule follow-up appointments and identify any potential barriers to care.

Behavioral health care. The M3 Checklist is a nationally recognized, peer-reviewed, and clinically validated tool that compiles and evaluates a patient's potential for mood and anxiety symptoms by using a secure web-based system (7). Each patient completes an initial behavioral assessment by using the M3 checklist. The checklist increases the mental health care provider's ability to detect and diagnose behavioral health concerns. On the basis of the results of the M3 Checklist assessment, the provider contacts the patient to develop a treatment plan.

Adherence counseling. Patients who struggle with adherence are referred to the adherence pharmacist. The pharmacist's main activities are reviewing laboratory results with physicians and patients, making drug recommendations to physicians, counseling patients on medication side effects and drug–drug interactions, checking pricing of drugs at patients' preferred pharmacies before new prescriptions are written to ensure that cost is not a barrier to adherence, contacting patients 2 weeks after filling a new prescription to discuss any side effects they may have experienced, and ensuring that patients pick up their prescriptions and are able to incorporate them into their regimen.

Social support services. The model provides wrap-around services in the form of internal and external referral services (ie, support groups, transportation, and emergency food assistance; housing, employment services, and mental health services).

Evaluation Methods

Our summative evaluation used a quasi-experimental, cross-sectional research design to examine Open Arms electronic health record data collected from January 1, 2015, through December 31, 2017, to determine if an integrated model of HIV care resulted in increased linkage to care, increased treatment adherence rates, increased retention rates, and improved viral load suppression. The data were analyzed from September 2018 through October 2018. The study setting was the Open Arms Healthcare Center located in Jackson, Mississippi.

An initial chart review showed that 287 HIV-positive patients used Open Arms services from January 1, 2015, through December 31, 2017. Of these, 231 patients received HIV care at Open Arms and 56 did not. We assessed demographic characteristics of the 231 (Table).

Outcome measures

We used 4 measures to assess effectiveness of the intervention: linkage to care, retention in care, adherence rate, and viral load suppression rate.

Linkage to care. Linkage to care measures the percentage of people who received a diagnosis of HIV in a given calendar year who had 1 or more documented viral load tests or CD4+ tests within 30 days (1 month) of diagnosis. Among Open Arms patients, linkage to care was measured by determining the percentage of patients who had at least 1 HIV medical care visit in each 6-month period of the 24-month measurement period and a minimum of 60 days between medical visits.

Retention in care. CDC defines retention in care as the percentage of patients diagnosed with HIV who had 2 or more viral load or CD4+ tests, performed at least 3 months apart. As part of the integrated model of care, each patient at Open Arms is scheduled for follow-up appointments every 3 months.

Adherence rate. An adherence to antiretroviral therapy of 95% is required as an appropriate level to achieve maximal viral load suppression (8–10) and lower the rate of opportunistic infections (11). The adherence rate was measured as an increase in adherence to antiretroviral therapy among people in HIV medical care.

Viral load suppression rate. The viral load suppression rate is defined as the percentage of patients on antiretroviral therapy for a minimum of 12 weeks who had 1 health care visit in each 6-month period of the review period and who were considered suppressed as derived from the last recorded viral load of the review period. Viral load suppression is defined as a viral load of less than 200 copies/mm. CD4+ counts were taken for Open Arms patients every 3 months.

Data collection and analysis

SPSS version 20.0 (IBM Corp) was used to analyze demographics, linkage to care, antiretroviral therapy adherence rate, retention rates, and viral load suppression rates. Data were collected and stored in Advanced MD, the Open Arms medical record system, and CAREWare (https://hab.hrsa.gov/program-grants-management/careware), a free, electronic health and social support services information system for Ryan White HIV/AIDS Program grant recipients and their providers. CAREWare contains "customizable modules for tracking demographics, services, medications, laboratory test results, immunization history, diagnoses (updated with ICD-10 [International Classification of Diseases, Tenth Revision (12)] codes), referrals to outside agencies, and an appointment scheduler."

Results

From January 1, 2015, through December 31, 2017, 231 HIV-positive patients were treated at Open Arms. Because Open Arms uses a rapid initiation model of HIV care, linkage to care for patients was 100%. Patients were immediately assigned to a case manager at the initial diagnosis and scheduled for the first medical visit within 72 hours of their diagnosis. Retention in care increased from 42% in 2015 to 53% in 2017, representing an 11.0% increase over the 3-year period. Falling out of care was defined as missing at least 2 scheduled appointments within one year, relocation, referral to another facility, or incarceration (Figure). The antiretroviral adherence rate for Open Arms patients increased from 82.8% in 2015 to 95.6% in 2017, representing a 12.8% increase over the 3-year period. The viral load suppression rate increased from 59% in 2015 to 81% in 2017, representing a 38% increase over the 3-year period since the model was implemented.

Figure. Antiretroviral therapy (ART) adherence rate, viral load suppression rate, and retention rate, Open Arms Healthcare Center integrated HIV care services model, 2015–2017.

Implications for Public Health

Early initiation and linkage to care is necessary to reduce the transmission of HIV and prevent new infections. Without timely entry into care, people with HIV infection miss an opportunity to benefit from HIV treatment at the earliest stage feasible. Linkage to care within 3 months of infection significantly increases the likelihood of achieving viral suppression. Delayed linkage to care is a major barrier to the potential of treatment as a means of prevention to reduce HIV transmission rates in the United States. Therefore, a comprehensive, holistic approach is necessary to effectively identify and connect HIV-positive patients to care and to relink patients who may have fallen out of care. This approach requires consistent follow-up and addressing of social barriers (eg, poverty, transportation, lack of insurance, mental health issues, basic dietary needs) that may impede a patient’s ability to access care consistently. Care and support are important because they facilitate immediate access to treatment when a person is diagnosed with HIV and promote adherence to treatment to attain viral suppression for people living with HIV.

The trend data presented by this study indicate that adherence rates, retention rates, and viral load suppression rates improved when this enhanced model of HIV care was implemented. The data presented in this article are limited in that only information about trends in rates of adherence, retention, and viral load suppression are presented. Future research should evaluate which specific elements of our integrated care model are most associated with viral control and what role provider experience plays in this association. The patient–provider relationship is a very important component of the HIV care continuum. Therefore, understanding the challenges to cultivating and maintaining this relationship is critical for linking and retaining patients in HIV care,

CDC released HIV care guidelines (13) based on the premise that early linkage to care results in improved care as a result of improved antiretroviral therapy adherence. Our intervention demonstrates that rapid initiation of treatment combined with wrap-around services results in increased viral load suppression, increased retention rates, and improved antiretroviral therapy adherence rates. Therefore, a comprehensive, evidence-based approach that includes early linkage to care and wrap-around services is necessary to effectively identify and connect patients to care and to relink patients who may have fallen out of care.

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Table

Table. Demographic Characteristics, Open Arms Healthcare Center Patients With HIV (N = 231), Jackson, Mississippi, January 2015–December 2017

Characteristic	Percentage		
	2015 (n = 141)	2016 (n = 75)	2017 (n = 74)
Sex			
Male	83	91	81
Female	13	9	19
Age, y			
17–24	36	40	17
25–44	48	47	67
45–64	16	14	16
≥65	0	0	0
Race/ethnicity			
Black	93	88	90
White	3	7	5
Hispanic	4	5	5
Sexual orientation			
MSM	76	72	72
Non-MSM	24	28	28

Abbreviations: MSM, men who have sex with men.

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ORIGINAL RESEARCH

Key Collaborative Factors When Medicaid Accountable Care Organizations Work With Primary Care Clinics to Improve Colorectal Cancer Screening: Relationships, Data, and Quality Improvement Infrastructure

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PEER REVIEWED

Summary

What is already known on this topic?

Partnering across organizational boundaries is critical to accountable care organization (ACO) success.

What is added by this report?

We explored how Oregon's Medicaid ACOs are working with primary care clinics to improve the colorectal cancer (CRC) screening performance metric. We identified partnership, performance data, and quality improvement infrastructure as critical dimensions when ACOs and primary care clinics work to implement interventions to improve CRC screening. Unintended consequences included the potential exclusion of smaller clinics and metric focus and fatigue.

What are the implications for public health practice?

Practitioners looking to build cross-sector ACO–clinic partnerships to increase CRC screening or address other performance metrics should consider these 3 key collaborative factors and 2 unintended consequences.

Abstract

Purpose

Accountable Care Organizations (ACOs) are implementing interventions to achieve triple-aim objectives of improved quality and experience of care while maintaining costs. Partnering across organizational boundaries is perceived as critical to ACO success.

Methods

We conducted a comparative case study of 14 Medicaid ACOs in Oregon and their contracted primary care clinics using public performance data, key informant interviews, and consultation field notes. We focused on how ACOs work with clinics to improve colorectal cancer (CRC) screening — one incentivized performance metric.

Results

ACOs implemented a broad spectrum of multi-component interventions designed to increase CRC screening. The most common interventions focused on reducing structural barriers (n = 12 ACOs), delivering provider assessment and feedback (n = 11), and providing patient reminders (n = 7). ACOs developed their processes and infrastructure for working with clinics over time. Facilitators of successful collaboration included a history of and commitment to collaboration (partnership); the ability to provide accurate data to prioritize action and monitor improvement (performance data), and supporting clinics' reflective learning through facilitation, learning collaboratives; and support of ACO as well as clinic-based staffing (quality improvement infrastructure). Two unintended consequences of ACO–clinic partnership emerged: potential exclusion of smaller clinics and metric focus and fatigue.

Conclusion
Our findings identified partnership, performance data, and quality improvement infrastructure as critical dimensions when Medicaid ACOs work with primary care to improve CRC screening. Findings may extend to other metric targets.

Introduction

Federal and state policies in the United States are increasingly moving away from pay for performance and toward reimbursement models that support the triple-aim objectives of improved quality and experience of care for populations while controlling costs (1). The Affordable Care Act, which was passed in March 2010, has many provisions that encourage achievement of the triple aim through expanded access to preventive care services, including encouraging cross-sector collaborations for care delivery through accountable care organizations (ACOs). ACOs are accountable for the quality and total costs of care for a defined population.

ACOs began in Medicare as a way to deliver high-quality, coordinated care; states have also expanded this model to Medicaid (2,3). Increased coordination and accountability in ACOs may lead to wiser spending and improved quality of care by delivering the right care to the right patient at the right time. In such cases, shared savings may be distributed across partner agencies (2). However, early research suggests there is considerable variation in partnership structures, decision making, and reimbursement models for ACOs (4,5). Moreover, the interventions that ACOs pursue and how they implement them may vary drastically and have implications for program effectiveness. Research suggests that ACO success will hinge on the ability of health care organizations to successfully partner across boundaries (6).

One quality indicator across many ACO and payer initiatives is colorectal cancer (CRC) screening (7,8). CRC is the second leading cause of cancer deaths in the United States, causing over 50,000 deaths annually (9). Guideline-concordant screening using endoscopic or fecal testing options can reduce CRC morbidity and mortality rates and is cost-effective (10,11). However, little research explores what interventions ACOs implement to increase CRC screening or how they work with primary care clinics.

Therefore, we sought to understand how ACOs work with primary care clinics to improve CRC screening. We focused on Oregon because of the opportunity to analyze 16 Medicaid ACOs (called coordinated care organizations or “CCOs”) to understand 1) which types of interventions CCOs are using to improve CRC screening rates and 2) how CCOs work with primary care clinics to implement the target interventions. Our study was designed to be hypothesis generating and to suggest promising practices to facilitate effective ACO–clinic partnerships to achieve performance benchmarks for CRC screening.

Methods

In 2011 the Oregon legislature passed House Bill 3650, authorizing the formation of CCOs. By statute, CCOs are governed by a partnership between those taking financial risk, professionals in the local health system (eg, doctors, hospitals), and community members; no CCO directly owns primary care clinics (12). CRC screening has been a CCO quality incentive metric since program inception, with annual reporting initiated in 2013.

We conducted a cross-case comparative study of CCOs in Oregon by using public performance data, transcripts from key informant interviews, and field notes from technical assistance consultations with CCO leadership. Our study was conducted in 2016, four years after CCO formation began. The institutional review board at Oregon Health and Science University approved this study (no. 11454).

Data collection and participant sampling

First, we collected publicly reported data about CCO characteristics and CRC screening performance in early 2016; we added 2016 CRC screening rates when they became available in 2017. Second, 2 members of the study team (M.M.D., R.P.) conducted CRC technical assistance consultation meetings with CCO leadership and quality improvement teams during June and July of 2016. Finally, one member of the study team (M.M.D.) conducted key informant interviews with a purposive sample of stakeholders from CCOs, primary care clinics, and the state from February 2016 through August 2016. Interviews followed a semistructured guide designed to clarify our understanding of how CCOs worked with clinics to address the CRC incentive metric. Interviews lasted approximately 60 minutes (range, 31–118 min) and were audio recorded and professionally transcribed.

Data management and analysis

Interview transcripts were checked for accuracy, and data were deidentified and analyzed using Atlas.ti version 7.0 (Atlas.ti Scientific Software). We found that existing conceptual frameworks and models did not account for the developmental nature of ACO and clinic partnerships over time (13). Therefore, we analyzed our data inductively to allow key themes to emerge naturally from the data.

We collected and analyzed data concurrently until saturation was reached (14). We used an iterative approach informed by Crabtree and Miller’s 5-stage immersion-crystallization analysis process

(15). First, 2 authors (M.M.D., R.P.) reviewed transcripts and coded key segments of text with descriptive names (eg, partnership development, intervention targets) using a group process. Second, we reviewed data from a single CCO to understand how the organization was approaching CRC screening improvement and how they engaged primary care clinics and other stakeholders in this work. In a third cycle, 3 authors (M.M.D., R.P., R.G.) conducted a cross-case comparative analysis to identify patterns in CCO–clinic partnerships and associated performance on the CRC screening metric. We refined emerging themes with the larger study team and shared preliminary findings with OHA staff as a form of member checking (16). Use of reflexivity, multiple reviewers, data saturation, and an audit trail are associated with rigor in qualitative research methods (14,17).

Results

In 2015 the 16 CCOs ranged in size from 11,347 to 228,263 Medicaid enrollees and had an average CRC screening rate of 46.4% (Table 1). Qualitative data were gathered from 14 CCOs (88% response rate). Thirty-eight informants representing 10 CCOs participated in technical assistance consultations; 26 stakeholders representing 12 CCOs participated in key informant interviews. Interview participants represented CCO leadership (n = 16), primary care clinics (n = 6), and the state (n = 4).

Participating CCOs were actively implementing multiple intervention strategies, including those to increase community demand, increase community access, and increase provider delivery of CRC (Table 2). The most common intervention strategies were reducing structural barriers (85.7%, n = 12), delivering provider assessment and feedback (78.6%, n = 11), and offering patient reminders (50.0%, n = 7). All 14 CCOs implemented intervention strategies with sufficient evidence of effectiveness according to the Community Guide (www.thecommunityguide.org); more than half (n = 8) were also implementing interventions with insufficient evidence.

CCOs addressed 3 key areas when working with primary care clinics to improve CRC screening: 1) establishing relationships and building partnerships, 2) producing and sharing performance data, and 3) developing a process and infrastructure to support quality improvement (Figure). Illustrative quotes detailing these themes are in Table 3.

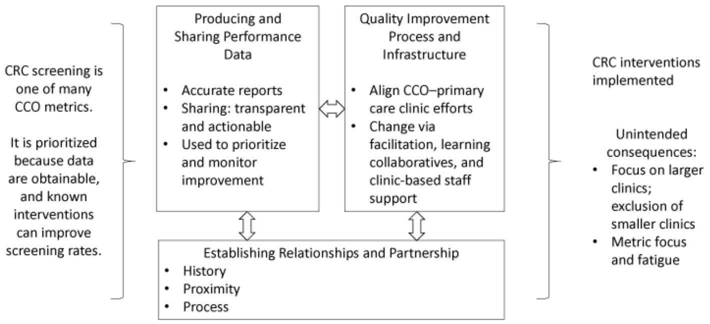

Figure. Three key collaborative factors when Medicaid accountable care organizations work with primary care clinics to achieve performance metrics for CRC screening. Abbreviations: CRC, colorectal cancer; CCO, coordinated care organization.

Establishing relationships and building partnerships

Relationships played an important role in shaping how CCOs interacted with primary care clinics in their service region and in their ability to make improvements. Relationship quality could facilitate as well as impede the selection and implementation of interventions to increase CRC screening.

Prior history between CCO leadership and primary care stakeholders, physical proximity of the CCO’s infrastructure, and joint leadership roles in the CCO and regional clinics shaped the tenor of these relationships. One stakeholder noted, “We really just try to build the bond and leverage our existing relationships. We had an advantage to be able to walk into the clinics and have a pretty long history of trust” (Participant 18). In contrast, CCOs that built on less-developed partnerships, strained relationships, or those that lacked a physical presence in the community faced challenges in raising local awareness and building trust.

CCOs developed or built on their relationships and partnerships with primary care clinics over time in 4 key ways. First, they had primary care providers and clinic leadership serve on the CCO board or on various subcommittees. Second, they hired local staff to provide ongoing support and to facilitate change in the primary care clinics. Third, CCO staff spent time listening, building trust, and aligning CCO initiatives with health system–level and clinic-level priorities and needs. Finally, CCOs created or expanded permanent physical space to house their staff in the local communities served.

Producing and sharing performance data

Performance data provided a starting point to prioritize and direct improvement activities for the CCOs and their contracted primary care clinics. CCOs used CRC screening data to inform targeted clinic outreach; motivate improvement at the clinic, provider, and team levels; and monitor progress toward performance goals. A first step was to obtain and share accurate performance data with clinics. One CCO medical director commented, "I think everyone assumes they're doing a good job, until we can present them with credible evidence otherwise" (Participant 14). Some CCOs withheld incentive metric resources in early years to "put a system together to provide data to our partners so that they could do that improvement work on accurate, reliable data" (Participant 25).

CCO leadership anticipated that routinely sharing performance data and gap lists for CRC screening would enable clinics to "scrub their schedules as people are coming in or be reaching out to patients [using a population management approach]" (Participant 16). Over time, CCOs learned to be more strategic in how they distributed the gap lists for CRC screening — in terms of who at the clinic received them and how the data were presented and/or accessed — and they created processes to increase data accuracy by enabling clinics to amend CCO claims data with historical screening recorders. Low-quality, inaccurate data were poorly received by clinic partners. One clinic member said, "We would get reams of paper, and about the fourth or fifth page in when three-quarters [of the patients] . . . weren't assigned to us we saw them as un-useful and put them aside" (Participant 8).

CCOs that had good standing relationships with clinics and the ability to generate metric data could also promote friendly, productive competition with transparent reporting of metric performance data, as illustrated in the following quote:

> [Routine sharing of identified performance data] has generated competition, transparency, and a spirit of collaboration. Clinics can look at each other and say, "Boy, you're doing great. Tell me what your secret is and let's figure this out together, and will you help us? What did you do to get from here to here?" (Participant 12)

However, clinics varied in their ability to respond to performance data. Some clinics distributed performance data to panel managers who would then reach out to patients. Without dedicated staff to process or act on the CCO reports, the data languished at a clinic.

Developing a process and infrastructure to support quality improvement

Relationships and data allowed CCOs to partner with clinics and health system leadership to focus on quality improvement initiatives at the clinic level. CCO-funded regionally based improvement staff focused on building relationships and supporting clinics as they worked to achieve the incentive metrics, including CRC screening. One CCO improvement facilitator described how the metrics were straightforward to understand, but the approach to achieve these metrics at each clinic required targeted support. Facilitators described asking, "What does it take for this clinic to implement this?" (Participant 4), then building a tailored improvement approach that attended to clinic needs (eg, addressing leadership, understanding and using data, improving team functioning). Improvement facilitators often began by educating providers on the quality metrics then helping clinics refine clinical workflows or implement strategies to improve service delivery frequency.

Some CCOs also led regional learning collaboratives and funded clinic-based quality improvement staff. Learning collaboratives allowed quality improvement leads and staff from regional clinics to gather and share best practices, troubleshoot workflows, and plan their own initiatives. Clinic-based quality improvement staff helped lead clinic change or were panel managers who performed key tasks to support improvement efforts for CRC screening and other incentive metrics.

Promising practices

Despite heterogeneity in interventions implemented across CCOs, certain patterns stood out as promising in relation to CCO–clinic partnerships to improve CRC screening. Stakeholders noted how certain CCOs leveraged their relationships with partner clinics or funded staff to help implement changes in care delivery needed to achieve CRC screening metric benchmarks. The ability to provide accurate data to prioritize action and improvement monitoring was also critical. However, clinics also needed a process for acting on this information. Although some clinics had robust quality improvement infrastructure, others needed resources and training to be able to review data, select interventions, and implement changes. In contrast, some CCOs with lower levels of clinic engagement and data reporting or sharing capacity implemented CRC initiatives that circumvented clinics (eg, offering fecal tests for CRC screening directly to Medicaid enrollees). Although CCO-led interventions could increase CRC screening rates, informants indicated that this approach contributed to over-screening by duplicating clinic-level workflows, raised concerns about legal ramifications in relation to patient follow-up on abnormal results, and reduced the willingness of clinics and health systems to collaborate.

Unintended consequences

Collaboration between CCOs and clinics suggested 2 emerging and unintended consequences: 1) prioritizing larger clinics and excluding smaller clinics and 2) metric focus and fatigue. The ability to generate high-quality data and the need to build relationships and quality improvement infrastructure led many CCOs to focus their attention and resources on larger clinics. Stakeholders expressed concern that some of the smaller clinics — which may have more limited quality improvement capacity to begin with and are often found in rural areas where screening disparities exist — were not given data reports from the CCO or support with improvement. One stakeholder commented, "Sadly, I think if you look at the large clinics that are doing well . . . we consider[ed] that a win and we move[d] on. I would hate for someone to not be screened [for CRC] just because of the clinic they chose" (participant 22).

A second unintended consequence was a focus on the CCO metrics to the exclusion of other factors associated with quality of care and feelings of metric fatigue. Stakeholders commented on the number of metrics that clinics are responsible for, the burden of capturing and reporting data, and the pressure for continual improvement. "People are just exhausted. They come to the end of a metric year and . . . it's like fighting with every ounce of energy you have to make sure that you've got enough people under your belt to hit a particular metric" (participant 12).

Discussion

Our study explored how Medicaid ACOs (CCOs in Oregon) work with primary care clinics to improve CRC screening. CCOs addressed 3 key collaborative factors: establishing relationships and building partnerships, producing and sharing performance data, and developing quality improvement processes and infrastructure. All CCOs were implementing multi-component interventions, some with sufficient evidence and others with insufficient evidence of effectiveness. Access to and knowledge of the performance metrics and an expectation that clinics would take action to increase CRC screening improvement was necessary but not sufficient. Robust relationships, high-quality actionable data, and helping clinics fund and figure out how to make improvements are promising practices associated with enhanced CCO–clinic collaboration to increase CRC screening.

Two unintended consequences emerged in our exploration of CCO–clinic partnerships that warrant additional attention. First, neglect or exclusion of smaller clinics may increase CRC screening disparities, and smaller clinics may experience more barriers to implementing change (18–20). Including smaller clinics is critical in supporting improved care, given that 78% of patients in the United States still receive care in clinics with 10 or fewer physicians (21). Second, metric focus and fatigue suggests the need to attend proactively to provider and staff burnout, to support team-based care models, and to stay cognizant of what "gets missed" as ACOs and CCOs focus on quality metrics at the potential expense of quality (22).

Our study contributes to a growing body of literature on effective practices for ACOs and to the broader literature on cross-sector partnerships and multi-level interventions using CRC as a case study. Findings encourage use of participatory approaches that attend to local context and needs (23,24) and support improvement as a dynamic process within a complex system using a "best processes" orientation (25).

Two areas warrant additional consideration. First, our findings highlight the opportunities and challenges of building cross-sector partnerships to implement interventions that increase CRC screening. Stakeholders described the importance of building trusting relationships and basic infrastructure as part of efforts to implement evidence-based interventions in routine care. Although ACOs may want to focus on specific interventions first, building basic improvement capacity can lay the foundation for successful implementation later. Second, although selecting an evidence-based intervention is a key component of improvement practice, determining how to support implementation is a critical determinant of intervention success. Facilitation — or providing support to aid implementation — is increasingly recognized as a critical factor of implementation success (26,27). Facilitators may engage key partners to implement needed change, to create a safe space for data sharing and reflection on improvement targets, and to optimize intervention delivery and understanding over time (28,29). Finally, our study findings suggest that in certain cases ACOs may also need to provide internal staffing support to enable clinics to implement interventions to achieve performance benchmarks. Even if well-intentioned, providing technical support without considering how to resource or to reward clinics and staff for making change may be poorly received and lack anticipated impact (30).

Our study has limitations. First, our data were cross-sectional. Although stakeholders described how CCOs were evolving their strategies over time, we were not able to evaluate these changes in detail or to definitively identify successful and unsuccessful intervention or implementation strategies. Future studies would benefit from assessing changes in CCO approaches over time, and their association with performance metrics. Also, we focused on how CCOs worked with primary care clinics on one metric, CRC screening. It is possible that different metrics may require other strategies to address. Regardless, our findings are likely generalizable to other preventive screenings.

Partnerships are perceived as critical to ACO success. We found that Oregon Medicaid ACOs engaged with primary care clinics to improve CRC screening by implementing multi-component interventions (eg, reducing structural barriers, delivering provider assessment and feedback, providing patient reminders). Facilitators of successful collaboration included a history of and a commitment to collaboration, the ability to provide accurate data to prioritize action and monitor improvement, and supporting clinics' reflective learning through facilitation, learning collaboratives, and support of clinic-based staff. Perceived exclusion of smaller clinics and metric focus and fatigue emerged as unintended consequences of these improvement efforts and warrant additional attention. ACO–clinic partnerships must go beyond simply sharing what is needed for improvement to helping clinics figure out how to make improvements, which may include resourcing external and internal infrastructure. Our findings can inform ACOs how to effectively partner with primary care clinics to improve CRC screening and may extend to other performance metrics.

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Tables

Table 1. Characteristics of Oregon's Medicaid Accountable Care Organizations,[a] Public Data 2015

Organization Name	Structure	Nonprofit Status	Number of Enrollees	Enrollee composition			
				% White	% Hispanic	% African American	% With a Disability
AllCare Health Plan	Corporation	No	48,790	71.7	10.5	0.9	6.5
Cascade Health Alliance	LLC	No	16,439	65.7	15.2	1.4	8.0
Columbia Pacific	LLC	Yes	24,975	72.7	9.6	0.7	6.3
Eastern Oregon	LLC	No	47,651	58.7	24.2	0.8	6.3
FamilyCare	Corporation	Yes	123,084	51.1	15.9	5.7	2.8
Health Share of Oregon	Corporation	Yes	228,263	49.9	18.0	7.8	8.5
Intercommunity Health Network	Corporation	Yes	54,679	69.4	10.7	0.8	7.8
Jackson Care Connect	LLC	Yes	29,157	64.5	15.8	0.9	6.1
PacificSource–Central Oregon	Corporation	Yes	51,973	70.6	12.2	0.6	5.5
PacificSource–Gorge	Corporation	Yes	12,833	52.3	33.3	0.6	4.8
PrimaryHealth of Josephine County	LLC	Yes	11,347	73.9	7.9	0.6	6.7
Trillium[b]	Corporation	No	90,564	70.1	9.8	1.8	8.3
Umpqua Health Alliance[b]	LLC	No	26,203	79.4	6.2	0.5	8.6
Western Oregon Advanced Health	LLC	No	20,048	77.3	7.4	0.6	9.9
Willamette Valley Community Health	LLC	No	98,112	51.5	28.5	1.4	6.6
Yamhill Community Care	Corporation	Yes	22,466	62.4	20.7	0.7	4.0

Abbreviation: LLC, limited liability corporation.

[a] Also known as coordinated care organizations (CCOs).

[b] Not included in subsequent analyses due to lack of qualitative data. Of the 16 CCOs, 14 participated in either the CCO technical assistance consultation or key informant interviews or both.

Table 2. Interventions Being Implemented by Oregon CCOs, Reported in 2016 (N = 14)[a]

	Increase Community Demand					Increase Community Access[d]	Increase Provider Delivery			CRC Screening Rate		
CCO ID[b]	Patient Reminders[c]	Patient Incentives	Small Media[c]	Mass Media	One-on-One Education[c]	Reducing Structural Barriers[c]	Provider Assessment and Feedback[c]	Provider Reminder and Recall[c]	Provider Incentives	2014	2015	2016
A	X		X			X	X	X		53.3	51.7	52.8
B	X					X				47.4	48.8	52.6
C		X				X	X			47.0	47.8	48.5
E							X	X		46.7	47.3	51.1
F						X	X		X	48.4	49.9	55.0
G						X	X		X	46.7	49.4	49.9
H		X	X			X	X			54.0	43.8	51.8
I	X		X		X	X	X		X	35.3	36.0	40.9
J	X	X			X		X	X	X	29.7	38.7	43.1
K	X				X	X	X	X		31.6	46.6	47.9
M						X	X	X		53.5	49.0	50.6
N				X		X				51.8	49.1	54.5
O	X		X			X		X		52.1	47.7	47.4
P	X		X	X		X	X			40.5	44.3	53.5

Abbreviations: CCO, coordinated care organization; CRC, colorectal cancer; ID, identification.

[a] The interventions identified are provided by and defined from the Community Guide (www.communityguide.org).

[b] Qualitative data was not available for CCOs D or L.

[c] Intervention with sufficient evidence of effectiveness.

[d] Reducing patient out-of-pocket costs (an intervention with insufficient evidence of effectiveness) does not appear in the table because it did not emerge as an intervention being implemented by any CCO.

Table 3. Illustrative Quotes for Key Themes and Unintended Consequences

Theme	Illustrative Quotes
Key factors in CCO–clinic collaborations	
Establishing relationships and building partnerships	[CCO Name] is cited as a real pioneer in this work. ...... They have had such incredible community investment from the very beginning. It's not like they have to talk their partners into doing something or engaging in work around the metrics . . . because the partners were there from the beginning and were part of the founding governing board. (P12) We were really close with some clinics, and they trusted us. And some clinics, we didn’t have as close a relationship. So we had to figure that out in the strategy. [Now our relationships are] pretty close ....partially because there’s a lot of need and they realize that we want to help. We don’t have some crazy ulterior motive. Our motive is the same as theirs. We want access for patients and quality care. (P7)
Producing and sharing performance data	We’ve gotten more sophisticated about [our process of sharing performance data]. .... We identified somebody at the clinic that’s our contact. It may be administration or care management, it’s not necessarily going to be the primary care provider anymore. (P10) This CCO puts [performance data] in front of all of the providers on a regular basis. This is how you’re doing, this is how the clinic next to you is doing, this is how the clinic down the street is doing. I would have thought that would have been very risky, but ...... [it] has generated competition and it's generated transparency and it’s generated a spirit of collaboration because clinics can look at each other and say, “Boy, you’re doing great. Tell me what your secret is and let’s figure this out together, and will you help us? What did you do to get from here to here?” (P12)
Developing a process and infrastructure to support quality improvement	[We consider] each clinic and say, “For this clinic, what is it for them?” They’ve already got strong leadership, so maybe for them it’s that their data system makes it really difficult for them to track this metric. ....We try to personalize our knowledge of each clinic to ensure that when we take something that seems straightforward, like they just need to improve the numerator hits for this process and it seems straightforward because you should just send out kits and they should get sent back but there’s always more beneath the surface. And typically what’s underneath it is some kind of system support that is not in place. (P4) Our first step is usually to educate the providers and their staff on what the quality measures are, how they are tracked, what kind of data are OHA looking for and what documentation do they need and the clinical record to back up that information . . . and then looking at what kind of clinical workflows or other strategies we can suggest to them or help them with that would improve the actual frequency in which services are occurring. (P16) It’s those kinds of hard stories that the clinics aren’t afraid to share [at the learning collaboratives] once we’ve developed trust ......where they feel comfortable sharing their failures with each other, so you’re not [going] down the street reinventing the same crooked wheel. (P3)
Unintended consequences	
Engaging larger clinics, exclusion of smaller clinics	I feel for [these small clinics], because I think they're at a disadvantage in that larger clinics have built-in infrastructure of IT people, of performance improvement people, 3-tier leadership. ...... In some clinics, the office manager is the billing manager, is the front desk manager, is everything. I worry about those clinics and I wonder how they are doing. I don’t know if that falls on the CCO to provide that sort of infrastructure. Maybe it does. I just worry that they're being overlooked. (P22) We have really good reporting. ......We have gap lists that we can produce by clinic, by provider, by measure. We know who’s got the most members for that measure, who’s contributing the most to the numerator and to the denominator so that we know where to target. Usually you would just go, “Oh, let’s let everybody know that we don’t, or everybody has to have them.” Well, now we go, “Okay, if we approach this one clinic, we can get everything we need to make the measure.” .... We’re just being very strategic about that. (P10)
Metric focus and fatigue	For good or for bad, I think the metrics are really driving a lot of the effort now, and if there’s any bandwidth leftover after you’ve hit the metrics, then they focus on those things that don’t necessarily impact the check at the end of the year. . . . Somebody said just a couple of weeks ago, “I thought this would get easier. I thought it would calm down. I thought it would become more routine functioning, and it isn’t.” It is intense work, and it has been from the beginning. (P12) That’s probably the biggest thing that hit the clinics with new metrics, which is one more thing. “We just are barely getting this other thing working, and now you want us to do one more, you want us to do 2 more, and 3 more things,” and that’s the hard part. (P15) There's just too many [metrics], and the administrative burden of capturing the data for many of them .... is too much. So it deters from true quality, and it deters from CCOs being able to focus on things that aren't quality metrics that could improve quality even more because quality isn’t just about quality metrics. (P7)

Abbreviations: CCO, coordinated care organization; IT, information technology; OHA, Oregon Health Authority; P, participant.

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ORIGINAL RESEARCH

Dietary Impact of Produce Prescriptions for Patients With Hypertension

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PEER REVIEWED

Abstract

Introduction

Little is known regarding the impact of produce prescriptions within the context of hypertension visits at safety net clinics. We evaluated intervention effectiveness on patient usage of farmers markets and dietary change related to fruit and vegetable consumption.

Methods

Health Improvement Partnership — Cuyahoga worked with 3 clinics to integrate, implement, and evaluated a produce prescription for hypertension (PRxHTN) program. PRxHTN involves 3 monthly, nonphysician provider visits, comprising blood pressure measurement, nutrition counseling, and four $10 farmers market produce vouchers, for hypertensive adult patients screening positive for food insecurity. Dietary measures were collected at visits 1 and 3. Voucher use was tracked via farmers market redemption logs.

Results

Of the 224 participants from 3 clinics, most were middle-aged (mean age, 62 y), female (72%), and African American (97%) and had a high school education or less (62%). Eighty-six percent visited a farmers market to use their produce vouchers, with one-third reporting it was their first farmers market visit ever. Median number of farmers market visits was 2 (range: 0–6), and median number of vouchers redeemed was 8 (range: 0–12). Among the subsample with follow-up survey data (n = 137), significant improvement in fruit and vegetable consumption was observed as well as a decline in fast food consumption.

Conclusion

PRxHTN participants visited at least 1 farmers market, reported increases in provider communication related to diet, and exhibited significant changes in dietary behavior. PRxHTN can serve as a strong model for linking safety net clinics with farmers markets to promote community resource use and improve fruit and vegetable consumption among food-insecure patients with hypertension.

Introduction

Eating a diet rich in fruit and vegetables lowers risk of mortality from cardiovascular diseases (1). In 2015, 12% of adults in the United States met recommendations for eating fruit and 9% of adults met recommendations for eating vegetables (2). These trends are much worse among those of lower socioeconomic status (2).

Farmers markets are a strategy to improve fruit and vegetable consumption (3), and exposure to farmers markets increases fruit and vegetable consumption among low-income populations (4). However, purchasing more costly produce instead of inexpensive processed foods remains a challenge for those at economic disadvantage. By one estimate, low-income households would have to allocate 43% to 70% of their budget to meet dietary guidelines for fruit and vegetable intake compared with 15% to 18% of the budget of average households (5). Despite reliance on the Supplemental Nutrition Assistance Program (SNAP) and other food assistance programs, access to fresh, nutrient-rich foods remains a challenge for low-income households (6,7).

Produce prescription partnerships that engage public health, health care clinics, and farmers markets are one approach gaining momentum to improve fruit and vegetable intake (8–13). A “prescription” refers patients to community resources providing fruit and vegetable access. These community-linked, health care provider–assisted models serve as powerful tools for motivating behavior change (14) and increasing fruit and vegetable consumption among low-income persons (10,12).

Among underserved populations with chronic conditions exacerbated by poor diet, little evidence exists on the impact of these interventions. Although decreases in glycated hemoglobin A_{1c} were observed among people with diabetes, participants' weight and blood pressure remained unchanged, and redemption and dietary behaviors were not examined (12). Others have demonstrated reduction in body mass index among low-income urban patients with chronic disease in a case–control design; however, it is unclear what effect the program had on intermediate outcomes such as fruit and vegetable consumption (13). We sought to evaluate the effect of a brief clinical produce prescription intervention for food-insecure patients with hypertension on program participation, nutrition counseling, fruit and vegetable voucher redemption, and dietary behavior change.

Methods

Study design and implementation

We conducted a comprehensive evaluation of a produce prescription program for patients with hypertension (PRxHTN). PRxHTN represents a clinical–community linkage intervention aiming to increase fruit and vegetable consumption among safety net clinic patients with hypertension who are at risk for food insecurity by providing incentives to use local farmers markets via produce prescription vouchers.

PRxHTN was implemented by partners of a countywide health collaborative, Health Improvement Partnership — Cuyahoga (HIP-Cuyahoga; hipcuyahoga.org), in response to a Centers for Disease Control and Prevention (CDC) grant that used mechan- isms to manage hypertension at both an individual and a clinic population level. Details on the partnerships, planning process, and overall framework for program implementation at clinical sites are reported elsewhere (11). The MetroHealth Medical Sys- tem Institutional Review Board approved the study.

Sites, population, and intervention

Three safety net clinics from 3 separate health systems were recruited to offer PRxHTN in spring 2015. Sites were selected based on their location and their focus on delivering primary care to underserved populations. Seven nonphysician health care providers from the clinics (2 to 3 per site) were trained in program delivery. Twenty farmers markets agreed to participate in PRxHTN by accepting vouchers and logging redemptions. Details on trainings for providers and farmers market managers are provided elsewhere (11).

PRxHTN was modeled after a program serving low-income pregnant women with young children (PRxMoms) (10). PRxMoms engaged prenatal programs in providing nutrition education, resources, and up to 4 months of farmers market produce vouchers to low-income pregnant women. The program was informed by the theory of implementation intentions and repeated behaviors, which stresses the importance of developing plans that address the when, where, and how of achieving a decided goal (15). In response to our CDC funding opportunity, key components of PRxMoms were translated into a chronic disease care model and adapted for an underserved adult population with diagnosed hypertension.

By using a brief screening tool, providers identified patients based on age (adults 18 or older), hypertension diagnosis, and screening positive on a validated 2-item screener for food insecurity (16), yielding a convenience sample drawn from patients scheduled for appointments during the recruitment period. PRxHTN was offered to align with an evidence-based best practice for hypertension management implemented at the clinics (17). Each PRxHTN visit (3 total; 1 per month) involved a blood pressure measurement, targeted nutrition counselling, and providing four $10 vouchers to purchase fresh produce only at farmers markets. To support participants' shopping habits, they had the flexibility of redeeming vouchers all at once or over time at any participating farmers market. Participants set goals around increasing fruit and vegetable consumption and identified motivations for changing behavior at each visit. Providers reviewed the following educational materials with the participants: 1) location card for 20 farmers markets accepting PRxHTN vouchers; 2) Community Food Guide, providing guidance on low-cost healthy meal plans, fresh food storage tips, and seasonal Ohio fruit and vegetables (18); and 3) adapted handouts on Dietary Approaches to Stop Hypertension, the DASH diet (19). Recruitment occurred from June through September 2015 and the program was conducted between July and December 2015 to align with the farmers market season; goal enrollment was 75 patients per site based on available resources for farmers market vouchers.

Data collection

Data were collected from 2 sources: patients and farmers markets. Patients completed an intake survey during visit 1 and a postprogram survey at visit 3. During each visit, participants received a produce prescription, which documented each patient's reasons for the prescription and their dietary behavior goals. All data collection instruments were coded with a unique identification number, which was recorded in the electronic health record. This identification number was used on the PRxHTN vouchers so that data could be linked for analysis. Vouchers received by farmers markets were considered redeemed, and the number of redeemed vouchers was recorded for each participant.

Measures

At intake, participants were asked to report sex, age in years, racial/ethnic identity, highest level of education, number of adults and children in the home, number of years since hypertension diagnosis, and whether they were currently receiving SNAP benefits.

At postprogram (visit 3), participants assessed impact of the program, including increased visits to farmers markets, trying a new farmers market, greater importance of fruit and vegetable consumption, intention to shop at farmers markets in the future, and trying new fruit and vegetables.

When completing the prescription voucher with the provider, participants' goals and reasons to use the prescription included the following: increase fruit and vegetable servings; shop more frequently for fruit and vegetables; visit farmers markets more frequently; add fruit and vegetables to meals and snacks; try new fruit and vegetables; improve hypertension; lead a healthier lifestyle; have a healthy family; find a new place (farmers market) to buy fruit and vegetables; and reduce risk of chronic disease. Participants could choose more than 1 reason or goal; responses were coded as selected (1) or not selected (0).

At intake, participants were asked about perceived barriers to eating fruit and vegetables, general perceptions of farmers markets, and their current food shopping habits. Barriers were coded as yes/present or no. Farmers market perceptions were coded on a 5-point Likert scale (strongly agree to strongly disagree) and included items such as "Quality of fruit and vegetables at farmers markets is as good or better than the grocery store." Responses were recoded to reflect agreement (agree or strongly agree) for each item. For shopping behaviors, participants were asked (yes/no) if they had ever shopped at a farmers market, the types of food stores they had shopped at in the last month, and if they use an electronic benefits transfer card or food stamps. Household responsibility for food shopping and meal preparing was also assessed by using a 5-point Likert scale (none to all).

Two items assessed patient–provider communication around diet on both the intake and postprogram survey; responses ranged from never to always.

Fruit and vegetable voucher redemption data were collected from each farmers market showing farmers market name, date of the redemption, and dollar amount redeemed.

Participants' fruit and vegetable consumption was assessed using the Fruit and Vegetable Checklist (20). This validated tool includes 7 items, facilitating computation of daily servings of fruit and daily servings of vegetables individually. We assessed fast food consumption by asking how many days of the past week the participant had eaten fast food, with responses ranging from 0 to 7.

Analyses

Participant demographic characteristics, goals, perceptions, and food-related shopping behaviors were examined by using descriptive statistics. Bivariate analyses compared completers (ie, those with a visit 3/postprogram survey) and noncompleters (ie, those without) by using χ^2 tests. Change in self-reported nutrition counseling frequency was assessed by using nonparametric tests. PRxHTN voucher use at farmers markets was calculated at the participant level and aggregate level. Changes in fruit and vegetable and fast food consumption were evaluated using paired *t* tests. Significance was set at $P < .05$ for all analyses; final analyses using SPSS v.24 (IBM, Inc) were conducted in 2018.

Results

Overall, 266 patients were screened and 224 enrolled in PRxHTN from 3 clinics (Table 1). Most were African American/black (97%) and women (72%) and had a high school or general equi- valency diploma or less (62%). Mean (standard deviation [SD]) age was 62 (11) years and years with hypertension was 13 (12). Approximately half were receiving SNAP benefits (48%). Mean (SD) daily fruit servings was 1.7 (1.4) and mean (SD) daily vegetable servings was 1.7 (1.3); fast food was consumed a mean (SD) of 1.5 (1.5) days per week. Program follow-up rates were 81% (n = 182) at check-in (visit 2) and 61% (n = 137) at postprogram (visit 3). Generally, participants with a postprogram survey were similar to those without a postprogram survey.

Of those completing PRxHTN (n = 137), 88% indicated they visited farmers markets more than before PRxHTN, 82% tried a new farmers market, and 95% reported that they would continue to shop at farmers markets in the future. Additionally, 88% reported that eating fruit and vegetables was more important because of the program, and 82% had tried a new fruit or vegetable.

Goals, barriers, perceptions, and food shopping behaviors

Program completers and noncompleters overwhelmingly endorsed goals of increasing fruit and vegetable consumption and improving hypertension (Table 2). Significant differences were observed for shopping more frequently for fruit and vegetables, adding fruit and vegetables to meals and snacks, and finding a new place to buy fruit and vegetables such that completers endorsed these goals more than noncompleters. In both groups, financial barriers to fruit and vegetable consumption were most highly endorsed; however, this concern was significantly higher among completers. There were no significant differences in perceptions of farmers markets except completers reported interest in shopping at farmers markets at a higher rate than noncompleters. Completers demonstrated different food shopping behaviors compared with noncompleters; they were significantly less likely to have shopped at a supermarket, grocery store, supercenter, or warehouse in the past month, and their use of convenience stores (P = .07) and food pantries or shelters (P = .05) were marginally but not significantly higher.

Voucher redemption and farmers market visits

Participant-level voucher redemption data were available for patients enrolled at only 2 of the 3 clinics (n = 149) because of a reporting error on the part of the third clinic. Of those, 86% of participants visited at least 1 participating farmers market and redeemed at least 1 voucher; one-third reported visiting a farmers market for the first time ever during the program. Median number of farmers market visits was 2, with a range of 0 to 6. Median number of vouchers redeemed was 8 (representing $80 worth of fruit and vegetables), and the maximum redeemed was 12 (or $120, the maximum amount provided to participants). Total fruit and vegetable sales at participating farmers markets from PRxHTN vouchers, obtained for the full patient sample (n = 224), was $15,140. Overall, 12 of 20 farmers markets were patronized.

Dietary counseling and behavior change

Among the 137 participants with intake and postprogram survey data, self-reported frequency of nutrition counseling during health care visits significantly increased from baseline to visit 3 (P < .001). Patients reporting that their health care team "always" talked about their overall diet increased from 41% to 65%, while reporting that their health care team "always" talked about increasing their daily fruit and vegetable consumption and variety increased from 38% to 75% (Table 3).

Significant changes in dietary behavior were also observed among participants with follow-up (Table 3). Daily fruit consumption increased from a mean (SD) of 1.6 (1.3) servings to 2.4 (1.2) servings (P < .001), and daily vegetable consumption increased from a mean (SD) of 1.7 (1.1) servings to 2.5 (1.3) servings (P < .001). Farmers market visits and voucher redemption were not associated with fruit and vegetable consumption. Fast food consumption significantly decreased from a mean of 1.3 days per week to 0.7 days per week (P < .001).

Discussion

PRxHTN engaged food-insecure, urban residents with hypertension in using an existing community resource of farmers markets to make recommended lifestyle changes. This was executed through a brief intervention during clinical visits with an existing nonphysician health care team member, allowing for an appropriate venue within which to discuss health-related benefits of dietary change and the practicalities of addressing barriers to dietary changes through providing relevant information and vouchers to purchase fresh, local fruit and vegetables at farmers markets.

Our findings extend the current literature by documenting significant intermediate dietary outcomes among patients with hypertension experiencing food insecurity. Overall, those who visited at least 1 farmers market reported a significant increase in provider communication related to diet and fruit and vegetable consumption and a decline in fast food consumption. Participants completing the program reported consuming a combined average of 4.9 servings of fruit and vegetables per day, effectively reaching the daily recommendation of 5 servings of fruit and vegetables compared with 3.3 at baseline. Although fast food consumption was not a primary focus of the program, a focus on reducing sodium along with increasing intake of fruit and vegetables may have contributed to changes in this behavior.

Our work highlights that among this particular population, patients are willing to set goals to improve their health condition, including increasing fruit and vegetable consumption and shopping at farmers markets. Participants had been living with diagnosed hypertension for over a decade on average and had likely received counseling on the benefits of lifestyle changes to improve hypertension. Notably, only 5% of participants indicated that they did not like fruit and vegetables. Two main barriers reported by participants included financial constraints and lack of access to fruit and vegetables in their neighborhoods. PRxHTN sought to address both of these barriers by promoting use of neighborhood farmers markets and providing financial resources to relieve the budgetary strain of purchasing fresh fruit and vegetables. Although these results are promising, it is unclear if the observed changes were maintained without ongoing access to additional financial resources.

Previous work has indicated that providers particularly appreciate that produce prescription programs allow them to provide resources that enable their clients to act on the lifestyle change advice they offer (10,21). Having an opportunity to provide such resources to clients may have facilitated counseling conversations about lifestyle behavior change and may have contributed to the significant increases in provider communication related to diet and fruit and vegetable consumption reported by participants. Given the new American College of Cardiology and American Heart Association hypertension guideline (22), which places a larger emphasis on lifestyle modification for management of hypertension, programs like PRxHTN are critically necessary for both management and prevention of hypertension as they are well positioned to deliver content while promoting healthy behavior change.

This work may have broader implications for other chronic diseases that recommend dietary changes for prevention and management. Although the longer-term goal is improved chronic disease outcomes, our work documents intermediate steps of understanding whether a brief intervention can affect dietary behaviors among people experiencing food insecurity. PRxHTN changes dietary behavior among people living with hypertension. This program may produce the same increases in fruit and vegetable consumption among food-insecure people who are being treated for other chronic diseases.

There are notable limitations to our study. First, the overall sample size was modest, although 3 different clinics from 3 separate health systems were represented, and only 61% of enrolled participants attended the third visit. While those who completed the program were similar to the enrolled population demographically, completers were more likely to report cost of fruit and vegetables as a significant barrier to fruit and vegetable consumption as well as interest in shopping at farmers markets. Thus, those who continue to participate may be in greatest need of additional financial resources and food access to support dietary change. Further, without a control group, it is unclear whether changes in dietary behavior would have occurred with provider advice alone. However, providers often do not have time to counsel patients on fruit and vegetable consumption, and traditional nutrition counseling referrals and uptake remained low at these clinics during the study. Second, this program aligned with the local farmers market season such that vouchers were distributed when farmers markets tended to have a broader range of fruit and vegetables in season and available. Although some farmers markets are moving toward a year-round schedule, many farmers markets in this community do not have a sufficient supply of fresh produce to make a year-round farmers market feasible. Thus, a shortcoming of PRxHTN is its reliance on seasonal farmers markets to address physical access to fresh fruit and vegetables. Given the high proportion of participants who reported shopping at a grocery store in the past month, it may be worthwhile to extend the program to these store types that are open year-round to allow participants to maintain their fruit and vegetable purchasing and consumption practices. Finally, programs such as PRxHTN require significant funding to support the cost of fruit and vegetable vouchers, require staff time to coordinate program roll-out, and assume existence or development of a strong farmers market presence. To date, PRxHTN has relied on time-limited local foundation funding and limited federal funding. Long-term sustainability and expansion of this model requires innovative approaches to dedicated funding to offset the cost of program coordination staff and fruit and vegetable vouchers or alternative methods to securing free fresh produce.

People with hypertension who are simultaneously experiencing food insecurity may be unable to execute recommended dietary changes because of physical and financial access barriers. PRxHTN serves as a strong model for linking safety net clinics with local farmers markets to promote community resources and improve fruit and vegetable consumption among this population.

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Tables

Table 1. Baseline Characteristics of Patients in the Produce Prescription for Hypertension Program, Cuyahoga County, Ohio, 2015

Characteristic	Enrolled, n = 224	Completed, n = 137
Demographic characteristics		
Age, mean (standard deviation)[a], y	61.6 (11.2)	60.3 (10.9)
Female, %	71.9	71.1
African American/black, %	96.8	98.5
Education, %		
Less than high school or general equivalency diploma	22.1	19.2
High school or general equivalency diploma	39.4	41.5
Some college	23.5	24.6
College degree	15.0	14.6
No. of adults in home, mean (standard deviation)	1.7 (0.8)	1.6 (0.8)
No. of children in home, mean (standard deviation)	0.7 (1.1)	0.6 (1.0)
Years with hypertension, mean (standard deviation)	13.1 (11.6)	13.2 (10.9)
Receives Supplemental Nutrition Assistance Program benefits, %	48.1	49.6
Dietary behaviors		
Daily fruit consumption, mean (standard deviation)	1.7 (1.4)	1.6 (1.3)
Daily vegetable consumption, mean (standard deviation)	1.7 (1.3)	1.7 (1.1)
Fast food consumption (days per week), mean (standard deviation)	1.5 (1.5)	1.4 (1.4)

[a] Significant difference between participants with and without a postprogram survey (*P* = .04).

Table 2. Goals, Barriers, Farmers Market Perceptions, and Food-Related Shopping Behaviors in the Produce Prescription for Hypertension Program, Cuyahoga County, Ohio, 2015

Category	Completed Program, % (n = 137)	Did Not Complete, % (n = 87)	*P* Value[a]
Goals and reasons for participating in the produce prescription for hypertension program[b]			
Increase fruit and vegetable servings	97.1	98.9	.65
Shop more frequently for fruit and vegetables	32.8	20.7	.049
Visit farmers market more frequently	86.9	79.3	.13
Add fruit and vegetables to meals and snacks	53.3	37.9	.03
Try new fruit and vegetables	35.0	41.4	.34
Improve hypertension	95.6	95.4	>.99
Lead a healthier lifestyle	81.8	79.3	.65
Have a healthy family	40.1	40.2	.99
Find new place to buy fruit and vegetables	50.4	35.6	.03
Reduce risk of chronic disease	78.8	71.3	.20
Barriers to fruit and vegetable consumption[b]			
Lack of access to fruit and vegetables in neighborhood	39.4	31.0	.20
Limited or no storage space for fruit and vegetables	14.6	12.6	.68
Don’t like fruit and vegetables	5.8	4.6	.77
Family doesn’t like fruit and vegetables	1.5	1.1	>.99
Not enough time	5.8	9.2	.34
Fruit and vegetables are expensive	69.3	51.7	.008
Farmers market perceptions[c]			
Interested in shopping at a farmers market	100.0	91.4	.001
Have transportation to get to a farmers market	80.3	84.8	.42
Quality of fruit and vegetables at farmers markets is as good or better than a grocery store	80.3	80.9	.93
Wide variety of fresh produce is available at farmers markets	86.8	88.1	.81
Prices at farmers markets are affordable	69.4	66.2	.65
Food shopping behaviors			
Ever shopped at a farmers market	66.2	56.1	.14
Food stores where shopped in past month			
Supermarket, grocery store, supercenter, or warehouse	90.5	97.7	.04
Convenience or dollar variety store	26.3	16.1	.07
Famers market	10.3	7.0	.40
Food pantry or shelter	29.9	18.4	.05
Use Supplemental Nutrition Assistance Program electronic benefits transfer card	49.6	45.7	.58
Responsible for majority of food shopping for household[d]	70.1	60.5	.14
Responsible for majority of meal preparing for household[d]	70.1	60.9	.16

[a] χ^2 test.
[b] Participants could choose more than 1 goal and reason or barrier.
[c] Percentage that agreed or strongly agreed, coded by using a 5-point Likert scale (strongly agree to strongly disagree).
[d] Percentage responding “more than half” or “all” on a 5-point Likert scale (none to all).

Table 3. Intake and Postprogram Communication and Dietary Behavior Among Program Completers in the Produce Prescription for Hypertension Program, Cuyahoga County, Ohio, 2015

Behavior	No.	Intake	Postprogram	*P* Value
Health care team “always” talks about overall diet, %[a]	122	41.0	64.8	<.001[b]
Health care team “always” talks about increasing fruit and vegetable consumption, %[a]	121	38.0	75.2	<.001[b]
Daily servings of fruit, mean (standard deviation)[c]	125	1.6 (1.3)	2.4 (1.2)	<.001[d]
Daily servings of vegetables, mean (standard deviation)[c]	126	1.7 (1.1)	2.5 (1.3)	<.001[d]
No. days ate fast food in past week, mean (standard deviation)	129	1.3 (1.4)	0.7 (1.0)	<.001[d]

[a] Responses on a 5-point Likert scale from never to always.
[b] Assessed by using nonparametric tests.
[c] Assessed by using the Fruit and Vegetable Checklist (20).
[d] Paired *t* test.

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IMPLEMENTATION EVALUATION

Clinical Identification and Referral of Adults With Prediabetes to a Diabetes Prevention Program

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PEER REVIEWED

Summary

What is already known about this topic?

The prevalence of type 2 diabetes and prediabetes extends to about one-third of the US adult population. Reducing this burden will require prevention programs, but clinical practices do not routinely screen, test, and refer patients to such programs.

What is added by this report?

We describe implementation of diabetes prevention strategies, including robust clinical–community linkages, that helped clinicians and their care teams at 26 health centers to systematically identify patients with prediabetes and refer them to an evidence-based diabetes prevention program.

What are the implications for public health practice?

Strategies developed and tested created robust clinical–community linkages that are generalizable across a wide variety of health centers and health systems across the United States.

Abstract

Purpose and Objectives

Community programs to prevent or delay the onset of type 2 diabetes are effective, but implementing these programs to maximize their reach and impact remains a challenge. The American Medical Association (AMA) partnered with the YMCA of the USA, as part of a Centers for Medicare and Medicaid Innovation demonstration project, to develop, implement, and evaluate innovative quality improvement strategies to increase routine screening, testing, and referral of Medicare patients with prediabetes to diabetes prevention programs (DPPs) at local YMCAs.

Intervention Approach

AMA recruited 26 primary care practices and health systems in 17 US communities to implement point-of-care and retrospective methods (or a combination of both) for screening, testing, and referral of Medicare patients with prediabetes.

Evaluation Methods

We assessed changes in rates of referral and enrollment of patients among participating practices. We used a mixed-methods pretest–posttest evaluation design to determine if use of certain tools and resources, coupled with systems changes, led to increased screening and referrals.

Results

Practices referred a total of 5,640 patients, of whom 1,050 enrolled in a YMCA DPP (19%; range, 2%–98%). Practices (n = 12) that used retrospective (ie, electronic medical record [EMR]) systems to identify eligible Medicare patients via a registry referred more people (n = 4,601) to the YMCA DPP than practices (n = 10) that used a point-of-care method alone (n = 437 patients) or practices (n = 4) that used a combination of these approaches (n = 602 patients). All approaches showed increased enrollment with point-of-care methods being most successful.

Implications for Public Health

Lessons learned from this intervention can be used to increase diabetes prevention in the United States and support the Centers for Medicare and Medicaid Services (CMS) decision to expand Medicare coverage to include the DPP for all Medicare beneficiaries.

Introduction

Type 2 diabetes, a highly prevalent and costly disease in the United States, affects more than 25% of the Medicare population, and its prevalence is projected to increase approximately twofold for all US adults aged 18 to 79 by 2050 if current trends continue (1). An estimated 84 million US adults, about 34% of the population, have prediabetes, but only 12% know they have it (2,3). Almost half (48.3%) of adults aged 65 or older may have prediabetes (2,3). Among those with prediabetes, the risk of developing type 2 diabetes may be 5% to 10% annually and 70% over a lifetime (4). The burden of prediabetes, including its associated risk for heart attack, stroke, and increased medical expenditures, suggests the need for population-based clinical strategies to identify and manage this common metabolic disorder (5). Thus, the US Preventive Services Task Force recommends diabetes screening for adults aged 40 to 70 who are overweight or obese (6). Adherence to this recommendation will identify millions of patients with prediabetes who could benefit from a program to prevent or delay type 2 diabetes.

The landmark 2002 Diabetes Prevention Program, a randomized controlled trial, found that an intensive lifestyle change program focused on diet, physical activity, and weight loss reduced the risk of developing type 2 diabetes by 58% among adults aged 18 or older and by 71% among adults aged 60 or older compared with adults on placebo and that the program was significantly more effective for reducing diabetes risk than metformin (7). The Centers for Medicare and Medicaid Services announced in 2016 that it would begin covering diabetes prevention programs that were part of the Centers for Disease Control and Prevention (CDC) National Diabetes Prevention Program (DPP) for all Medicare beneficiaries beginning in April 2018 (8).

Purpose and Objectives

US adults make more than 500 million visits to primary care providers annually, making these providers' offices ideal for identifying patients with prediabetes (9). However, these clinical practices and the health systems that comprise them face barriers to preventive procedures, such as systematic identification and referral of patients with prediabetes to CDC-recognized diabetes prevention programs (10). To maximize the potential of primary care providers to help prevent or delay the onset of type 2 diabetes among the Medicare population, the American Medical Association (AMA) partnered with the YMCA of the USA, as part of a Centers for Medicare and Medicaid Innovation demonstration project, to develop and test innovative quality improvement strategies to implement routine screening, testing, and referral of Medicare patients with prediabetes to DPPs at local YMCAs.

This article describes our evaluation of a pilot systems-change study to integrate screening, testing, and referral of Medicare patients with prediabetes to DPPs. Study findings serve as a framework that can be adopted or adapted to support the Medicare diabetes prevention services that were made available as of April 2018 through the Medicare Diabetes Prevention Program (MDPP) expanded model (11). The study, which was conducted over a 15-month period from 2013 through 2015, was part of a population-based quality improvement strategy in 26 clinical practices and health systems in 8 states that had DPPs in 17 YMCA communities. The assumptions were that 1) clinical practices had no systematic process for screening and testing Medicare patients with prediabetes and referring them to CDC-recognized lifestyle change programs or DPPs, 2) clinical practices that used tailored tools and resources for screening and testing Medicare patients with prediabetes and referral to DPPs would have increased patient referrals and enrollment, and 3) clinical practices would have different numbers of referrals and enrollment of Medicare patients with prediabetes depending on which method of patient identification and which intervention they chose.

Intervention Approach

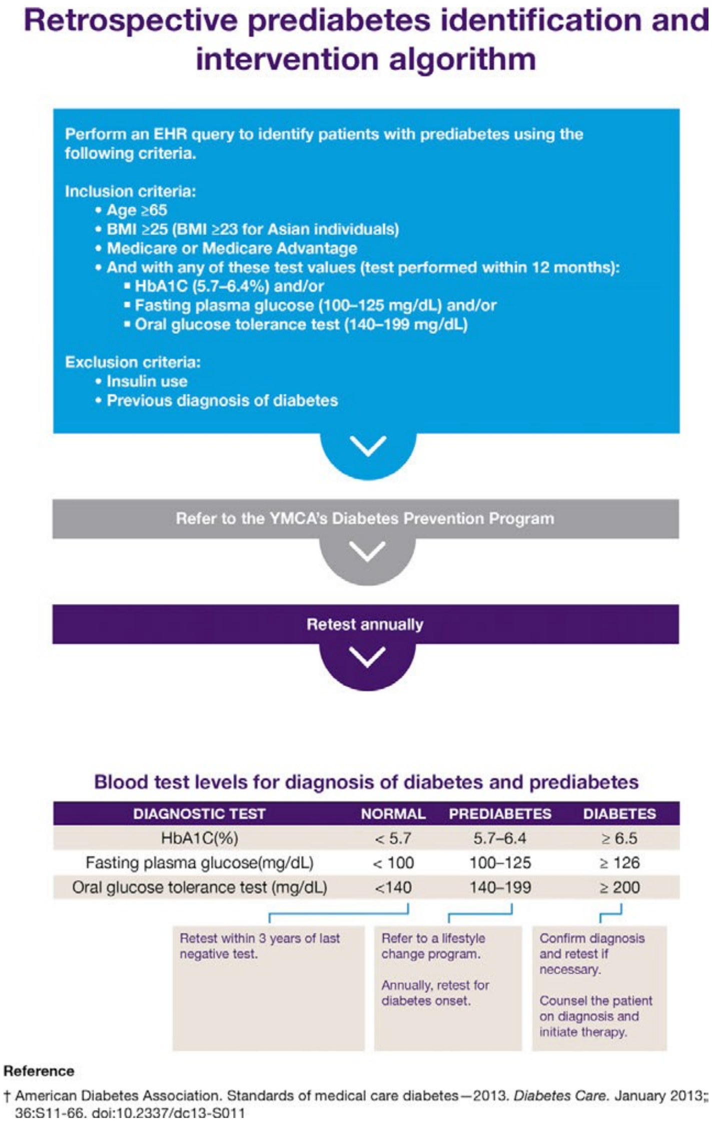
We conducted a quasi-experimental, mixed methods, prospective study by using the RE-AIM (reach, efficacy, adoption, implementation, maintenance) implementation science framework (12,13) to determine whether a health system intervention (ie, adoption of a set of tools and resources and health service strategies) in various types of primary care practices increased systematic screening, testing, and referral of Medicare patients with prediabetes to CDC-recognized YMCA DPPs. Registration costs for participants in the year-long program, which averaged $450 per enrollee, were covered under a Centers for Medicare and Medicaid Innovation demonstration grant. Twenty-six clinical practices in 17 US communities were identified by state and county medical societies and the YMCA of the USA on the basis of the presence of a local YMCA with a CDC-recognized DPP within 5 miles of the practice and no previous referrals from that practice to a YMCA DPP. These practices were located in 8 states and varied in size from 2 to 910 physicians. Practices ranged from small, independent practices (generally 10 or fewer physicians), some with multiple sites, to large, integrated health systems (Table 1). The patient population of each practice was not reported because the panel size (patients assigned to a particular provider) varied greatly depending on the referring physician.

Evaluation Methods

We chose a mixed-methods pretest–posttest evaluation design to determine if the use of certain tools and resources, coupled with systems changes, led to increased screening and referrals of Medicare patients at high risk for type 2 diabetes to community YMCA DPPs. Measures included pretest and posttest surveys and structured interviews.

We recruited 30 clinical practices in 17 communities to participate in our study; 26 clinics agreed to participate. AMA and YMCA staff members trained physicians and care teams across all practice sites in use of the American Medical Association's Clinician Diabetes Prevention Toolkit for Identifying Patients with Prediabetes (toolkit) (Table 2). On the basis of feedback obtained from structured interviews with practice staff members, the toolkit was slightly refined for clarity and ease of use before distribution to the 26 clinics. The YMCA DPP intervention consisted of the toolkit, which includes workflows and process maps to identify and refer Medicare patients with prediabetes; direct education for health care teams via in-person trainings and technical assistance; standardized forms for referrals from clinical settings to local DPPs; and pretest and posttest surveys and interviews to determine what worked and what tools needed refinement. These toolkit elements were based on existing models for referring patients to internal medical services (eg, referral to medical nutrition therapy) or to external programs (eg, referral to physical therapy) (14).

The toolkit included a retrospective algorithm (Figure 1) for querying electronic medical records (EMRs) to identify patients with prediabetes on the basis of a hemoglobin A_{1c} value of 5.7% to 6.4% or fasting plasma glucose levels of 100 to 125 mg/dL and a body mass index (BMI, weight in kg divided by height in m^2) of 25 or more. The toolkit recommended verifying blood glucose levels in the prediabetes range and provided criteria for referring patients to YMCA DPPs. The toolkit also included point-of-care methods to identify candidates for YMCA DPP referral. Practices integrated a prediabetes screening and referral process workflow (Figure 2) into their daily patient care. The University of Illinois at Chicago Institutional Review Board reviewed the study (Diabetes Prevention Physician Referral Program, protocol no. 2013–1258) and exempted it from full review.



Retrospective prediabetes identification and intervention algorithm

Perform an EHR query to identify patients with prediabetes using the following criteria.

Inclusion criteria:
- Age ≥65
- BMI ≥25 (BMI ≥23 for Asian individuals)
- Medicare or Medicare Advantage
- And with any of these test values (test performed within 12 months):
  - HbA1C (5.7–6.4%) and/or
  - Fasting plasma glucose (100–125 mg/dL) and/or
  - Oral glucose tolerance test (140–199 mg/dL)

Exclusion criteria:
- Insulin use
- Previous diagnosis of diabetes

Refer to the YMCA's Diabetes Prevention Program

Retest annually

Blood test levels for diagnosis of diabetes and prediabetes

DIAGNOSTIC TEST	NORMAL	PREDIABETES	DIABETES
HbA1C(%)	< 5.7	5.7–6.4	≥ 6.5
Fasting plasma glucose(mg/dL)	< 100	100–125	≥ 126
Oral glucose tolerance test (mg/dL)	<140	140–199	≥ 200

Retest within 3 years of last negative test.

Refer to a lifestyle change program.

Annually, retest for diabetes onset.

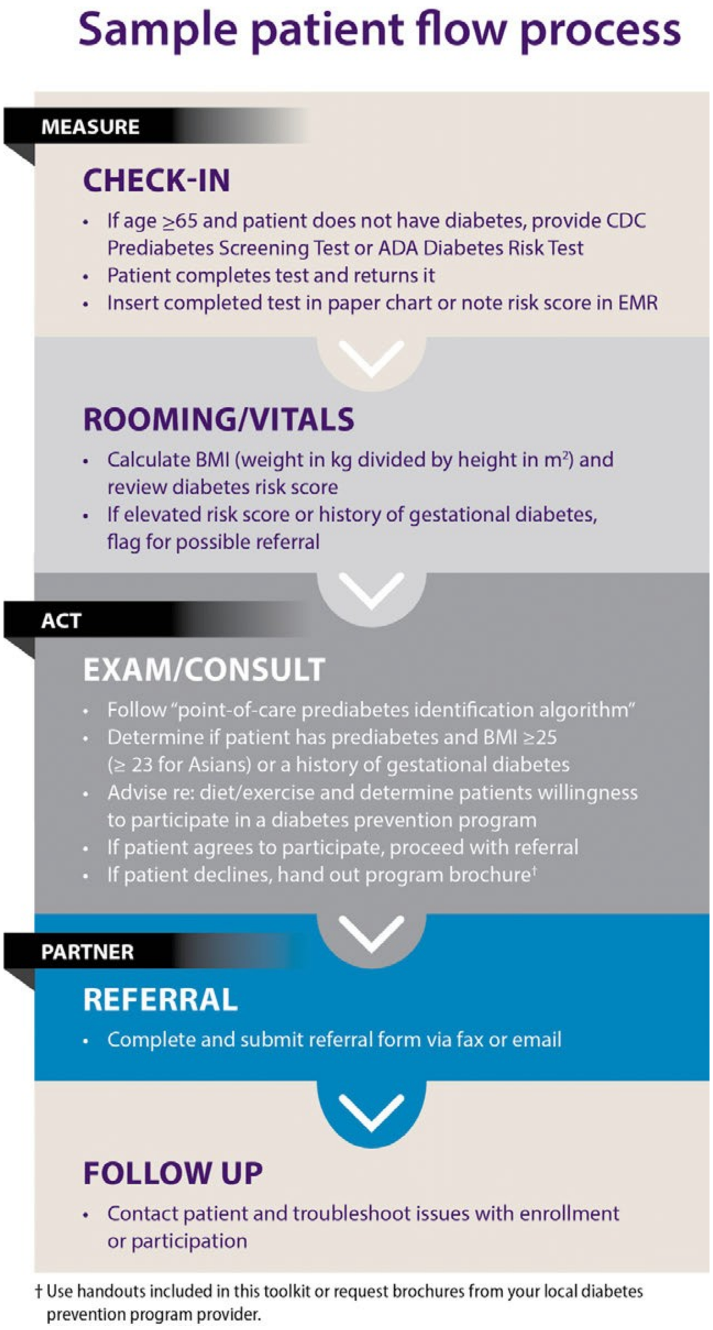
Confirm diagnosis and retest if necessary.

Counsel the patient on diagnosis and initiate therapy.

Reference

† American Diabetes Association. Standards of medical care diabetes—2013. *Diabetes Care*. January 2013;; 36:S11-66. doi:10.2337/dc13-S011

Figure 1. Handout for clinical practices used in YMCA's Diabetes Prevention Program showing the retrospective prediabetes identification and intervention algorithm developed by the American Medical Association to identify patients with prediabetes for referral to the program. Abbreviations: BMI, body mass index; EHR, electronic health record; HbA1C, hemoglobin A1c. Reprinted with permission of the American Medical Association.



Sample patient flow process

MEASURE

CHECK-IN

- If age ≥65 and patient does not have diabetes, provide CDC Prediabetes Screening Test or ADA Diabetes Risk Test
- Patient completes test and returns it
- Insert completed test in paper chart or note risk score in EMR

ROOMING/VITALS

- Calculate BMI (weight in kg divided by height in m^2) and review diabetes risk score
- If elevated risk score or history of gestational diabetes, flag for possible referral

ACT

EXAM/CONSULT

- Follow "point-of-care prediabetes identification algorithm"
- Determine if patient has prediabetes and BMI ≥25 (≥ 23 for Asians) or a history of gestational diabetes
- Advise re: diet/exercise and determine patients willingness to participate in a diabetes prevention program
- If patient agrees to participate, proceed with referral
- If patient declines, hand out program brochure†

PARTNER

REFERRAL

- Complete and submit referral form via fax or email

FOLLOW UP

- Contact patient and troubleshoot issues with enrollment or participation

† Use handouts included in this toolkit or request brochures from your local diabetes prevention program provider.

Figure 2. Handout for clinical practices used in the YMCA's Diabetes Prevention Program showing a patient workflow process using point-of-care methods to identify candidates for referral to the program. Abbreviations: ADA, American Diabetes Association; CDC, BMI, body mass index; Centers for Disease Control and Prevention; EMR, electronic medical record; GDM, gestational diabetes mellitus. Reprinted with permission of the American Medical Association.

The study was conducted from March 2013 through June 2015. Data collection on patients referred to the program began in March 2014. Each practice was trained on the refined toolkit (Table 2) and each chose a strategy or approach based on its staffing resources. Practice staff members (ie, medical assistants, clerical staff) asked Medicare patients to complete 1 of 2 screening tests (15,16) to identify prediabetes risk. If a patient was at risk, the clinical staff (physician, nurse) verified eligibility and determined if a referral to a YMCA DPP was appropriate. As part of the referral, primary care providers briefly counseled patients and provided an educational handout about prediabetes and the YMCA DPP.

In lieu of point-of-care screening and referral methods, several clinical practices used the retrospective (EMR) algorithm (Figure 1) to query their electronic records to create a prediabetes registry. A subset of practices generated a prediabetes registry as well as integrated screening and referral at the point of care. The practice staff contacted patients from the registry via telephone, email, letter, or postcard to explain what prediabetes was and how it increased the risk of type 2 diabetes and to encourage patients to participate in a YMCA DPP that was designated by YMCA of the USA. A business associate agreement between the local YMCA and the clinical practice allowed these practices to provide information on eligible patients to the local YMCA DPP coordinator and for that coordinator to record and report the number of patients referred and enrolled in their YMCA DPP each month. The agreement assured the safe exchange of protected health information in accordance with HIPAA (Health Insurance Portability and Accountability Act) guidelines. Once the YMCA DPP coordinator received the registry list of referrals or each of the point-of-care referrals, that person contacted patients to enroll them. Enrollment was confirmed when a patient registered and attended the first class. Concurrently, the clinical practice staff flagged patients' medical records with a reminder to physicians to discuss program participation with patients at the next office visit. If a patient declined to participate, physicians at follow-up discussed the importance of lifestyle change for diabetes prevention and encouraged enrollment in a YMCA DPP.

This implementation evaluation was designed by using the RE-AIM (reach, efficacy, adoption, implementation, maintenance) implementation science framework (12) to assess whether the adoption of a set of tools and resources and health service strategies increased systematic screening, testing, and referral of Medicare patients with prediabetes to CDC-recognized YMCA DPPs. The YMCA DPPs selected were part of the CDC National DPP recognition program, and used the standardized curriculum, although they may not have achieved full recognition at the time of our pilot study. By using the RE-AIM implementation science framework, the impact of the intervention was determined as a function of the framework's 5 factors (reach, efficacy, adoption, implementation, maintenance) (Box).

Box. RE-AIM (Reach, Efficacy, Adoption, Implementation, Maintenance) Model As Applied to Clinician Referrals to YMCA's Diabetes Prevention Program

Component	Study Factors Description
Reach	Number of at-risk patients identified, number of referrals made, number enrolled, and proportion of the referred that enrolled
Efficacy	Number of at-risk patients identified, number of referrals made, number enrolled, and proportion of patients referred who enrolled from baseline, as a function of the method(s) used for screening, testing, and referring adult Medicare patients with prediabetes
Adoption	Proportion and representativeness of clinical settings that adopt point-of-care, retrospective, or a combination of both methods for screening, testing, and referring adult Medicare patients with prediabetes
Implementation	Implementation of point-of-care, retrospective, or a combination of both methods for screening, testing, and referring adult Medicare patients with prediabetes
Maintenance	Extent to which implementation of point-of-care, retrospective, or a combination of both methods for screening, testing, and referring adult Medicare patients with prediabetes is preferred and maintained or repeated

Evaluation

To better understand reach and efficacy, a 13-item pretest survey was administered online that asked about practice type, existing screening and referral practices, and the demographics of the clinical practice setting (ie, location, system type, specialty). The survey also asked practices to identify facilitators and barriers to the use of workflows and algorithms and asked about attitudes and behaviors among practice clinicians regarding prediabetes (eg, Does your practice refer patients with prediabetes to community programs for lifestyle interventions?). This quantitative pretest survey was distributed to multiple clinic staff members (eg, physicians, nurses, medical assistants, physician assistants) and was completed before beginning the pilot study.

The same 13-item online survey was administered at the start of the pilot and at the end as a posttest survey of the same clinic staff members to measure changes in attitudes and behaviors regarding prediabetes screening, testing, and referral. The survey also contained a question on adoption of the toolkit. Practices worked with the YMCA DPP to track the number of at-risk patients identified and referred, number enrolled, and proportion of patients referred who enrolled. Each clinical site was given a form that could be updated electronically with the number of Medicare patients with prediabetes referred each month. These referrals were compared with the referral and enrollment numbers captured by the associated YMCA DPP. Patient demographic characteristics were not collected, to reduce burden of reporting for each site.

The qualitative assessment included semistructured interviews conducted with clinical practice staff members to identify health care system barriers to screening and referral strategies and to better understand changes in adoption, implementation, and maintenance. The interviews were conducted per practice by telephone and were recorded and transcribed verbatim. The transcripts were analyzed by using NVivo qualitative data analysis software (QSR International), which categorized and classified that qualitative data into themes and attributes.

Results

Results were analyzed on each of the associated RE-AIM study factors.

Reach. The 26 participating clinical practices moved from no referrals of Medicare patients to referral of 5,640 Medicare patients with prediabetes to the YMCA's DPP (Table 1). All clinical practices referred patients, and all had increased enrollment from baseline. Pretest and posttest awareness and behavior revealed important changes in clinical behavior. Across the clinical practice sites, pretest surveys (n = 48) and posttest surveys (n = 44) were most often completed by primary care physicians (67%–72%), followed by nurses (14%–15%), nurse practitioners (7%–15%), medical assistants (2%), physician assistants (2%), health educators (2%), receptionists (2%), and social workers (2%). The same staff member completed both pretest and posttest surveys. Findings indicate that knowledge about prediabetes and routine screening levels for the condition was high among referring physicians and care team members in both the pretest and posttest surveys. The pretest survey showed that 59% of clinical practice staff members agreed or strongly agreed that they were aware of community resources that help patients prevent diabetes, and 84% were aware in the posttest survey. In the pretest survey, 53% of physicians said they agreed or strongly agreed that they referred patients with prediabetes to community resources that help prevent diabetes, and in the posttest survey that increased to 83% of physicians. Referral rates did, however, differ on the basis of the method used by the practice. Slightly more clinical settings (n = 16) chose to use the retrospective method to develop a registry of their Medicare patients with prediabetes rather than the point-of-care method (n = 14). The 12 practices that used only a retrospective method referred a greater number of Medicare patients (n = 4,601) than the 10 practices that used only a point-of-care method (n = 437) or 4 practices that used a combination of these methods (n = 602).

Efficacy. Of the 5,640 Medicare patients referred to a YMCA DPP, 1,050 (19%) enrolled. Enrollment rates varied widely across clinical sites, ranging from 2% to 98%. The weighted average for enrollment across all sites was 49%. The highest enrollment rates (90%, 96%, and 98%) were from independent clinical practices. Practices that used only a retrospective method had a lower rate of enrollment (11%) than those that used only the point-of-care method (56%) and those that used a combination of retrospective and point-of-care methods (51%). Although the point-of-care method had the highest enrollment rate (56%), that method had the lowest number of referrals. A small proportion of sites (19%) that used retrospective or point-of-care methods only had referrals, but no subsequent enrollment.

Adoption. Structured interviews with clinical staff members (n = 44) in 26 clinical practices revealed that point-of-care, retrospective, or combination strategies were uniformly adopted at each site as intended, depending on which strategy clinical teams chose. The 26 clinical practice sites varied in size from 2 to more than several hundred physicians. Half (n = 13, 50%) were small, inde- pendent practices, 4 of which had multiple sites. The other half was made up of large, integrated health systems. The practices also varied in geographic distribution across the East, Midwest, and South and in size of patient population. All referring physi- cians were primary care providers (ie, family medicine) and fur- ther demographic data were not collected. No differences were re- ported or observed among the physicians. Some physicians were informed of their patients with prediabetes as a result of the gener- ation of a patient registry by clinic staff. Physicians were consul- ted by clinic staff to verify prediabetes and to approve the referral.

Implementation. We saw no preference of strategy implemented that was based on clinical setting type, although slightly more integrated delivery sites chose the retrospective strategy, probably a result of ease of registry development within their EMR systems. Clinical staff members reported that it was helpful to frame screening and referral as a quality improvement strategy rather than an additional requirement and that screening and referral could be operationalized across various team members, with any one team member being the lead or champion. The clinical staff also identified barriers to implementing screening and referral strategies. Staff members reported challenges, such as not having enough staff members to query the EMR to identify Medicare patients at risk for prediabetes and to create a prediabetes registry. Staff members were also uncertain about the best ways to integrate identification and referral into busy clinical workflows at the point of care. The staff had concerns about additional work load and sustainability; staff members spoke specifically about how to continue to screen, test, and refer patients and maintain behavior change when patients and providers faced competing medical problems and priorities. Unique contextual factors, such as patient readiness for change and YMCA DPP program accessibility, were also mentioned as important factors that affected implementation. At a few sites, strategies were not sufficiently implemented because of various factors, including having no one available to code the retrospective algorithm in the EMR system or because enrollment data from YMCA DPPs were missing or lost to follow-up.

Maintenance. More than a third of practices (n = 10) reported that they continued to use AMA referral tools in their practice at 6 months beyond the pilot. Practices preferred using retrospective identification of Medicare patients when dedicated staff members were available to run queries and maintain a registry to identify patients with prediabetes.

Implications for Public Health

Despite the availability of effective, community-based YMCA DPPs (17,18), a gap remains between identification and referral of Medicare patients with prediabetes to lifestyle change programs (18). The results of this study can help accelerate translation of evidence into real-world clinical settings, particularly as the results relate to the identification and referral of Medicare populations at high risk for type 2 diabetes, a subset of the nearly 84 million US adults with prediabetes.

This implementation evaluation revealed that increased awareness and simple modifications to clinical workflows led to increased screening and referrals to YMCA DPPs for preventing type 2 diabetes. Before engaging in this effort, the identified clinical practices were not screening Medicare patients for prediabetes or referring patients with prediabetes to evidence-based lifestyle change programs. Because of the intervention, during a 15-month period the 26 participating clinical practices and health systems began routinely screening patients suspected of having prediabetes, confirming prediabetes by blood test, and referring patients to YMCA DPPs.

Key lessons learned were that framing screening and referral as a quality improvement strategy rather than an additional requirement resulted in greater engagement by busy clinicians. Diabetes prevention is a team sport, and collective buy-in through team-based care is essential. A practice champion is needed but does not have to be a physician.

Only integrated delivery systems practices chose the combination approach, likely because of their higher capacity. Practices preferred using retrospective identification when dedicated staff members were available to run queries and maintain a registry that could be used to identify patients with prediabetes. Referral to a YMCA DPP can be integrated into existing referral systems used by clinical practices, such as those for referring to a physical therapist or dietitian–nutritionist. Opportunities to build screening and referral models as part of value-based care include tying payment incentives, prediabetes screening, and referral into annual checkups, which can increase the probability that diabetes prevention becomes part of routine care.

The highest numbers of referrals were from health systems or clinical practices that used retrospective methods to query their EMRs to create a prediabetes registry. This approach ensured that Medicare patients with prediabetes were identified, an opportunity that is often missed during an acute or routine visit when competing priorities exist. More referring physicians are captured with the retrospective method because this is a systems approach to identifying patients within the EMR across multiple physician panels.

Physician referrals done at the point of care seemed to yield a higher enrollment rate. Although the retrospective method generated more referrals by volume, it did not yield as many enrollments as the other methods. Although fewer clinical sites chose deploying both methods concurrently over deploying only one method, they experienced more referrals than clinical sites that used the point-of-care method alone and a comparable enrollment rate. Small, independent clinical practices had the highest percentage of patients who enrolled in a YMCA DPP. Those practices had a smaller patient population and strong physician–patient relationships. Clinical settings that used AMA tools to deploy a combination of retrospective and point-of-care methods to identify their Medicare patients with prediabetes increased screening, testing, and referral of these patients to CDC-recognized lifestyle change programs. The capacity of a health system or clinical practice to deploy both methods concurrently is an important consideration. However, physician involvement at the point of care increased rates of enrollment. Some studies suggest that physician recommendation and discussion can increase patient motivation to change certain behaviors, including diet, physical activity, and weight loss.

Our study had limitations. The study was a convenience sample of clinical practices and YMCA DPPs. A primary limitation was that we did not determine the total number of patients served by each of the clinical practices; therefore, the proportion of Medicare patients screened to those referred cannot be determined. In addition, the number of referred Medicare patients was low when considering the average referral rate by practice or by provider — in some cases fewer than 5 referrals per provider over the course of the pilot study. Also, for a small number of clinical sites that used retrospective or point-of-care methods only, referrals were made, but no record was kept of enrollment. Some physicians reported referral of Medicare patients at the outset of the pilot, but no referrals or enrollment could be verified. Overreporting of referrals of Medicare patients with prediabetes by physicians before the pilot study may have been due to social desirability bias. Lower enrollment may have been due to communications issues between the clinical practice and the local YMCA DPP or between provider and patient or to other factors that prohibited conversion of referrals to enrollment (eg, patient readiness). The missing enrollment numbers were patients considered lost to follow-up after initial enrollment.

Community-based organizations such as local YMCA DPPs are promising channels for wide-scale dissemination of low-cost approaches to lifestyle changes for diabetes prevention. Our study found that primary care is a potentially ideal setting for routinely screening and testing Medicare patients for prediabetes and then referring them to a YMCA DPP; a robust linkage between the 2 settings is an effective way to prevent type 2 diabetes. As a next step, AMA is working with national, state, and community partners to implement and scale these strategies in diverse health care delivery systems with the goal of reducing the burden of diabetes in the United States. In addition, AMA will be developing a physician-focused educational module on the Medicare Diabetes Prevention Program. The goal is to ensure all that program-eligible Medicare beneficiaries are referred by their primary care physician to an MDPP.

Developing and testing strategies that operationalize a linkage between the clinical setting and community resources can improve the capacity of the US health care system to respond to the 84 million Americans with prediabetes. Learnings from this study and the strategies tested are generalizable in a wide variety of health centers and health systems across the United States. Our findings can also have an impact, because the approach described in this article can be disseminated and implemented in clinics and communities in need of population health approaches to type 2 diabetes prevention and can be adapted to support the new set of covered services made available in 2018 through the CMS MDPP Expanded Model.

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Tables

Table 1. Referral and Enrollment of Medicare Patients in the YMCA's Diabetes Prevention Program, by Clinical Practice (N = 26) Characteristics, and Methods, March 2014 – June 2015[a]

State	Clinical Site No.	Clinical Practice Type[b]	No. Referring Physicians in Practice	Patient Identification and Intervention Method[c]	No. Patients Referred	No. Patients Enrolled (%)
Delaware	1	Integrated delivery	15	Retrospective + point of care	214	118 (55)
	2	Integrated delivery	3	Point of care	15	10 (67)
	3	Independent	3	Point of care	48	43 (90)
	4	Independent	3	Point of care	2	1 (50)
	5	Independent, multisite	8	Retrospective	589	109 (19)
	6	Independent, multisite	2	Retrospective	277	43 (16)
	7	Independent	6	Retrospective	252	56 (22)
	8	Independent	14	Retrospective	30	6 (20)
	9	Independent	7	Retrospective	40	39 (98)
	10	Independent	8	Retrospective	89	85 (96)
Florida	1	Integrated delivery	4	Retrospective + point of care	93	31 (33)
	2	Independent, multisite	10	Point of care	296	156 (53)
	3	Integrated delivery	3	Retrospective + point of care	16	4 (25)
	4	Integrated delivery	5	Point of care	22	13 (59)
	5	Independent	7	Point of care	4	1 (25)
	6	Independent, multisite	6	Point of care	5	4 (80)
Indiana	1	Integrated delivery	215	Retrospective	200	—[d]
Minnesota	1	Independent	14	Point of care	30	15 (50)
	2	Integrated delivery	143	Retrospective + point of care	279	156 (56)
New York[e]	1	Integrated delivery	910	Retrospective	2,500	40 (2)
Arizona	1	Integrated delivery	48	Point of care	8	—[d]
	2	Integrated delivery	6	Point of care	7	—[d]

[a] Data were self-reported by practices or reported by YMCAs.

[b] An integrated delivery system is a network of health care facilities under a parent holding company that provides a continuum of health care services for seamless, coordinated care.

Independent clinics are provider-owned multi-specialty health care clinics guided by the providers who care for their patients. Independent, multisite clinics are provider-owned multi-specialty health care clinics in multiple sites that are guided by the providers who care for their patients.

[c] Point of care was defined as identifying a patient with prediabetes during an office visit; retrospective was defined as using existing laboratory values in the electronic medical record to create a report or list of patients based on risk factors or laboratory values to identify patients who meet the criteria for prediabetes.

[d] Data lost to follow-up.

[e] New York is an outlier with 2,500 referrals. If this site is excluded, retrospective methods still yield more referrals (2,101).

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(continued)

Table 1. Referral and Enrollment of Medicare Patients in the YMCA's Diabetes Prevention Program, by Clinical Practice (N = 26) Characteristics, and Methods, March 2014 – June 2015[a]

State	Clinical Site No.	Clinical Practice Type[b]	No. Referring Physicians in Practice	Patient Identification and Intervention Method[c]	No. Patients Referred	No. Patients Enrolled (%)
	3	Integrated delivery	117	Retrospective	168	20 (12)
Ohio	1	Independent	6	Retrospective[e]	100	—[d]
	2	Integrated delivery	177	Retrospective	250	100 (40)
Texas	1	Integrated delivery	217	Retrospective	106	—[d]
Total	26		1,957		5,640	1,050 (19)

[a] Data were self-reported by practices or reported by YMCAs.

[b] An integrated delivery system is a network of health care facilities under a parent holding company that provides a continuum of health care services for seamless, coordinated care.

Independent clinics are provider-owned multi-specialty health care clinics guided by the providers who care for their patients. Independent, multisite clinics are provider-owned multi-specialty health care clinics in multiple sites that are guided by the providers who care for their patients.

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[d] Data lost to follow-up.

[e] New York is an outlier with 2,500 referrals. If this site is excluded, retrospective methods still yield more referrals (2,101).

Table 2. American Medical Association Clinician Diabetes Prevention Toolkit for Identifying Patients with Prediabetes

Tool	Use	How Used
Retrospective algorithm[a]	Querying electronic medical records to identify patients with prediabetes based on HbA$_{1c}$ or glucose levels and BMI (weight in kilograms divided by height in meters squared)	• IT staff codes EMR to develop a list or registry of patients with prediabetes, based on prerecorded HbA$_{1c}$ and BMI values • Practice staff verifies eligibility (HbA$_{1c}$ or glucose level, BMI, and that patient is alive and ambulatory) • Practice staff generates letter to patients informing them that they are at high risk for type 2 diabetes, provides educational materials about prediabetes, and lets the patient know that someone from the YMCA DPP will be contacting them about the program. • Practice staff faxes referral to YMCA DPP for follow-up to enroll patient
Point-of-care method[b]	Identifying patients with prediabetes in office, based on HbA$_{1c}$ or glucose levels and BMI	• Patient completes ADA/CDC paper-based prediabetes risk test (13,14) • Practice staff verifies eligibility (Hb$_{A1c}$ or glucose level, BMI) • Practice staff counsels patient, provides educational materials about prediabetes and the YMCA DPP • Practice staff provides referral to patient and faxes patient information to YMCA DPP for follow-up to enroll patient
Combination of retrospective algorithm and point-of-care method	Applying both methods	Use both retrospective algorithm and point-of-care method concurrently

Abbreviations: ADA, American Diabetes Association; BMI, body mass index; CDC, Centers for Disease Control and Prevention; HbA$_{1c}$, hemoglobin A$_{1c}$; IT, information technology; YMCA DPP, YMCA's Diabetes Prevention Program.

[a] Illustrated by Figure 1.

[b] Illustrated by Figure 2.

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IMPLEMENTATION EVALUATION

A Community-Wide Collaboration to Reduce Cardiovascular Disease Risk: The Hearts of Sonoma County Initiative

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PEER REVIEWED

Summary

What is already known on this topic?

Clinical and community collaborations are foundational to primary care transformation efforts, but it has proved challenging to build sustainable, effective collaborations.

What is added by this report?

Several lessons from the experience of the successful Hearts of Sonoma County (HSC) collaborative, including 1) start small and focused to build trust among participants and demonstrate value, 2) work within the framework of a larger effort, and 3) providing long-term, open-ended backbone support.

What are the implications for public health practice?

The HSC experience may provide a roadmap for other, similar efforts.

Abstract

Purpose and Objectives

Collaboration across multiple sectors is needed to bring about health system transformation, but creating effective and sustainable collaboratives is challenging. We describe outcomes and lessons learned from the Hearts of Sonoma County (HSC) initiative, a successful multi-sector collaborative effort to reduce cardiovascular disease (CVD) risk in Sonoma County, California.

Intervention Approach

HSC works in both clinical systems and communities to reduce CVD risk. The initiative grew out of a longer-term county-wide collaborative effort known as Health Action. The clinical component involves activating primary care providers around management of CVD risk factors; community activities include community health workers conducting blood pressure screenings and a local heart disease prevention campaign.

Evaluation Methods

The impact of the clinical improvement efforts was tracked using blood pressure data from the 4 health systems participating in HSC. Descriptive information on the community-engagement efforts was obtained from program records. Lessons learned in developing and maintaining the collaborative were gathered through document review and interviews with key informants.

Results

Favorable trends were seen in blood pressure control among patients with hypertension in the participating health systems: patients with controlled blood pressure increased from 58% in 2014 to 67% in 2016 ($P < .001$). Between 2017 and 2019, the community engagement effort conducted 99 outreach events, reaching 1,751 individuals, and conducted 1,729 blood pressure screenings, with 441 individuals referred to clinical providers for follow-up care. HSC scored highly on 6 essential elements of an effective coalition and achieved a degree of sustainability that has eluded many other collaboratives.

Implications for Public Health

Factors contributing to the success of HSC include 1) starting small and focused to build trust among participants and demonstrate value, 2) working within the framework of a larger effort, and 3) providing long-term, open-ended backbone support.

Introduction

Improving the health of a population requires a multi-faceted approach that includes both community and clinical strategies (1). Implementing these clinic/community strategies successfully often requires multi-sectoral collaborations that bring together a broader range of organizations and institutions than are part of typical public health coalitions (2). For example, multi-sector Accountable Communities of Health have been part of many State Innovation Model (3) health improvement projects that are attempting to bring together a range of partners to work on health system transformation (4).

Although effective collaboration is needed to bring about health system transformation, doing it well has proved challenging. In a recent study by Siegel et al (5) of 145 health system improvement collaboratives that had a reputation for being mature and effective, as few as 10 were judged to be mature enough to make true progress toward supporting a transformed health system. Some of the challenges that have limited the effectiveness of previous public health–oriented coalitions (6) are accentuated in these newer, larger collaboratives encompassing more sectors (ie, reaching agreement on goals, approaches, and steps to action among varied organizations with competing organizational objectives).

One way of overcoming these challenges is to learn from successful collaborative efforts. Substantial literature on what makes a successful coalition exists (2,7,8), but we are aware of few published examples in which multi-sector collaborative efforts have been sustained over an extended period, and long-term sustainability is critical for creating a transformed, integrated health care system.

In this article, we describe the Hearts of Sonoma County (HSC) initiative, a county-wide, multi-sector collaborative effort to reduce cardiovascular disease (CVD) risk in Sonoma County, a medium-sized county in northern California. HSC grew out of Health Action, a larger multi-sector effort that has existed for more than 10 years. HSC is being evaluated using 1) a process evaluation to capture milestones in initiative development and factors associated with success, and 2) an outcome evaluation documenting changes in CVD outcomes (eg, blood pressure control) using pooled county-level provider data. This article describes the initiative and outcomes to date and identifies lessons learned and recommendations that may be useful for other, similar initiatives.

Purpose and Objectives

Sonoma County is the northwestern-most county in the 9-county San Francisco Bay Area region, with a population of 502,000 in in 2016 (9). Its county seat and largest city is Santa Rosa. The county is near the average for California in terms of income/poverty: the median household income of $61,000 is below the $67,700 statewide median, but the federal poverty rate is lower than the state as a whole — 11.2% versus 14.3% (9). The largest racial/ethnic groups are white (66%) and Hispanic (25%) (9). From 2015 through 2017, 31% of adults in Sonoma County had ever been diagnosed with high blood pressure, and 7% had ever been diagnosed with heart disease (10). Health care providers include Kaiser Permanente, St. Joseph Health, Sutter Health, and several federally qualified community health centers.

In 2007 the Sonoma County Department of Health Services, which includes the public health department, approached the county board of supervisors with a proposal to form a collaborat- ive to address social determinants of health and health equity. Health care was at the top of the county agenda because of a pub- lic hospital closing, and there was a growing recognition that health involves more than just health care. Therefore, the board of supervisors adopted the proposal and formed the Health Action collaborative.

Health Action brought together organizations in education, business, health care, labor, and public health to focus on social determinants of health and health equity and justice. Three focus areas were chosen: health care, education, and economic wellness, and standing committees created in each area. Education, known as Cradle To Career, focused on educational and social strategies to support children and youth reaching their fullest potential at every stage of life, such as coordinating a campaign focused on school attendance to address the effect of student absenteeism and working to develop agreed-upon local standards for college and career readiness in Sonoma County. Economic wellness focused on addressing local economic conditions and issues to support families becoming better able to make ends meet, such as affordable housing and helping low-income families take advantage of the earned income tax credit. The health care committee (the Committee for Healthcare Improvement) focused initially on primary care, addressing a shortage of primary care physicians and working to increase Patient-Centered Medical Home (PCMH) capacity. Over time, the committee recognized that a broadened focus was needed and shifted their attention first to end-of-life care and then, after a community health needs assessment, to reduce CVD risk. The initial collaborations around assessing local primary care capacity and PCMH were critical in establishing trust across health care entities in a competitive market. This trust extended to sharing workforce data.

HSC was formed by the committee in 2014 as a result of the new focus on CVD risk reduction. Drawing from the Centers for Disease Control and Prevention's Million Hearts campaign (11) and work being done by Kaiser Permanente to implement an effective algorithm for reducing CVD risk (12), individual provider organizations participating in the committee began implementing improved practices in their clinics in 2014. The fact that the community health centers and Kaiser Permanente groups served more than half of the population and were both engaged in cardiovascular health initiatives was a major factor in deciding to focus on CVD across health systems.

In 2016 the county applied for and received a California Accountable Communities of Health Initiative (CACHI) grant to transform and operationalize the work of Health Action by piloting accountable communities of health principles to address CVD with HSC through health care system and community-based interventions. Community outreach, education, and engagement efforts coalesced in the It's Up to Us campaign, a partnership between the United Way of the Wine Country and the Northern California Center for Well-Being (Center for Well-Being), which was launched in 2017. It's Up to Us has 3 primary goals: 1) educate the community about CVD risk factors, 2) conduct community-based blood pressure screenings, and 3) link high-risk individuals to primary care to reduce risk of heart attacks and strokes.

Intervention Approach

This section describes the clinical care and community engagement components of HSC, as well as the structure, and operations of the HSC collaborative. Figure 1 shows the structure of HSC and its position within Health Action.

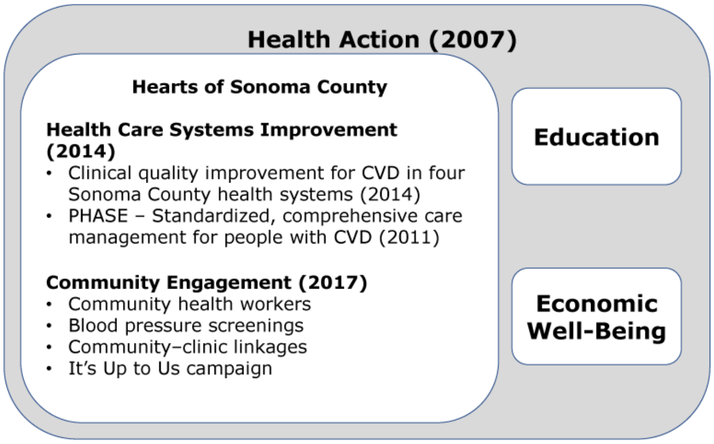

Figure 1. Sonoma County Health Action Collaborative, overall structure and health care activities, the Hearts of Sonoma County Initiative, Sonoma County, California. Abbreviations: CVD, cardiovascular disease; PHASE, Preventing Heart Attacks and Strokes Everyday.

Improving clinical care

The goal of the clinical care effort is to activate primary care providers around evidence-based interventions, including improved identification and management of hypertension and more consistent screening for other CVD risk factors, coupled with more robust smoking cessation support. With the funding from CACHI, the scope of the clinical effort was expanded to include secondary prevention modeled on the Kaiser Permanente Preventing Heart Attacks and Strokes Everyday (PHASE) initiative, which encompasses standardized, comprehensive care management and cardioprotective medications for people with CVD and those who have had a heart attack or stroke. The PHASE strategies being implemented include adoption of evidence-based clinical guidelines and standardized procedures for registered nurses; capacity building for population health management; provider/clinician/medical staff education and training; primary care workflow improvements; and extended team-based care. The population health framework introduced through PHASE is used by each entity, wherein the population at risk is identified and stratified and interventions and results are tracked on the population as a whole and by individual providers and, in some cases, by care team staff. This approach is effective in influencing clinical practice and improving outcomes.

Community engagement

The second part of the HSC strategy was to engage the community around CVD risk reduction and help link efforts in the clinical domain with interventions across the community, policy, systems, and environmental domains. Activities have included convening a new Community Engagement workgroup, training community health workers (CHWs) to conduct community-based education and blood pressure screenings, and convening a media workgroup to partner in a localized heart disease prevention media campaign. The following provide a brief summary of those activities.

Community Engagement workgroup. A Community Engagement workgroup facilitated by Center for Well-Being staff planned and implemented the campaign, including listening sessions (15 listening sessions, engaging 170 participants) to ensure the subsequent campaign spoke to populations at greatest risk for heart disease. Community was integral in shaping campaign messaging to shift their perception of risk and motivate them to take action.

Community-based education and blood pressure screenings. The Center for Well-Being developed a training module for Promotores de Salud/CHWs to be trained in blood pressure screening, identifying risk factors and warning signs, and learning what to do when they encounter residents with blood pressure outside the normal range, including how to link residents to care. Once trained, the Center for Well-Being leveraged existing partnerships to begin outreach in nontraditional settings. The Center for Well-Being developed a protocol to contact community members found to have high (140–169 mm Hg systolic or 90–99 mm Hg diastolic) or very high (≥170 mm Hg systolic or ≥100 mm Hg diastolic) blood pressure readings a few days after the screening to learn if they followed through with scheduling an appointment with their medical provider or contacting a clinic if they were out of care. The Center for Well-Being made arrangements with one community health center site in Santa Rosa, enabling CHWs to use a direct phone line to schedule medical appointments for people as soon as possible. Center for Well-Being staff links residents to additional support services, including health insurance assistance and behavioral change classes to prevent heart disease.

Localized heart disease prevention campaign. Listening session results were developed into 3 campaign concepts, further tested with residents from our target populations and revised based on their feedback. The goal of the It's Up to Us campaign, launched in August 2017, is community empowerment, encouraging people to take ownership of their health, with a first action of checking their blood pressure. Images, taglines, and the corresponding website (CheckYourBP.org) provide a cohesive media and messaging campaign. Collateral material such as the blood pressure cards and posters were designed and distributed to health care partners.

HSC collaborative identity and functioning

The HSC collaborative has evolved over time, from starting as an initiative of the Committee for Healthcare Improvement (a committee of the larger Health Action collaborative) to piloting how Health Action will function as an Accountable Community for Health. Table 1 lists the HSC partner organizations and their role on the project, as defined by their membership in workgroups and committees. Table 2 lists these same organizations and shows which parts of the organization are represented regularly at meetings (eg, clinical representatives, organizational leadership, administration/program managers).

The Sonoma County Department of Health Services provides backbone support for HSC, and the It's Up to Us community engagement work is backboned by the Center for Well-Being with funding from United Way. The Department of Health Services provides approximately 20 to 30 hours per week or 75% of a full-time position to coordinate HSC associated meetings. On average, the Center for Well-Being estimates 16 hours per week on work associated with HSC. However during the height of the campaign initiation (2017–2018), it was closer to 25 hours per week on campaign planning, coordination, and evaluation.

In 2018, HSC members assumed oversight of the CACHI Portfolio of Interventions, which includes management of mutually reinforcing clinical and community-based strategies that support the overall goal of improving cardiovascular health throughout Sonoma County. The clinical improvement and community engagement tracks operate independently but inform each other's activities, with several operational connections now, including a Clinical–Community Linkages workgroup. For example, patients identified with high blood pressure at the community screenings are linked to health care providers who are represented on the Committee for Healthcare Improvement.

Evaluation Methods

The evaluation design was largely retrospective and descriptive, documenting the development of the HSC initiative and its impact to the extent possible, given that this was not designed as a prospective research/evaluation study. The evaluation of HSC includes 1) documenting clinical care improvement efforts around CVD and the impact those changes have had on CVD outcomes; 2) capturing diverse community engagement efforts and their impact; and 3) working to understand the factors associated with the success of the collaborative, including challenges and lessons learned. The following is a brief description of the methods used in each of these three areas.

The long-term evaluation of the HSC clinical work is focused on tracking county-level CVD outcomes. HSC representatives recognized early the importance of sharing data, both for the continuous improvement and to document county-level outcomes. HSC clinical partner organizations signed a multi-party data sharing/nondisclosure agreement that enables them to report and aggregate data related to CVD risk factor interventions. To date, reporting partners have shared their Healthcare Effectiveness Data and Information Set (HEDIS) blood pressure control data annually to create a countywide report card that benchmarks and tracks how the local health system is doing overall with screening, diagnosing, and managing hypertension, and to track collective improvement. As of September 2017, 4 major primary care provider organizations in Sonoma County contributed 2014, 2015, and 2016 numerator and denominator totals for the 3 age groups and populations defined by the 2015 HEDIS Controlling Blood Pressure Technical Specification (control defined as blood pressure <140/90 mm Hg.). These organizations also reported their total number of adult patients for each of these years, which collectively represent about 57% of Sonoma County's overall adult population.

The evaluation of the community engagement efforts — blood pressure screening, CHW outreach, It's Up to Us media campaign — is a descriptive, process evaluation. Information gathered, both in real time through progress reporting and retrospectively, includes the number of screening events held, number of people screened, number of people with high or very high blood pressure, and number of individuals connected with primary care. There are several community engagement outcomes in which measures are being developed (eg, increased public awareness of CVD risk factors and community resources to help address them) (Figure 2).

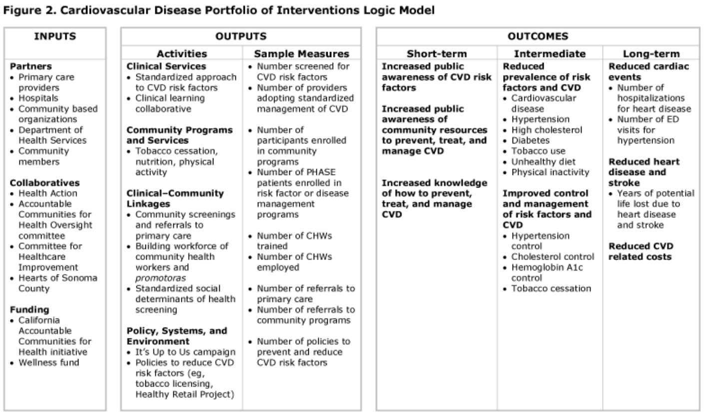

Figure 2. Cardiovascular Disease Portfolio of Interventions Logic Model

INPUTS	OUTPUTS		OUTCOMES		
	Activities	Sample Measures	Short-term	Intermediate	Long-term
Partners • Primary care providers • Hospitals • Community based organizations • Department of Health Services • Community members **Collaboratives** • Health Action • Accountable Communities for Health Oversight committee • Committee for Healthcare Improvement • Hearts of Sonoma County **Funding** • California Accountable Communities for Health initiative • Wellness fund	**Clinical Services** • Standardized approach to CVD risk factors • Clinical learning collaborative **Community Programs and Services** • Tobacco cessation, nutrition, physical activity **Clinical–Community Linkages** • Community screenings and referrals to primary care • Building workforce of community health workers and *promotoras* • Standardized social determinants of health screening **Policy, Systems, and Environment** • It's Up to Us campaign • Policies to reduce CVD risk factors (eg, tobacco licensing, Healthy Retail Project)	• Number screened for CVD risk factors • Number of providers adopting standardized management of CVD • Number of participants enrolled in community programs • Number of PHASE patients enrolled in risk factor or disease management programs • Number of CHWs trained • Number of CHWs employed • Number of referrals to primary care • Number of referrals to community programs • Number of policies to prevent and reduce CVD risk factors	**Increased public awareness of CVD risk factors** **Increased public awareness of community resources to prevent, treat, and manage CVD** **Increased knowledge of how to prevent, treat, and manage CVD**	**Reduced prevalence of risk factors and CVD** • Cardiovascular disease • Hypertension • High cholesterol • Diabetes • Tobacco use • Unhealthy diet • Physical inactivity **Improved control and management of risk factors and CVD** • Hypertension control • Cholesterol control • Hemoglobin A1c control • Tobacco cessation	**Reduced cardiac events** • Number of hospitalizations for heart disease • Number of ED visits for hypertension **Reduced heart disease and stroke** • Years of potential life lost due to heart disease and stroke **Reduced CVD related costs**

Figure 2. Cardiovascular disease portfolio of interventions logic model, the Hearts of Sonoma County Initiative, Sonoma County, California. Abbreviations: CHW, community health worker; CVD, cardiovascular disease; ED, emergency department; PHASE, Preventing Heart Attacks and Strokes Everyday.

Details about the evolution of the collaborative structure and process, as well as successes, challenges, and lessons learned, were gathered through document review and interviews with 8 key participants. The data gathering was organized using a framework developed by the Center for Community Health and Evaluation (CCHE) to track key elements in coalition development (Figure 3).

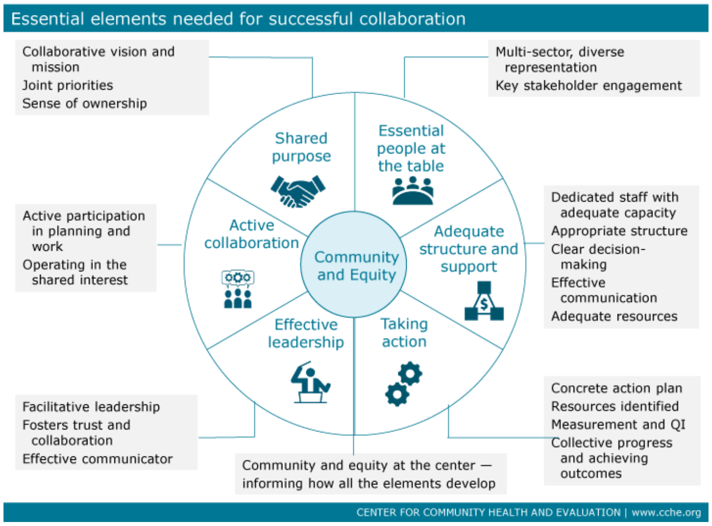

Figure 3. Essential elements needed for effective collaboration, the Hearts of Sonoma County Initiative, Sonoma County, California. Abbreviation: QI, quality improvement.

Results

Improving clinical care

Four major health systems have participated in the HSC work around implementing the PHASE protocol and other clinic-level interventions. Kaiser Permanente developed the protocol and has implemented it successfully in their 4 Sonoma County clinics. Other health systems have focused initially on pilot implementation in selected clinics or pods within clinics (eg, a large St. Joseph Health Medical Group practice in Santa Rosa). The community health centers began implementing PHASE in 2011 through a Kaiser Permanente Northern California Community Benefits program grant to the Redwood Community Health Coalition. Progress to date has included identification of nearly 25,000 patients with a diagnosis of hypertension, diabetes and/or atherosclerotic CVD across 22 clinic sites. Since baseline of March 2017, community health centers have demonstrated aggregate performance improvements in lifestyle measures including body mass index, tobacco, and depression screenings with documented follow-up plans as well as on prescription measures, including angiotensin converting enzyme/angiotensin receptor blocker and statin prescription rates, among patients aged 55 through 75 with diabetes.

County-level trends in CVD outcomes assessed by using the shared data from the 4 participating health systems have been encouraging. Figure 4 shows trends in blood pressure control for ages 18–59 years; results were similar in other age groupings. All of the year-to-year changes were significant ($P < .001$), increasing from 58% of participants who had their blood pressure controlled in 2014 to 67% in 2016. HEDIS benchmark trends for a comparable measure essentially did not change during that same period.

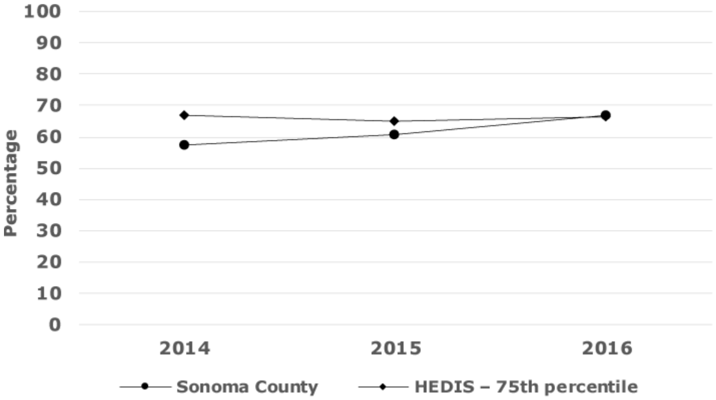

Figure 4. Percentage of hypertension patients aged 18 to 59 years with controlled blood pressure, the Hearts of Sonoma County Initiative, Sonoma County, California.

Community engagement

Between 2017 and 2019, the community engagement effort has conducted 99 outreach events, reaching 1,751 individuals, and conducted 1,729 blood pressure screenings. A total of 441 of the people screened were found to have high or very high blood pressure readings and were contacted for follow-up by bilingual Center for Well-Being staff to evaluate the effectiveness of the screening and to motivate them to connect with their doctor or a referred provider. Partners such as St. Joseph Health have integrated It's Up to Us into their community-based screenings, with staff adapting the campaign to meet the needs of the populations they serve. Future outreach opportunities being explored include senior centers, school parent groups, and grocery stores located in low-income neighborhoods. Work is underway to launch a blood pressure clinic with Santa Rosa Community Health's Fiesta site, piloting a faster point of entry to care for residents out of care found to have high or very high blood pressure readings. The Center for Well-Being and Santa Rosa Community Health are looking to expand the pilot to other clinic sites in the future.

Collaborative impact, sustainability, and success factors

The HSC collaborative provides the overall structure and support for the clinical and community activities, including forming relationships for interventions linking clinics and communities. The collaborative has achieved sustainability, a result that eludes many collaboratives. Understanding why it has been successful may provide lessons for other similar collaboratives.

Figure 3 summarizes the 6 elements in the coalition model that were used to enumerate and understand the success of the collaborative. Quotes were drawn from interviews with key HSC stakeholders, which included someone from each of the major participating organizations. HSC successfully fulfilled all 6 of the essential elements in the model. The shared purpose of reducing CVD risk through clinical and community approaches used was agreed to by all, and the language was revisited and updated as the initiative continued. A component of success was a strategic approach in aligning the existing goals, interests, and requirements of individual primary care organizations with the shared communitywide goal of improving CVD health. For example, all of the primary care organizations are evaluated on HEDIS or HEDIS-like measurements. Measurements were developed that would most closely match the specifications of required performance metrics to take advantage of data the organizations were already collecting. This approach and alignment meant that improvements resulting from the collaborative work of the HSC initiative translated to improved outcomes on performance measures that are important to the individual entities participating in the initiative, which in turn supported ongoing investment in the process.

The essential people and organizations were generally present within HSC although several informants noted the absence of community residents to provide a consumer perspective: "We're struggling with having resident involvement . . . [for example] neighborhood organizations." Community is at the center of the coalition model to emphasize that the efforts are ultimately designed to improve the health of community residents, who should therefore be engaged to define what matters to them in the way of health and how their health can be improved. The It's Up to Us campaign is working to increase the level of community engagement.

Effective leadership of HSC has generally been present in the form of a rotating group of clinical leaders from the different health systems. Several informants noted that leadership has come from many of the participating organizations: "Yes, we have strong leaders from all sectors — public health, clinical providers, and community-based organizations."

Informants were unanimous in praising the staff person from the Department of Health Services for providing more than adequate staffing and support, leveraging the small amount of county funding and the CACHI grant to support the growing number of HSC activities: "Our health department [Department of Health Services] has provided consistent critical support. They have competing priorities but have always been engaged in this effort."

Active collaboration is a critical but hard-to-define property of effective collaboratives: people and organizations set aside their more narrow organizational interests in support of the whole group. All of the informants understood the concept and agreed that over time people had seen the value of collaboration. As one informant said, “The tone of the meetings is sharing what works so that others can benefit from it. How can we improve care for all, recognizing differences and helping each other. It’s in the nature of how the organization came about. We’re charged with improving quality of life in a number of domains.”

Finally, taking action occurred initially in the form of health care organizations bringing back what they learned from the collaborative to their own organizations to be implemented: “Moving quickly to action to demonstrate value has been important; for example, one of the medical groups implemented a team-based care pilot in her own practice based on their HSC experience. People take things back.” The value of those early learnings helped catalyze other activities, including CACHI and community engagement.

In addition to validating the elements of the CCHE model, we asked respondents in a more open-ended way about the key accomplishments of HSC and why they thought the effort had lasted. They did not often mention specific activities or clinical improvements, but rather that they appreciated the collaboration itself and being able to step outside the competitive realm of their different health systems to focus on what could be done to improve patient and community health. The dialog and shared learnings at the monthly meetings built trust and promoted the active collaboration. Respondents attributed the sustainability of the HSC effort to the building of that level of trust.

Implications for Public Health

Although the positive results — early but encouraging countywide trends in blood pressure control and significant community engagement activities with more in the works — are important, another goal of the HSC evaluation was to understand the factors behind the staying power and impact of the collaborative. We looked in particular for structural or process factors that might be generalizable to other, similar collaboratives. Three such factors that emerged were starting small and focused, while working within the framework of a larger effort, and providing backbone support that was open-ended and not limited by funding time constraints.

Start small and focused to build trust and demonstrate value. The initial seeds of the HSC initiative were the activities of the Committee for Healthcare Improvement (CHI), operating as part Health Action starting in 2007. A small number of clinical champions from the key health organizations came together to see whether sharing lessons from others could benefit their own organizations. They were able to agree on a purpose and mission and move to action fairly quickly even though resources to implement whatever changes they identified were limited and had to come from within their own organizations. These early successes helped build trust and demonstrate the value of the collaborative.

Operate within a larger structure. Although the health care work involved a small number of people with a narrow focus, it was embedded in the larger Health Action collaborative. This had 3 long-term advantages. First, leaders on the Health Action Council approved projects undertaken by CHI, including HSC, which translated into a leadership and organizational commitment to HSC. Second, connections were created with a larger group of member organizations who were potential collaborators as the work grew in scope. Third, it was easier to secure long-term backbone support from Sonoma County, because the effort had a broad focus and therefore a wider political constituency.

The lessons about starting small but operating within a larger structure suggest a path for others seeking to ultimately create a large-scale collaborative to achieve health system transformation. Create a large, ambitious collaborative structure and membership, but be willing to focus initial activities narrowly where progress can most readily be made. This requires accepting modest results in terms of health impact, which can also help build the trust required for sustainability.

Other lessons were learned through this process. Grant-funded collaboratives are often time-limited, and it can be challenging to find funding streams to sustain the effort. A key to the success of HSC was the long-term in-kind support provided by the Sonoma County Department of Health Services. This was enough to provide support to the early focused efforts of HSC. Also, administrative and especially clinical leadership in each organization is essential to teach colleagues, guide the direction of change, and encourage the use of protocols. These can all be difficult for clinicians to accept and implement, so leadership is essential. Finally it is important to have small successes and celebrate them along the way. This keeps people interested and knowing progress is being made. Having the shared purpose, however, is key. These lessons are consistent with what others have found (8) and not revolutionary, but they are often ignored in the sense of urgency created by the need to transform the health care system and the availability of large-scale, but time-limited, funding available through State Innovation Model grants (3), Medicaid DSRIP (Delivery System Reform Incentive Payment) Waivers (13), and other sources.

Some limitations should be noted. The evaluation of the community engagement activities has been a more qualitative, process evaluation; longer-term outcome measures are still being developed. The data on CVD outcomes (eg, blood pressure) are limited to the 4 participating providers, which represent just over half of the county patient population. Finally, HSC is focused on CVD only, which, although a leading cause of illness and death, is not indicative of overall health system transformation. However, many of the issues that arise in working in CVD (eg, data sharing, collaboration across systems, linking with community resources) are present in broader transformation efforts, so the HSC lessons should apply.

The HSC collaborative members continue to work together. On the horizon are the continued expansion of the community engagement work, the creation of a clinical population health improvement collaborative to broaden and standardize the clinical improvement work, and additional population-level metrics to judge the impact. The goal continues to be implementing targeted, coordinated clinical, community, and policy interventions to improve cardiovascular health, recognizing that only by sustaining efforts over the long term can sustained health improvement be achieved.

Acknowledgments

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Tables

Table 1. Partner Organization Participation in Key Initiative Components, Hearts of Sonoma County Initiative, Sonoma County, California

Organization	Type of Organization	Health Action Council	Committee for Healthcare Improvement	HSC Leadership Team	HSC Membership	HSC Clinical WG	HSC Community-Clinical Linkages WG	HSC Community Engagement WG	HSC Data WG and Participation in Data Sharing	Accountable Communities of Health Oversight Committee
Center for Well-Being	Community-based organization: wellness programs	X		X		X	X	X		X
Ceres Community Project	Community-based organization: nutrition/meal assistance			X		X	X	X		
Farm To Pantry	Community-based organization: nutrition/meal assistance				X		X			
Health Action	Multi-sector collaborative	X	X	X	X	X	X	X	X	X
Integrative Medical Clinic Foundation	Health care provider				X	X	X	X		
Kaiser Permanente Santa Rosa	Health care provider				X	X	X		X	
Northern California Medical Associates	Local medical association									
Partnership Health-Plan of California	Managed Medicaid health plan		X		X	X	X			X
Petaluma Health Care District	Public health district	X			X	X	X	X		
Redwood Community Health Coalition	Consortium of community health centers	X	X		X	X	X	X	X	X
Santa Rosa Family Medicine Residency	Health care provider				X	X	X			
Santa Rosa Community Health	Health care provider	X	X		X	X	X	X	X	X
Sonoma County Department of Health Services	County public health department	X	X	X	X	X	X	X	X	X
Sonoma County Department of Health Services Tobacco Team/Smoke Free Tobacco Coalition	County public health department				X	X	X	X		
Sonoma County Family YMCA	Community-based organization: wellness programs				X	X	X	X		
St Joseph Health Medical Group	Health care provider	X	X		X	X	X		X	
St. Joseph Health Sonoma County, Health Promotion Programs	Health care provider				X	X	X	X		

Abbreviations: HSC, Hearts of Sonoma County; WG, workgroup.

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Table 1. Partner Organization Participation in Key Initiative Components, Hearts of Sonoma County Initiative, Sonoma County, California

Organization	Type of Organization	Health Action Council	Committee for Healthcare Improvement	HSC Leadership Team	HSC Membership	HSC Clinical WG	HSC Community-Clinical Linkages WG	HSC Community Engagement WG	HSC Data WG and Participation in Data Sharing	Accountable Communities of Health Oversight Committee
Sutter Medical Group of the Redwoods	Health care provider	X	X		X	X	X		X	
The Permanente Medical Group/Kaiser Permanente Santa Rosa	Health care provider	X	X		X	X	X		X	
United Way of the Wine Country	Non-profit organization/fundraising coalition				X			X		
West County Health Centers	Health care provider			X	X	X	X		X	

Abbreviations: HSC, Hearts of Sonoma County; WG, workgroup.

Table 2. Organizational Staff, by Partner Organization, Hearts of Sonoma County Initiative, Sonoma County, California

Organization	Clinical Representation[a]	Quality/Data Representation	Leadership Representation	CHW Participation	Administration/ Program Managers
Center for Well-Being			X	X	X
Ceres Community Project			X		X
Farm To Pantry			X		
Health Action	X		X		
Integrative Medical Clinic Foundation	X		X		X
Kaiser Permanente Santa Rosa	X	X	X		
Northern California Medical Associates	X				
Partnership HealthPlan of California	X		X		
Petaluma Health Care District			X		
Redwood Community Health Coalition	X	X	X		X
Santa Rosa Family Medicine Residency	X		X		X
Santa Rosa Community Health	X	X	X		X
Sonoma County Department of Health Services		X	X		
Sonoma County Department of Health Services Tobacco Team/Smoke Free Tobacco Coalition			X		X
Sonoma County Family YMCA			X		X
St Joseph Health Medical Group	X	X	X		X
St Joseph Health Sonoma County, Health Promotion Programs		X	X	X	
Sutter Medical Group of the Redwoods	X	X	X		X
The Permanente Medical Group/Kaiser Permanente Santa Rosa	X	X	X		
United Way of the Wine Country			X		X
West County Health Centers	X	X	X		X

Abbreviation: CHW, community health worker.

[a] Includes providers, pharmacists, and nurses.

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IMPLEMENTATION EVALUATION

Washington State's Fruit and Vegetable Prescription Program: Improving Affordability of Healthy Foods for Low-Income Patients

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Accessible Version: www.cdc.gov/pcd/issues/2019/18_0617.htm

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PEER REVIEWED

Summary

What is already known on this topic?

Programs that increase affordability of fruits and vegetables through financial incentives have improved fruit and vegetable consumption and food security among participants. However, program scalability is limited when programs rely on partnerships with farmers markets and small-scale grocers.

What is added by this report?

Through a process and outcome evaluation, this report highlights program implementation successes and barriers of providing fruit and vegetable prescriptions in partnership with a supermarket chain to low-income residents in Washington State.

What are the implications for public health practice?

A statewide fruit and vegetable prescription program is scalable and translatable across various types of patient–provider encounters and helps improve affordability of fruits and vegetables for low-income residents.

Abstract

Purpose and Objectives

We conducted a mixed-methods process and outcome evaluation for a statewide fruit and vegetable prescription program. The process evaluation assessed program implementation, identified opportunities for quality improvement, and provided recommendations for future programmatic activities. The outcome evaluation measured how the program affected purchases of fruits and vegetables among low-income patients and patient satisfaction with the program.

Intervention Approach

The Washington State Department of Health (WA DOH) partnered with public and private health care systems, public health agencies, a community-based organization, and a supermarket chain to launch a fruit and vegetable prescription program in 2016. The prescription was a $10 voucher redeemable for fruits and vegetables at any one of 169 participating supermarkets. Prescriptions were distributed to eligible low-income patients in clinics and community settings.

Evaluation Methods

WA DOH reviewed quarterly reports, meeting minutes and notes, telephone call logs, and email logs to solicit feedback on program implementation processes. We calculated overall prescription redemption rates on the basis of the number of prescriptions distributed by implementing partners and the number of prescriptions redeemed at participating supermarkets. We assessed patient satisfaction through a web-based survey. The study period was July 1, 2016, through June 30, 2018.

Results

Best practices for implementation included using the prescription to improve patient engagement and retention and connect patients to additional services, and working in the community to enhance program support and uptake. Overall, $154,810 in fruit and vegetable prescriptions were redeemed during the study period (54.4% redemption rate). Most survey respondents (88.2%) reported eating more fruits and vegetables than previously as a result of the prescription.

Implications for Public Health

Fruit and vegetable prescriptions are an effective way to increase affordability of healthy foods for low-income patients. These programs are scalable and translatable across various types of patient–provider encounters.

Introduction

Despite public health efforts, people in Washington State and the United States overall do not eat enough fruits and vegetables to meet national recommendations for a healthy diet (1–3). This is especially true for people who have limited access to healthy foods (4,5). Food insecurity — the limited or uncertain availability of nutritionally adequate and safe foods (6) — disproportionately affects people with low incomes, people of color, and rural residents (7). Food insecurity has a negative effect on health and increases the risk of developing chronic diseases such as type 2 diabetes (8–10) and hypertension (8,11). Increased fruit and vegetable consumption can mitigate the progression of chronic disease (12,13) and is associated with reduced risk of cardiovascular disease (14,15), cancer (16), stroke (14,17,18), and premature death (17,19).

Although in 2017 the overall food insecurity rate in Washington State (11.5%) was lower than the national average (12.5%), intrastate geographic and demographic disparities exist; the rate in some Washington counties is nearly 1.5 times the national average (20). Federal nutrition assistance programs, such as the Supplemental Nutrition Assistance Program (SNAP), are effective in significantly reducing food insecurity (21). However, SNAP participants are less likely than income-eligible and higher-income nonparticipants to consume fruits and vegetables (22,23). Programs that increase affordability of fruits and vegetables through financial incentives have improved rates of fruit and vegetable consumption (24) and food security (25) among participants overall and improved glycemic control among participants with diabetes (26). However, such programs are limited when they rely on partnerships with farmers markets that may operate only seasonally, or small-scale grocers that may carry only a small variety of fruits and vegetables.

The US Department of Agriculture's Food Insecurity Nutrition Incentive (FINI) Grant Program supports projects that incentivize the purchase of fruits and vegetables among SNAP participants (27). In 2015, the Washington State Department of Health (WA DOH) received a FINI grant to improve the nutritional quality of SNAP participants' diets in Washington State by implementing fruit and vegetable incentive programs with food retailers and community partners (www.doh.wa.gov/FINI). As part of the FINI grant, WA DOH began implementing a statewide fruit and vegetable prescription program in July 2016.

Purpose and Objectives

The objective of this study was to describe mixed-method process and outcome evaluation results after 2 years of implementation of the fruit and vegetable prescription program, using data collected from July 1, 2016, through June 30, 2018 (hereinafter, "the study period"). The purpose of the process evaluation was to 1) examine strengths and weaknesses of the fruit and vegetable prescription program implementation and 2) gain insight into successful programming activities for fruit and vegetable prescriptions. The purpose of the outcome evaluation was to 1) assess overall effectiveness of the program in improving affordability of healthy foods among low-income patients and 2) assess patient satisfaction with the fruit and vegetable prescription program. Although the program is planned to run through December 2019, the reporting of mid-program evaluation findings, given the current national climate for fruit and vegetable incentives (28), can help other health departments and interested parties in implementing similar programs.

Intervention Approach

In July 2016, WA DOH partnered with public and private health care systems, public health agencies, and a community-based organization (hereinafter, "implementing partners"), and a supermarket chain to launch a fruit and vegetable prescription program in counties where the prevalence of low fruit and vegetable intake, food insecurity, and chronic disease are disproportionately high (29). The fruit and vegetable prescription is a $10 fruit and vegetable voucher redeemable at any one of 169 participating supermarkets — defined as a store containing all major food departments and reporting at least $2 million in annual sales (30) — belonging to the supermarket chain (Figure 1). WA DOH designed the program on the basis of a 2014 fruit and vegetable prescription pilot program in Washington State with one participating health care system and the supermarket chain, and in consideration of the modeled health effects of fruit and vegetable incentives (31).

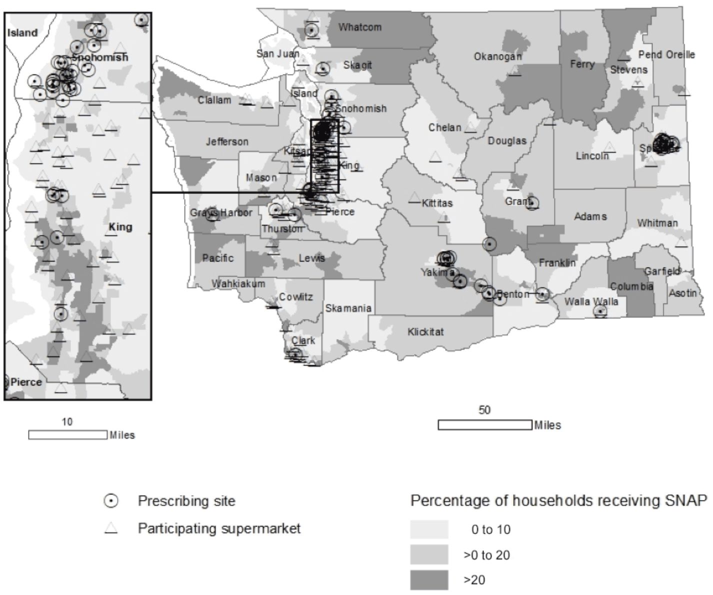

Figure 1. Percentage of households receiving Supplemental Nutrition Assistance Program benefits by census tract and location of prescribing sites and participating supermarkets, Washington State's Fruit and Vegetable Prescription Program, 2016–2018. Resources: Supplemental Nutrition Assistance Program data, American Community Survey, 2012–2016; clinic data, Healthy Eating Active Living Program, Washington State Department of Health.

Programmatic planning exercises during the first 15 months of the grant period (April 2015–June 2016) included an in-person meeting, email correspondence, and webinars with implementing partners. Through these exercises, WA DOH and implementing partners identified that they needed flexibility in implementing the fruit and vegetable prescription program.

Implementing partners used various types of patient encounters, prescribers, and dosing amounts (Table), which were determined by the needs of their diverse patient populations — including racial/ethnic minority groups, senior citizens, and residents in urban and rural areas — and typical workflows. The prescription — available in English, Spanish, and Russian — was distributed to patients during one-on-one clinic visits; disease prevention and management classes (including the Diabetes Prevention Program [32] and Chronic Disease Self-Management Program [33]); maternal, infant, and child health visits; community events; health education classes; and nutrition education classes. Prescribers handwrote a 1-month expiration date on the prescription at the time of distribution. Patients were required to be a SNAP participant to be eligible for the program, and prescribers confirmed eligibility verbally or through a questionnaire. The number of prescriptions (ie, "dose") received by patients varied across implementing partners, encounter types, and frequency of encounters (Table). We established no limit on the number of times a patient could receive a prescription (eg, in some settings patients received a prescription once per week for 6 months), and patients could receive prescriptions from more than one implementing partner. In some settings, adults received the prescription on behalf of children younger than 18 years. Implementing partners tracked prescription distribution via paper method or electronic medical record (EMR). Once per quarter, implementing partners reported monthly distribution numbers to WA DOH through an electronic data collection system. One or more unique Price Look Up (PLU) numbers was assigned to each implementing partner and was printed on the prescription.

Patients redeemed the prescription at any one of 169 participating supermarkets in Washington State. Patients presented the prescription at point-of-sale to purchase qualifying items, which included fresh, canned, or frozen fruits and vegetables without added fats, oils, sugars, or salt. No additional purchase was necessary to redeem the prescription, but patients were encouraged to purchase at least $10 of qualifying items per transaction. WA DOH and the supermarket chain provided training to store staff members to prepare for prescription redemption. At the point-of-sale, the prescription was scanned and purchase information was stored in the supermarket's sales database. The supermarket chain provided data on the number of prescriptions redeemed by PLU, by quantity and characteristics of items purchased, and by dollar amount.

Overall, 14 implementing partners participated during the study period. The program began with 9 implementing partners; 3 implementing partners discontinued distributing prescriptions in 2017 and 2018 because of staffing limitations. In 2018, 5 new implementing partners began distributing prescriptions, resulting in 11 implementing partners with 185 prescribers in 86 prescribing sites in the program in June 2018 (Figure 1).

Evaluation Methods

To assess the fruit and vegetable prescription program, we conducted a mixed-methods process and outcome evaluation. The process evaluation assessed program implementation, examining strengths and weaknesses of the program and identifying successful programming activities, to identify opportunities for program quality improvement and provide recommendations for future programmatic activities. The outcome evaluation measured program use: how the fruit and vegetable prescription program affected patients' purchasing of fruits and vegetables and patient satisfaction with the program. We developed the evaluation plan and questions on the basis of extensive stakeholder input through annual in-person meetings and presentations, quarterly telephone calls and webinars, and frequent email communication with implementing partners. The Washington State Institutional Review Board deemed evaluation activities exempt from review.

Process evaluation: qualitative data analysis of program implementation

As part of process evaluation activities, we reviewed quarterly reports, meeting minutes and notes, and telephone call and email logs to solicit feedback on program implementation processes. Each quarter, as part of regular reporting required for participation in the program, implementing partners identified key successes in their fruit and vegetable prescription program implementation activities and overall experiences with prescription distribution, including facilitators and barriers to effective implementation. We collected this information electronically through a secure online survey platform. All implementing partners responded to the same open-ended questions on facilitators, barriers, and key program activities. WA DOH staff members reviewed these electronic reports each quarter and tracked responses through a Microsoft Excel 2013 spreadsheet, providing technical assistance as needed for continuous program quality improvement. In all, this review included 89 reports generated during the study period.

WA DOH staff members also kept records of telephone calls and emails from implementing partners requesting technical assistance for program implementation and telephone calls and emails that described the steps taken as a result of this assistance. We matched details from telephone call and email logs to implementing partner reporting to identify and confirm quality improvement measures taken. In all, we reviewed records from 20 telephone calls and emails during the study period.

In addition to required implementing partner reporting and requests for technical assistance, WA DOH staff members held quarterly meetings, including 6 virtual meetings and 2 in-person meetings, during the study period. These meetings were an opportunity for the study team to ground-truth key themes emerging from reporting and provided a venue for more in-depth knowledge sharing among all implementing partners. WA DOH kept detailed agenda and meeting notes from each of these meetings.

Evaluation staff members reviewed all compiled responses from reporting, technical assistance efforts, and meeting notes and closed-coded responses to answer the following questions:

- What are major facilitators and barriers to 1) program implementation in the clinic setting and 2) patients' use of a fruit and vegetable prescription?
- What are key activities and/or resources considered critical to the successful implementation of an incentive program in the clinic setting?

Evaluation staff analyzed coded responses and identified patterns across responses by using thematic analysis.

Although one-on-one in-depth interviews were originally planned during the study period as part of the process evaluation, staffing limitations led to a change in methodology and approach. Additionally, preliminary review of documents received from implementing partners and sharing of results with key stakeholders showed that information from regular reporting and technical assistance activities was more than sufficient for identifying facilitators and barriers to program implementation and provided more timely information for continuous program quality improvement than would have been possible from interviews.

Outcome evaluation: quantitative data analysis of program use and patient satisfaction

We calculated overall prescription redemption rates for each implementing partner as a measure of program use. Each quarter, implementing partners reported the number of prescriptions distributed each month via a secure online portal. Each month, WA DOH also received point-of-sale transaction details for each prescription redeemed, including the PLU, dollar amount spent, and characteristics of items purchased, from the supermarket's sales database via secure file transfer. Fruits and vegetables purchased at the point of redemption were categorized according to type (fresh, frozen, or canned) and whether they were eligible to be purchased with the prescription (ie, contained no added fats, oils, sugars, or salt). We calculated redemption rates by dividing the number of prescriptions redeemed by the number of prescriptions distributed over the specified time period. We reported rates to implementing partners each quarter. We assessed redemption rates by quarter and time of month (first 10 days of month, second 10 days, and third 10 days) to determine how timing of SNAP benefit issuance affected prescription redemption. We compared redemption rates from earlier in the month (ie, the first and second 10 days of the month, when SNAP benefits would have been issued) with the third 10 days to assess whether the fruit and vegetable prescription was helping to stretch participants' SNAP benefits. We used data on purchases and redemption data to assess program use to answer the following evaluation question: To what extent did patients use the fruit and vegetable prescription?

We surveyed patients to assess their satisfaction with the fruit and vegetable prescription program. Because response rates for telephone and mail-based surveys are declining (34) and because these survey types are relatively labor-intensive to implement, we required a different approach and chose to test a web-based approach. Although one concern about web-based approaches to data collection is its accessibility among low-income or elderly populations, national data show that most low-income households and households with people 65 years or older use a computer or other handheld device for internet access (35).

Patients could complete the voluntary survey on any electronic device and were eligible to take the survey each time they received a prescription. When the prescription was distributed to an adult on behalf of a child's participation, the parent or guardian was invited to take the survey on behalf of the child. The survey consisted of 30 questions, including validated questions on demographic and socioeconomic characteristics (36), food insecurity (37), and fruit and vegetable consumption (38). Additional survey questions were provided or adapted from implementing partner feedback and tested among patient populations as applicable. These questions asked about health and shopping behaviors and general satisfaction with the fruit and vegetable prescription program. Analysis of the survey responses helped answer evaluation questions related to patient satisfaction, namely

- To what extent did patients find the fruit and vegetable prescription acceptable to use?
- How does receipt of a fruit and vegetable prescription change patients' knowledge, attitudes, and practices toward fruit and vegetable consumption, health behaviors, and perceived access to healthy foods?

The survey first became available to patients in September 2017. Each participant received a $3 electronic gift card at each survey completion (maximum 1 per week). We managed and calculated summary statistics (ie, percentages) by using Microsoft Excel 2013.

Results

Perspective of implementing partners

Implementing partners identified several key milestones and lessons learned as a result of the prescription program, illuminating potential areas for future program success.

Offering the fruit and vegetable prescriptions improved patient visits. Implementing partners consistently reported increased attendance and retention in health care appointments and community-based classes when prescriptions were offered. For example, one implementing partner reported higher-than-average completion rates among patients in the Chronic Disease Self-Management Program as a result of offering the prescription, with 95% of patients completing the 6-week program. Anecdotal evidence also showed that as a result of the fruit and vegetable prescription program, patients scheduled and kept more follow-up appointments with primary care dietitians, and no-show rates for home visiting decreased slightly.

Providing a method to identify high-need patients helped connect these patients to additional services. Several implementing partners incorporated food insecurity screening and nutrition wraparound services into their institutional workflows as a result of offering fruit and vegetable prescriptions. One pediatric primary care clinic referred food-insecure families to an outreach organization that helped families determine eligibility for and enroll in SNAP and other food assistance resources. Another implementing partner worked with community health workers who lived and worked in low-income housing sites to distribute prescriptions during nutrition education events. The community health workers were uniquely situated in these low-income housing sites and connected their peers to other health-related screenings and programs that improve food security and other social determinants of health.

Working in the community enhanced program support and uptake. Implementing partners reported using several methods to best reach eligible patients in their communities. One such method was having bilingual dietitians, nutrition educators, and other health care providers distribute fruit and vegetable prescriptions. One implementing partner hosted culturally relevant nutrition education classes in Russian and distributed the prescriptions in the Russian-speaking community. Other implementing partners reported efforts to engage with the Spanish-speaking community; however, some patients expressed hesitancy in enrolling in SNAP for fear of negative consequences to their documentation status.

Eliminating administrative burden helped ease program implementation. Implementing partners reported difficulty tracking distribution of the paper-based prescriptions for various reasons. First, the prescriptions required a hand-written expiration date, which increased workload on prescribers, as well as time required for distribution, which could affect patients' perception of the program. Prescribers in many encounters also had to count out each prescription during distribution, which required time and introduced potential human error in the number of prescriptions distributed. Many prescribers distributed prescriptions outside of traditional clinic visits (eg, at community-based nutrition education classes, during community health worker visits), and they used paper tracking sheets to document distribution because they did not have access to an EMR. Although prescribers could have used technology — for example, tablets or smart phones — for tracking purposes, the use of technology could have been perceived as intrusive to patients or as a barrier to prescribers. Finally, in the few locations where the EMR was available, implementing partners found that introduction of an EMR tracking method was cost-prohibitive because of the involvement of outside vendors or information technology staff.

Program use and patient satisfaction

Redemption rates and other characteristics of fruit and vegetable prescription transactions. During the study period, 28,481 prescriptions were distributed, with $284,810 provided to patients to use when purchasing fruits and vegetables. Of these, 15,481 prescriptions were redeemed, for an overall redemption rate of 54.4% (15,481 of 28,481). Because each prescription was valid for 1 month from the date of distribution, and the exact date of prescription distribution was not linked with date of redemption, this redemption rate is a conservative estimate; true redemption rates cannot be calculated until one month after the program's end, in December 2019. Redemption rates varied by quarter (Figure 2), ranging from 42.5% (376 of 884) in the first quarter of operation (July–September 2016) to 72.5% (2,336 of 3,221) in the third quarter of operation (January–March 2017). Rates also varied by implementing partner type, with 2 partners consistently showing redemption rates greater than 50% (partner 1, 64.1% [7,606 of 11,865] and partner 2, 57.1% [3,222 of 5,643]). Among all partners, overall redemption rates measured 33.9% (914 of 2,698) or higher. Redemption rates also varied by time of month. The redemption rate averaged 29.0% (4,489 of 15,481) during the first 10 days of the month, 33.0% (5,109 of 15,481) during the second 10 days, and 38.0% (5,883 of 15,481) during the third 10 days.

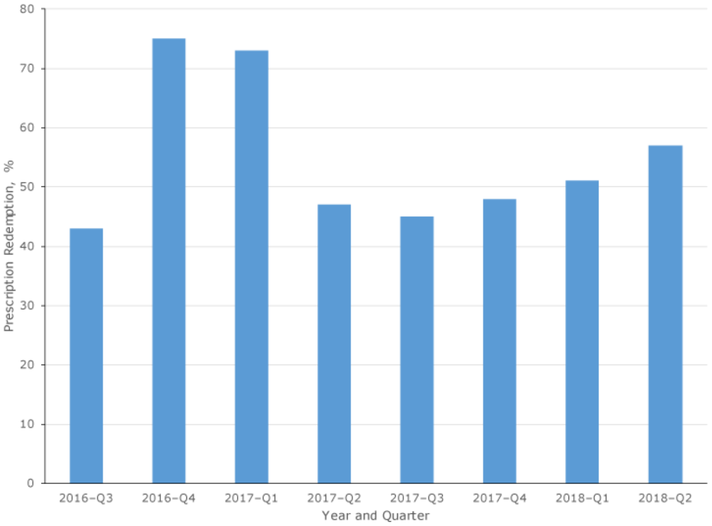

Figure 2. Quarterly redemption rate of prescriptions for all implementing partners combined, Washington State's Fruit and Vegetable Prescription Program, July 2016–June 2018. Redemption rates were calculated by dividing the number of prescriptions redeemed by the number of prescriptions distributed over the specified time period.

Although we could not track transactions at the patient level, linkage with the supermarket's loyalty shopper program showed that prescriptions were redeemed by at least 3,688 unique shoppers. In 95.6% of all prescription transactions (14,802 of 15,481), patients spent more than $10.00 on qualifying items (Figure 3). On average, shoppers spent $17.62 (standard deviation, $11.18) on qualifying items during the first shopping trip in which they redeemed a prescription. Although most items (94.0% of dollar amount spent; $145,520 of $154,810) purchased were fresh fruits and vegetables, patients used the prescription for purchase of canned (4.0%; $6,190 of $154,810) and frozen (2.0%; $3,100 of $154,810) fruits and vegetables.

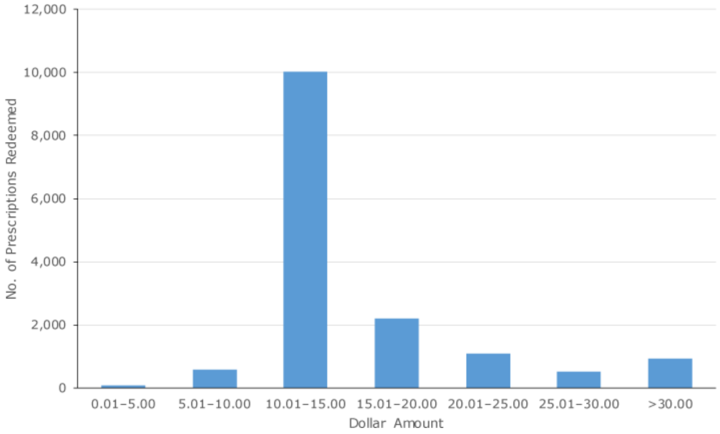

Figure 3. Dollar amount spent on fruit and vegetable purchases per prescription redeemed, Washington State's Fruit and Vegetable Prescription Program, July 2016–July 2018.

Perception of the fruit and vegetable prescription program among patients receiving prescriptions. From September 1, 2017, through June 30, 2018, 144 patients completed the electronic survey. Most respondents (88.9%; n = 128) reported the prescription was easy to use. Of the 144 respondents, 74.3% (n = 107) reported food in their home was less likely to run out as a result of the prescription, and 86.8% (n = 125) reported increased ability to afford balanced meals.

Patients also reported a perceived increase in fruit and vegetable intake as a result of receiving the fruit and vegetable prescription: 88.2% (n = 127) reported eating more fruits and vegetables than previously and 70.1% (n = 101) reported that they tried a new fruit or vegetable. In addition, 76.4% (n = 110) reported increased fruit and vegetable consumption among family members.

Participation in the program also resulted in patients' perceived health benefits: 71.5% (n = 103) reported managing their health conditions better, and 81.2% (n = 117) reported improvement in meeting nutrition, diet-related, or meal plan goals.

Implications for Public Health

Results from the mid-program evaluation affirmed that the fruit and vegetable prescription program improved affordability of fruits and vegetables for low-income patients and helped them achieve their health behavior goals. Our analysis shows patients maximized the full value of the prescription, and stretched limited food budgets to buy healthy foods. Patient-level survey responses showed a perceived improvement in consumption of healthy foods and perceived health benefits as a result of receiving the prescription.

Findings from our evaluation highlight several important points. First, our results show that fruit and vegetable prescription programs are scalable and translatable across various patient–provider encounter types in various geographic settings, but they require flexibility for implementing partners to fit into their typical institutional or programmatic workflows. Despite this requirement of flexibility, offering the prescriptions is an effective way to engage patients in educational and counseling sessions. A key reason for its effectiveness is that the prescription simultaneously addresses food insecurity and chronic disease prevention/management by providing financial support for patients to modify purchases and achieve healthy eating goals.

Second, our evaluation results show how social determinants of health can be incorporated into patient-provider encounters. Implementing partners can capitalize on fruit and vegetable prescription programs by establishing consistent, holistic enrollment criteria and processes for patients. Although funding for this program requires patients to be enrolled in SNAP, a useful screening tool for other fruit and vegetable prescription programs would be the Hunger Vital Sign (37), a validated 2-question food insecurity screening tool that identifies marginally and severely food-insecure patients (39). Screening for food insecurity is preferable to relying on enrollment in nutrition assistance programs to improve program reach, because some patients who are food insecure may not be eligible for or choose to sign up for SNAP benefits for various reasons (eg, income, immigration status). Additionally, patients who screen positive for food insecurity can be referred to other wraparound services such as federal nutrition assistance programs (eg, Special Supplemental Nutrition Program for Women, Infants, and Children [WIC], SNAP, senior nutrition programs) and community resources (eg, food banks). As evidenced by implementing partners' inclusion of community members in distributing prescriptions, along with providing community–clinical linkages for patients, it is important for prescription programs to offer culturally and linguistically tailored classes and materials to ensure programmatic effectiveness.

Third, minimizing the amount of time required by prescribers to distribute the prescriptions is helpful for effective program implementation. Although streamlining the process of distribution for all implementing partners may not be feasible, one strategy is to move from a paper prescription to a reusable card. Prescribers would issue the card and load it with a certain amount of dollars for fruits and vegetables, and patients would use it just like any other payment card at participating food retailers at point-of-sale. Prescribers could reload cards during follow-up appointments or classes. Although a card-based system may be more expensive than a paper-based system, ultimately it could increase efficiency and improve tracking for distribution and redemption.

Implementing partners worked with various populations, including racial/ethnic minority groups, senior citizens, and residents in urban and rural areas. For all implementing partners, redemption rates were 34% or higher. We realize that a statewide fruit and vegetable prescription program may not be feasible for other states to implement because of lack of funding and resources. However, similar programs at any scope or scale can benefit from the lessons learned in our evaluation. Additionally, such programs can play a role in connecting health care with social determinants, which ultimately can improve population health; therefore, funding organizations and legislators should consider investing in programs that support healthy food purchases for low-income patients.

This evaluation has several limitations. The diverse implementation of the fruit and vegetable prescription program limited the evaluation design, data collection methods, and subsequently the generalizability of findings. WA DOH supported flexibility in program implementation, which increased the number of patients receiving a prescription; however, this flexibility prevented the clear, concise interpretation and translation of results that is pos- sible under the conditions of a controlled trial. Although a redemp- tion rate of 54% is respectable, 46% of prescriptions were not redeemed. Because of the varied approaches in program implementation, we could not collect information from patients who did not redeem the prescription and better understand reasons for not using it. Data collection was logistically and ethically challenging because of the number of implementing partners and prescribers; for this reason, we collected a minimal amount of patient-level data. Additionally, program implementation hindered the collection of preprogram and postprogram measures, so we could not ascertain causal relationships. Finally, information on perceived benefit was limited to self-report, which is subject to bias. More objective measures, such as biometric measures collected from an EMR, could eliminate potential bias, and will be added to data collection activities in future years, where possible. Although the use of the electronic survey to collect data from patients enhanced data collection and minimized administrative burden, the response rate could be improved, and evaluation staff members will continue to work with implementing partners to improve this rate.

Despite these limitations, we believe that these evaluation activities were effective in providing a snapshot of the fruit and vegetable prescription program in Washington State. By using an electronic survey to collect data from patients and having electronic access to implementing partner reports and point-of-sale data, we streamlined the process of data collection, entry, and analysis. Consistent reporting from implementing partners allowed for continuous program quality improvement and provided an easy outlet for partners to report programmatic facilitators and barriers. We also believe that our findings and our approach, compared with those of a controlled trial, more accurately describe best practices for translating a fruit and vegetable prescription program to US settings that would not be appropriate for a controlled trial.

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Table

Table. Summary of Fruit and Vegetable Prescription Program Implementation Characteristics Across Implementing Partners, Washington State, 2016–2018

Partner ID No.	Implementing Partner type	Patient Encounter Type	Prescribers	Dose	Patient Population[a]	Distribution Period
1	Federally qualified health center	• Maternal, infant, and child health visits[b] • Nutrition education classes	Dietitians/nutritionists (n = 4), nurses (n = 4), social workers (n = 9), health educators (n = 2)	Varied according to family size and encounter frequency	Adults and children	July 2016–June 2018
2	Federally qualified health center	• Clinic visits • Health education classes	Health educators (n = 12)	1 or 2 Prescriptions per week, depending on family size	Adults	January 2018–June 2018
3	Federally qualified health center	• Clinic visits • Disease management and/or prevention classes[c] • Maternal, infant, and child health visits[b] • Nutrition education classes	Dietitians/nutritionists (n = 9), nurses (n = 6), social workers (n = 3), health educators (n = 9), community health workers (n = 8)	Varied according to family size and encounter frequency	Adults and children	April 2018–June 2018
4	General hospital	• Disease management and/or prevention classes[c] • Maternal, infant, and child health visits[b]	Dietitians/nutritionists (n = 4), nurses (n = 12), health educators (n = 11)	Varied according to family size and encounter frequency	Adults and children	July 2016–June 2018
5	General hospital	• Community events • Maternal, infant, and child health visits[b] • Nutrition education classes	Dietitians/nutritionists (n = 2), social workers (n = 2) clinician (n = 1), health educators (n = 1), outreach workers[d] (n = 7)	1 Prescription per encounter	Adults	July 2016–June 2018
6	Pediatric primary care clinic	• Clinic visits	Social workers (n = 2)	1 or 2 Prescriptions per week, depending on family size	Children	July 2016–June 2018
7	Outpatient medical clinics	• Clinic visits	Dietitians/nutritionists (n = 5)	2 Prescriptions per week	Adults	May 2018–June 2018
8	Public hospital district[e]	• Clinic visits • Community events • Nutrition education classes • Health education classes	Dietitians/nutritionists (n = 8), social workers (n = 2), outreach workers[d] (n = 14)	Varied according to family size and encounter frequency	Adults and children	March 2018–June 2018
9	Tribal health department	• Clinic visits • Community events • Nutrition education classes	Dietitians/nutritionists (n = 1), nurses (n = 1), social workers (n = 1), outreach workers[d] (n = 2)	1–4 Prescriptions per encounter, depending on family size	Adults and children	April 2018–June 2018
10	Local health department	• Community events • Maternal, infant, and child health visits[b] • Nutrition education classes	Dietitians/nutritionists (n = 3), health educators (n = 15), community health workers (n = 17)	1 Prescription per encounter	Adults and children	July 2016–June 2018
11	Local health department	• Community events • Nutrition education classes	Health educator (n = 1), community health workers (n = 2)	1 Prescription per encounter	Adults	July 2016–June 2018

[a] For all patient populations that include children, adults receive prescriptions on behalf of their children.

[b] Maternal, infant, and child health visits defined as home visiting, parenting classes, pregnant and postpartum visits, or Special Supplemental Nutrition Program for Women, Infants, and Children (WIC).

[c] Disease management and/or prevention programs defined as childhood obesity prevention programs, Chronic Disease Self-Management Program (34) or Diabetes Prevention Program (33).

[d] Outreach workers defined as community-based staff who link patients to health services.

[e] Public hospital district defined as a governmental entity authorized by Washington State law to deliver health services, including acute hospital care and preventive care.

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(continued)

Table. Summary of Fruit and Vegetable Prescription Program Implementation Characteristics Across Implementing Partners, Washington State, 2016–2018

Partner ID No.	Implementing Partner type	Patient Encounter Type	Prescribers	Dose	Patient Population[a]	Distribution Period
12	Local health department	• Nutrition education classes	Health educators (n = 2)	1 Prescription per encounter	Adults	July 2016–March 2018
13	Local health department	• Community events • Nutrition education classes	Outreach workers[d] (n = 2)	1 Prescription per encounter	Adults	July 2016–September 2017
14	Community-based organization	• Health education classes	Health educator (n = 1)	1 Prescription per encounter	Adults	July 2016–May 2017

[a] For all patient populations that include children, adults receive prescriptions on behalf of their children.

[b] Maternal, infant, and child health visits defined as home visiting, parenting classes, pregnant and postpartum visits, or Special Supplemental Nutrition Program for Women, Infants, and Children (WIC).

[c] Disease management and/or prevention programs defined as childhood obesity prevention programs, Chronic Disease Self-Management Program (34) or Diabetes Prevention Program (33).

[d] Outreach workers defined as community-based staff who link patients to health services.

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PREVENTING CHRONIC DISEASE
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PROGRAM EVALUATION BRIEF

A Public Health Framework to Improve Population Health Through Health Care and Community Clinical Linkages: The ASTHO/CDC Heart Disease and Stroke Prevention Learning Collaborative

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PEER REVIEWED

Summary

What is already known on this topic?

Integrating public health, clinical care, and community approaches can improve the clinical, social, and economic burdens of cardiovascular disease.

What is added by this report?

A learning collaborative to support state and territorial health agencies, health care systems, and community partners was developed to implement evidence-based practices for hypertension diagnosis and control across communities. A systems-change framework and rapid quality improvement process helped increase coordination between health agencies and health care systems.

What are the implications for public health practice?

This learning collaborative shows that health agencies in various jurisdictions can improve communication between community health organizations and public health and leverage technical and financial resources to support programs for patients to self-manage their blood pressure.

Abstract

Thirty-one state and territorial public health agencies participated in a learning collaborative to improve diagnosis and management of hypertension in clinical and community settings. These health agencies implemented public health and clinical interventions in medical settings and health organizations using a logic model and rapid quality improvement process focused on a framework of 4 systems-change levers: 1) data-driven action, 2) clinical practice standardization, 3) clinical–community linkages, and 4) financing and policy. We provide examples of how public health agencies applied the systems-change framework in all 4 areas to assess and modify population-based interventions to improve control of hypertension. This learning collaborative approach illustrates the importance of public health in the prevention and control of chronic disease by supporting interventions that address community and clinical linkages to address medical risk factors associated with cardiovascular disease.

Background

Cardiovascular disease (CVD) is the most common cause of death in the United States and a source of suffering and disability. Reductions in deaths from CVD are largely due to decreased use of tobacco products, improvements in blood pressure and cholesterol control, and advances in medical treatment (1,2). However, declines in death rates from heart disease have slowed, and additional action is needed to sustain progress and decrease the risk of illness and death associated with CVD (3).

In 2017, the American College of Cardiology and the American Heart Association released new blood pressure guidelines that suggest lowering the optimal blood pressure target from below 140/90 mm Hg to below 130/80 mm Hg; however, among people with high blood pressure in the United States, only half were in compliance with the previous guidelines, and fewer will meet the new ones (4). Diagnosis and control of hypertension is an opportunity for public health entities to work with health care systems at the state, tribal, local, and territorial levels to support and improve clinical care of patients with high blood pressure. In addition, blood pressure control largely depends on patient self-management and may benefit from more comprehensive community-based approaches (5–7).

Cooperative Agreement Purpose and Structure

In 2013, the Centers for Disease Control and Prevention (CDC), Division for Heart Disease and Stroke Prevention, began a cooperative agreement with the Association of State and Territorial Health Officials (ASTHO), a national nonprofit organization representing public health agencies in the United States, the US territories, and the District of Columbia. ASTHO and CDC developed a learning collaborative, defined as a group of public health leaders and partners who have a common interest in a subject area that collaborates to achieve sustainable change and improvement. The ASTHO/CDC Heart Disease and Stroke Prevention Learning Collaborative was designed to support state and territorial health agencies, health care systems, and community partners in efforts to improve hypertension diagnosis and control in and across communities by supporting the implementation of evidence-based practices (8).

ASTHO and CDC developed a logic model for the learning collaborative that served as a blueprint for health improvement measures and approaches (Figure). The logic model was based on the CDC National Center for Chronic Disease Prevention and Health Promotion's 4 domains of public health action (9). A framework for systems change was developed for the learning collaborative (10), and it focuses on 4 systems-change levers: 1) data-driven action, 2) clinical practice standardization, 3) clinical–community linkages, and 4) financing and policy (10).

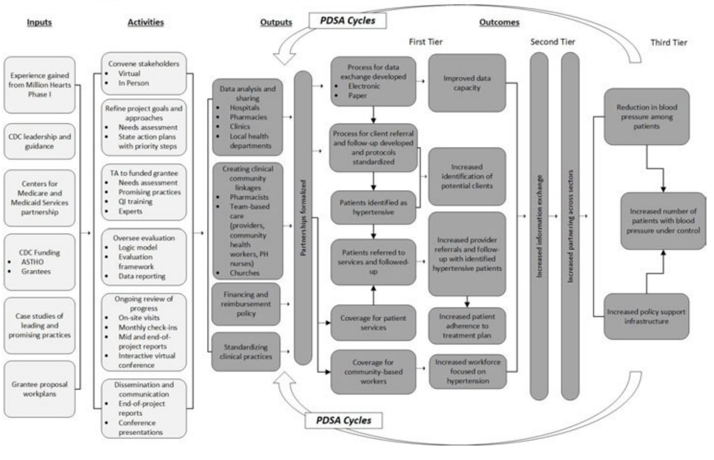

Figure. Logic model for ASTHO/CDC Heart Disease and Stroke Prevention Learning Collaborative. Abbreviations: ASTHO, Association of State and Territorial Health Officials; CDC, Centers for Disease Control and Prevention; PDSA, Plan, Do, Study, Act; PH, public health; QI, quality improvement; TA, technical assistance.

Jurisdictions, including state, territorial, and tribal-serving organizations, partnered with local public health agencies, community health centers, and private clinics to implement programs that prevent, detect, and reduce hypertension rates. States, tribal-serving organizations, and territories developed an aim statement to summarize their project's intervention approach, objectives, and program, which provided a source of continuity of reporting and data sharing, as officials and partners regularly communicated and reported on project progress to CDC, ASTHO, and other jurisdictions in their cohort. Jurisdictions used the logic model as a guide to help categorize their intervention approaches into the 4 main components of the ASTHO framework. The learning collaborative also used a rapid quality improvement process focused on the "plan," "do," "study," and "act" (PDSA; Institute of Health Improvement [11]) model to improve program implementation in a rapid, yet systematic fashion. The PDSA cycle allowed for rapid implementation, refinement of activities in the framework, and process improvement in a 10-month period.

We reviewed our experience using a 4-component framework to address systems change and the rapid quality improvement process to help states change systems, provide an overview of activities from 3 state health departments who implemented the framework, and summarize the implications for public health practice of using this approach.

Implementation of the Learning Collaborative

After an ASTHO-led Request for Proposal, states, tribal-serving organizations, and territories (jurisdictions) submitted proposals and were funded to develop a quality improvement process to improve hypertension diagnosis and control (Phase 1) (9). Ultimately, 31 jurisdictions, which included partnerships with tribal-serving organizations, participated in the learning collaborative during a 5-year period. Each collaborated with a range of stakeholders, which included public health agencies, health care providers, clinical quality improvement organizations, health information technology experts, public and private payers, pharmacists, community-based health care professionals, community organizations, local health departments (LHDs), and others. These unique partnerships provided jurisdictions with access to various resources to facilitate community and patient engagement (eg, home blood pressure monitoring and pharmacy counseling programs), as well as data sources (eg, electronic patient registries) to identify people with undiagnosed hypertension, uncontrolled hypertension, or both.

We applied the strategies used to implement the ASTHO/CDC framework in 3 states, each with a unique set of characteristics:

New York, Oklahoma, and Arkansas (Table). New York State has many resources and has consistently been an early adopter in implementing population-based interventions through its health department to improve control of medical risk factors for chronic disease. New York participated in Phases 1 and 2 of the learning collaborative. Arkansas has modest resources and has emerged as a leader in addressing community–clinical linkages to address self-management of chronic disease risk factors through work with local clinics. Arkansas enrolled during the second year (Phase 2) and continued to participate throughout the 5 years. Oklahoma instituted a unique collaboration between the state health department and an independent, self-governed, tribal nation. Oklahoma joined the collaborative during the third year (Phase 2) of implementation under an expansion of the initiative to address hypertension disparities in American Indian/Alaska Native populations. Each state used a comprehensive approach to improve hypertension identification and control by working across all 4 systems-change levers in our framework (Table). Each state excelled in its implementation of specific areas of the framework.

New York. New York used data-driven action to support Federally Qualified Heath Center use of electronic health records to identify and track patients with hypertension, resulting in an improvement in hypertension control rates of 18.7% across centers in just 2 years. Their use of a regional health information exchange provided real-time county-level rates of hypertension, hypertension control, and undiagnosed hypertension and is now a model for other state and territorial programs.

Arkansas. Arkansas developed and tested well-defined hypertension care management plans in 4 counties, on the basis of a community team-based care approach that ultimately became the model for a standardized protocol that is now used statewide. They used a web-based pharmacy platform to help community pharmacists identify patients with uncontrolled blood pressure and calculate and monitor patient medication adherence (12).

Oklahoma. A unique collaboration with Oklahoma and the Choctaw Nation leveraged community resources to establish a pharmacy-based hypertension management model through a partnership with a university college of pharmacy. The approach greatly expanded self-management options and resources for patients across a large rural area, throughout nontribal health systems and within the Choctaw Nation.

Implications for Public Health Practice

The jurisdictions participating in the ASTHO/CDC Heart Disease and Stroke Prevention Learning Collaborative are compelling examples of effective approaches to hypertension management and control that can be implemented at the state and community levels when funding and technical support are made available. Before their participation in the learning collaborative, states received direct funding from CDC to support their core heart disease and stroke prevention programs. The learning collaborative work built on this capacity and provided a structured environment for states to work more deliberately on systems change using the team-based rapid improvement model. Learning collaborative states received modest additional funding through the learning collaborative, which was used to facilitate team building, expand data collection efforts, and support additional reporting requirements. Grantees were able to hire additional personnel to oversee and facilitate their intervention approach, expand the use of jurisdiction-wide standardized hypertension measures, refine and expand capacity to use health information exchanges to inform clinic-based and population-based health improvement efforts, and establish and strengthen ongoing, standardized clinical data reporting.

Findings from these case studies support early reports that integration of public health, clinical care, and community health centers can help health systems address the clinical, social, and economic burdens of CVD (8,9). These jurisdictions demonstrated short-term gains in health systems integration and progress toward long-term goals of systems and policy change to improve hypertension diagnosis and control.

This learning collaborative illustrates how public health efforts are necessary to help prevent and control chronic disease by supporting interventions that focus on clinical outcomes associated with CVD. Although clinical outcomes are challenging to attribute to a population health program, in part because of a lack of a comparison group, quality improvement programs have shown substantial improvements in management and control of chronic diseases when public health and clinical care services are integrated (10,13). However, implementing large program-based initiatives typically takes time, is contingent on both public and private partnerships, and requires multiple resources for implementation and evaluation. ASTHO was able to accelerate the implementation process, while maintaining standards for quality improvement because of its ties with jurisdiction health leaders and historical success with multisector collaboratives (8,9). A focus on a 4-component framework of systems-change levers, and a rapid quality improvement process allowed for increased coordinated efforts between jurisdictions and community health agencies. Jurisdictions had opportunities to assess the progress of their intervention, rapidly adjust their program with tools provided by ASTHO and CDC, and share evidence-based best practices among other jurisdictions.

Blood pressure control is largely dependent on patient self-management programs. However, such programs are less frequently integrated into the team-based care model and monitored by health care systems (5–7). This learning collaborative shows that health agencies in various jurisdictions can facilitate communication between community health organizations and public health and leverage technical and financial resources to support programs for patients to self-manage their blood pressure. Ultimately, other funding streams and strategies such as health care payer reimbursement are needed to sustain these programs and take them to a national scale.

Jurisdictions that participated in the ASTHO/CDC Heart Disease and Stroke Prevention Learning Collaborative addressed different intervention approaches. These approaches included partnering with leadership from traditionally marginalized communities, bridging clinical services, and providing capacity building. Our report highlights a framework of systems-change levers that addresses key areas for program sustainability and reach. Examples include using electronic health record systems to drive identification of undiagnosed and uncontrolled hypertension; implementation of protocols for treatment, referrals, and follow-up to ensure clinical practices are standardized across public health; and formation of partnerships between community organizations and local clinics that help expand networks and self-management support. An evaluation of the approaches and outcomes of the 5-year learning collaborative is under way (unpublished data). It will provide further insight into differences in governmental public health structures that may better integrate diagnosis and control of hypertension at the community level and improve outcomes.

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Table

Table. State and Tribal Characteristics and Results of Evidenced-Based and Promising Best Practices in 3 States, ASTHO/CDC Heart Disease and Stroke Prevention Learning Collaborative, 2013–2018

Best Practices Used to Achieve Results	New York State	Oklahoma	Arkansas
Community–clinical linkages			
Establish connections between health care, public health, and other jurisdictions to improve access to hypertension services and support throughout the care continuum, as well as increase data sharing among states and territories.	Local health departments and Federally Qualified Health Centers; home blood pressure monitoring program with clinical support; health information exchange data analysis.	Pharmacy hypertension clinic; Choctaw Nation health system and pharmacists; academic partnership with University of Oklahoma Health Sciences Center College of Pharmacy.	Partnerships with providers, local health units, community pharmacies and senior centers in rural, underserved communities.
Data-driven action			
Improve data exchange or capacity by using health information technology to facilitate patient identification, referral, and follow-up.	Metrics developed with electronic medical record data; data registries used to track and contact patients; data system used to evaluate and report clinical outcomes.	Data from electronic health records used to identify patients with uncontrolled hypertension for referral (counseling or management).	Used data from electronic medical records to identify undiagnosed hypertension. Partnership with Humana to improve quality of care.
Standardization of clinical practice			
Implement protocols to ensure consistency in intervention implementation and data collection and analysis methods.	Adopted and implemented hypertension treatment protocols; home blood pressure program with clinical support; and systems for tracking and follow-up.	Developed a referral process; established a pharmacist–provider collaboration; educated and counseled patients; calculated arteriosclerotic cardiovascular disease risk; and conducted blood pressure monitoring and follow-up.	Protocols for referrals to local clinics established a program for counseling by pharmacist; developed strategies for hypertension management based on a team-based care framework.
Financing and policy			
Create a sustainable system to improve hypertension prevention, detection, and control through payment reform, and help jurisdictions leverage funding outside of the learning collaborative to establish systems of care or expand their programs and initiatives to other areas throughout the jurisdiction.	Instituted a 90-day pharmacy benefit to expand coverage for medications for hypertension in their Medicaid-managed care plans.	Computed a return of investment of $160 per dollar spent, based on the average emergency department cost of a single cardiovascular disease event.	Established a partnership with a private payer, a health care coalition, and a hospital to develop a payer model for transition of hypertension care from emergency departments to team-based care and medical homes.

Abbreviations: ASTHO, Association of State and Territorial Health Officials; CDC, Centers for Disease Control and Prevention.

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IMPLEMENTATION EVALUATION

Multisector Approach to Improve Healthy Eating and Physical Activity Policies and Practices in Early Care and Education Programs: The National Early Care and Education Learning Collaboratives Project, 2013–2017

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PEER REVIEWED

Summary

What is already known on this topic?

Incorporating healthy eating and physical activity best practices in early care and education settings is important for instilling healthy behaviors early in life.

What is added by this report?

A collaborative intervention among a health care system, state-level partners, and early care and education programs increased the number of best practices being met related to breastfeeding and infant feeding, child nutrition, infant and child physical activity, screen time, and outdoor play and learning in early care and education settings.

What are the implications for public health practice?

Development, implementation, and evaluation of policy and practice-based partnerships to promote healthy eating and physical activity among children attending early care and education programs may help prevent obesity in the United States.

Abstract

Purpose and Objectives

Embedding healthy eating and physical activity best practices in early care and education settings is important for instilling healthy behaviors early in life. A collaborative partnership between Nemours Children's Health System and the Centers for Disease Control and Prevention was created to implement the National Early Care and Education Learning Collaboratives Project (ECELC) in childcare settings in 10 states. We measured improvement at the program level by the self-reported number of best practices implemented related to healthy eating and physical activity.

Intervention Approach

The ECELC implemented a collaborative model with state-level partners (eg, child care resource and referral networks) and early care and education programs. Intervention components received by program directors and lead teachers included 1) self-assessment, 2) in-person learning and training sessions, 3) action planning and implementation, 4) technical assistance, and 5) post-reassessment.

Evaluation Methods

A pre–post design assessed self-reported policies and practices related to breastfeeding and infant feeding, child nutrition, infant and child physical activity, screen time, and outdoor play and learning as measured by the validated Nutrition and Physical Activity Self-Assessment for Child Care (NAP SACC) best practices instrument. The sample included 1,173 early care and education programs.

Results
The number of best practices met for each of the 5 NAP SACC areas increased from pre-assessment to post-assessment approximately 6 months later and ranged from 1.5 to 4.7 best practices ($P <$ .001). Almost all increases occurred regardless of participation in the Child and Adult Care Food Program, Quality Rating Improvement System, Head Start/Early Head Start, and/or accreditation status.

Implications for Public Health
The innovative and collaborative partnerships led to broad implementation of healthy eating and physical activity–based practices in early care and education settings. Development, implementation, and evaluation of policy and practice-based partnerships to promote healthy eating and physical activity among children attending early care and education programs may contribute to obesity prevention in the United States.

Introduction

More than 1 in 8 children (14%) aged 2 to 5 years were obese in 2016 (1). Children who are obese are more likely to be adults who are obese and are at an increased risk for chronic diseases (ie, type 2 diabetes, cardiovascular disease, and some cancers) and premature death in adulthood (2). Furthermore, children with obesity are susceptible to depression, emotional and behavioral disorders, and poor self-esteem (3). Possibly because of comprehensive changes at the environmental and policy levels and targeted practice interventions, slight declines in obesity among children aged 2 to 5 years have been reported in some communities in the United States (1,4). These reports provide early and promising evidence for policy and practice obesity prevention efforts for this age group (1,4).

Promotion of healthy eating and physical activity (HEPA) behaviors in early care and education (ECE) settings can reduce the risk of obesity among the nearly 13 million children aged 5 years or younger who spend some portion of their week in this setting (5,6). Given the high level of exposure young children have to policies and practices in ECE programs, they are a key setting to implement strategies to improve policies and practices and contribute concurrently with other childhood obesity prevention efforts in the United States (7). Further, HEPA-based interventions targeting ECE environments, practices, and policies have demonstrated success in improving the quality of care provided (5,8–12). Preliminary evidence suggests that ECE environmental-level strategies, such as improving policies and practices related to eating, physical activity, and sedentary behaviors, may improve health behaviors of children enrolled in these programs (13–15). Although ECE provider-level interventions have demonstrated success, integrating the promotion of HEPA-based practices and policies into existing ECE systems may contribute concurrently with other initiatives aimed at childhood obesity prevention among children aged 5 years or younger.

Nemours Children’s Health System (Nemours) collaborated with the Centers for Disease Control and Prevention (CDC) to implement the National Early Care and Education Learning Collaboratives (ECELC) Project in 10 states. In 2007, Nemours developed and implemented an intervention in Delaware to promote HEPA among children in various settings, including ECE settings. A key part of the initiative was the establishment of learning collaboratives using a “train-the-trainer” model with ECE programs to identify and implement healthier policies and practices (16). The Nutrition and Physical Activity Self-Assessment for Child Care (NAP SACC) instrument (17,18) documented that all 28 ECE programs reported significant improvement in either healthy eating practices or physical activity practices, and 81% of the programs improved in both (16). In 2012, Nemours adapted this model for spread and scale, ultimately reaching 10 states (Alabama, Arizona, California, Florida, Indiana, Kansas, Kentucky, Missouri, New Jersey, and Virginia) in collaboration with CDC (19). The resulting ECELC aimed to promote healthy environments, policies, and practices related to breastfeeding and infant feeding, child nutrition, infant and child physical activity, screen time, and outdoor play and learning in ECE programs. To our knowledge, this is the largest effort to improve HEPA policies and practices in ECE programs across multiple states.

Purpose and Objectives

The ECELC recently ended its sixth and final year of implementation. The project established and implemented learning communities with teams of ECE providers to promote peer learning and to support and improve their HEPA policies and practices. The ECELC’s learning collaborative design is an adaptation of the Institute for Healthcare Improvement’s Breakthrough Series model (20). The ECELC was guided by a theory of change (Figure 1), which was previously applied to ECE programs (21), to outline the inputs, activities, and outcomes anticipated as part of the intervention. Evaluation efforts explored the degree to which several short-term outcomes were achieved. The primary outcome assessed throughout the evaluation was related to changes to HEPA policies and practices in ECE settings, and data were derived by using the NAP SACC instrument from 2013 to 2017 (the first 5 years of the

ECELC). The purpose of this evaluation was to determine if scores from the NAP SACC instrument improved from pre-assessment to post-assessment and how similar or different these scores were across programs with regard to auxiliary federal, state, or independent agency program participation.

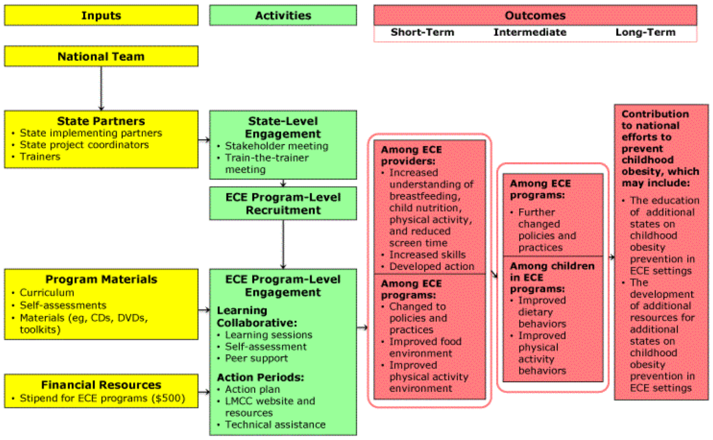

Figure 1. Abbreviated National Early Care and Education Learning Collaboratives Project theory of change. Abbreviations: CD, compact disc; DVD, digital versatile disc; ECE, early care and education; LMCC, Let's Move! Child Care.

Intervention Approach

Inputs. Inputs included the national team (ie, Nemours, CDC, and the Gretchen Swanson Center for Nutrition), state partners, program materials, and financial resources. State partners included a state implementing partner (statewide organization serving as the implementer), a state project coordinator (a staff member employed by the state implementing partner), and trainers to facilitate learning sessions and provide technical assistance. Program materials included the ECELC curriculum and training materials (eg, toolkits), as well as self-assessments (eg, NAP SACC instrument). Lastly, each ECE program received a $500 stipend to support staff time and purchasing of equipment.

Activities. Although Nemours provided guidance and direction on implementation, the state implementing partner had flexibility for the purposes of ownership and buy-in. It was anticipated that ECE program involvement in other state-level programs and initiatives had potential for impact on the effectiveness of the ECELC, so the model was intended to be tailorable at the state, local, and ECE program levels. ECE programs were recruited by state project coordinators through various informal methods, including personal telephone calls, online recruitment, and connections with groups such as Head Start/Early Head Start. A strength of this recruitment method was many state implementing partner agencies had existing relationships with programs and were providing them with support in other, nonhealth areas of program improvement. To be eligible to participate, ECE programs initially had to be op- erating in a center-based physical facility and designate a team of up to 3 people (eg, owner or director, teacher, cook) to attend 5 in- person learning sessions. During the first 5 years of the ECELC, 2,266 ECE programs were enrolled and 1,910 completed the intervention (84%).

ECE program engagement. The ECELC implementation cycle spanned approximately 10 months and consisted of 5 main strategies: 1) self-assessment; 2) in-person peer learning sessions, 3) action planning and implementation, 4) technical assistance, and 5) re-assessment.

In-person peer learning. Leadership teams and other staff participated in 5 approximately 6-hour in-person learning sessions led by trainers over a 10-month period. These sessions included didactic presentations on HEPA-based content, interactive activities, and peer sharing and support. Of the 572 programs enrolled in the first year of this project, the average number of learning sessions attended per program was 3.4 sessions (attendance data were not analyzed in later years).

Action planning. After each of the first 4 learning sessions, teams were tasked to return to their ECE programs and share what they learned. This type of peer sharing aimed to help build program-wide staff support for implementing best practices across the 5 topic areas. Each program created improvement goals with corresponding objectives based on their self-determined need (using what they learned from their self-assessment as a guide), interest, and capacity. Programs were not required to set goals for each of the 5 topic areas. Using a social ecological approach (22), programs then set action steps for each objective across 5 levels: child, family, program staff, program environments, and program policies (Figure 2).

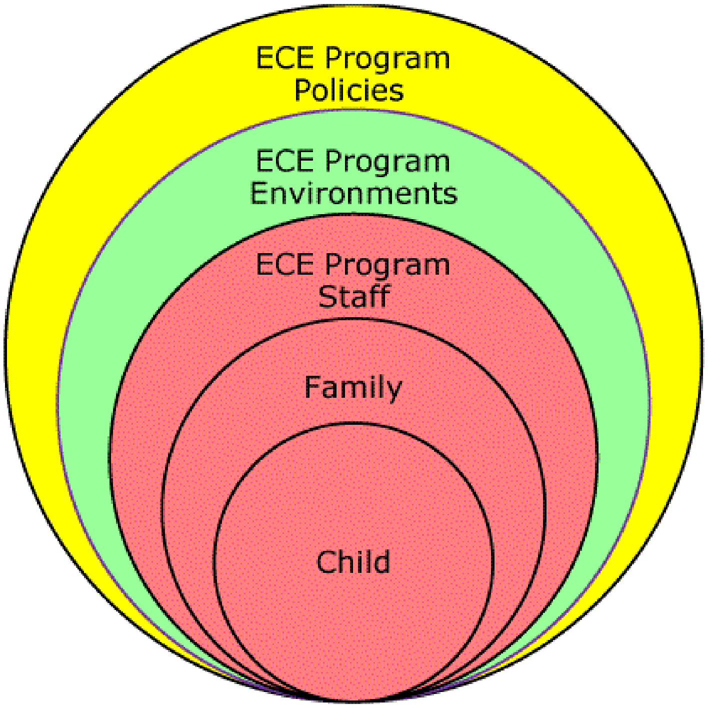

Figure 2. Abbreviated National Early Care and Education Learning Collaboratives Project social ecological approach.

Technical assistance. Individualized technical assistance at various levels of intensity, type, and frequency occurred in between learning sessions to support programs during their action planning phases. Each trainer provided technical assistance via in-person, telephone, or electronically to about 15 programs at a time. Trainers completed forms for each technical assistance interaction to describe how the technical assistance was delivered (eg, which programs received it, how much time it took, the mode of technical assistance), what NAP SACC topic area the technical assistance was related to, and if the technical assistance was related to the program's action plan.

Evaluation Methods

A pre–post design assessed the self-reported changes in policies and practices related to breastfeeding and infant feeding, child nutrition, infant and child physical activity, screen time, and outdoor play and learning for programs participating in the ECELC. The primary outcome data were derived from the NAP SACC instrument (17). Other data were collected before the first learning session via electronic enrollment and assessment forms including contact information, ECE program characteristics (eg, ages of children served), and state characteristics (eg, presence of a quality rating and improvement system [QRIS]). For almost all participating ECE programs, ECELC activities ended 3 months after the last learning session, and no further intervention activities were implemented. Study activities were approved by the Nemours institutional review board.

Self-assessment of policy and practice data

Participating ECE programs completed the NAP SACC instrument after the first learning session (pre-assessment). A previous study demonstrated that 89% of NAP SACC items showed at least moderate agreement for test-retest reliability, 100% of items showed at least moderate agreement for inter-rater reliability, and 52% of items showed at least moderate agreement for validity when tested against the Environment and Policy Assessment and Observation ($\kappa \geq 0.20$) (18). The NAP SACC instrument consisted of 5 topic areas: breastfeeding and infant feeding (23 items), child nutrition (44 items), infant and child physical activity (22 items), outdoor play and learning (20 items), and screen time (12 items) (17). Some items were specific to age groups served (ie, infants, toddlers, or preschoolers), and the rest were global (ie, applied to all 3 age groups). Programs were stratified on the basis of which age groups they served (eg, preschoolers only, toddlers and preschoolers) and were assessed according to which NAP SACC best practice items applied to their program (as opposed to individual classrooms, if applicable). Each item had 4 response options, ranging from low compliance to full compliance. For the purpose of this assessment, when the response option representing full compliance was selected, it was considered as the best practice being met (best practice met = 1). All other responses were considered to mean the best practice was not met (best practice not met = 0). Post-assessment using the NAP SACC instrument occurred during the action period before the last learning session.

Analysis

The inclusion criteria for this evaluation included center-based ECE programs that participated in the ECELC through June 2017. Family child care homes were excluded from this analysis because of the heterogeneity of that setting compared with center-based ECE programs. The eligible pool of ECE programs was 1,879. Programs were further excluded from analysis if they served any combination of age groups other than preschoolers only; toddlers and preschoolers; or infants, toddlers, and preschoolers, the 3 most common configurations of age groups served in this sample. To align with the self-determined, pre–post design of this evaluation, programs were further excluded from topic area-specific analyses if they did not respond to at least one item in both the pre-assessment and post-assessment for that topic area of the NAP SACC instrument.

Primary comparisons of NAP SACC instrument change scores were conducted by using a longitudinal linear mixed model where the outcome variables were the 5 NAP SACC topic area scores measured for each ECE program at pre-assessment and post-assessment. Covariates contained in every model were: wave (denoting time point), age-groups served (except for breastfeeding and infant feeding, because it was administered only to programs serving infants, toddlers, and preschoolers), implementation cycle, wave-by-age-groups-served interaction (except for breastfeeding and infant feeding), and wave-by-implementation-cycle interaction. Models for specific program characteristics (eg, participation in the Child and Adult Care Food Program [CACFP]) also included the identified characteristic and a wave-by-characteristic interaction. The interrelatedness of a program's pre-assessment and post-assessment scores was captured by using a first-order autoregressive structure covariance pattern (1). We used *t* tests to assess overall effects of program characteristics on change scores without controlling for covariates. Significance was set at a 2-sided α level of $P < .05$.

Results

The final analytic sample included 1,173 ECE programs (62% of eligible programs), of which 260 served preschoolers only; 229 served toddlers and preschoolers; and 684 served infants, toddlers, and preschoolers (Table 1). Almost all of the ECE programs offered full-day care (93%), approximately half operated as non-profit organizations (47%), 19% were designated as Head Start/Early Head Start, 14% were school-based, 18% were faith-based, and 1% were military-based. Most programs participated in the CACFP (62%), 34% reported being accredited, and 39% reported participating in their state's QRIS. Meals and snacks most frequently served were breakfast (81%), lunch (87%), and afternoon snack (90%).

The number of best practices met for each of the 5 NAP SACC topic areas significantly increased over the 10 months from pre-assessment to post-assessment (ranging from 1.5 to 4.7 best practices; $P < .001$) (Table 2). The percentage change was the lowest for child nutrition, where an improvement of 4.7 best practices resulted in a 20% improvement. It was the highest for outdoor play and learning, where an improvement of 2.4 best practices resulted in a 44% improvement.

This evaluation focused on the potential for 4 program characteristics to influence NAP SACC scores: CACFP, QRIS, Head Start/Early Head Start, and accreditation (Table 3). Of these, Head Start/Early Head Start programs, those participating in CACFP, or accredited programs had significantly higher scores at pre-assessment (for all 5 topic areas) than those that did not. Participation in these supplemental initiatives was associated with pre-assessment scores being between 0.5 to 6.8 best practices higher. QRIS participation was associated with higher pre-assessment scores among 4 of the 5 topic areas at pre-assessment, with outdoor play and learning being the exception. Head Start/Early Head Start programs improved by 1.6 fewer best practices in Child Nutrition compared with ECE programs that were not Head Start/Early Head Start designated ($P < .001$). Additionally, accredited programs improved with regard to screen time, but by a smaller amount (0.4 fewer best practices; $P = .02$) when compared with nonaccredited programs.

Implications for Public Health

We found that the ECELC was an effective multisector approach to promote important changes to policies and practices in ECE programs related to breastfeeding and infant feeding, child nutrition, infant and child physical activity, outdoor play and learning, and screen time. Findings suggest that the ECELC fulfilled a key, short-term outcome, in that ECE programs made changes to policies and practices that evidence suggests may lead to improved food and physical activity environments for young children in ECE settings (13–15).

An evaluation conducted after the ECELC was initially implemented found that a subsample of ECE programs that had participated in the ECELC maintained improvements in NAP SACC best practices for all topic areas one year later (23), suggesting potential for the ECELC to also achieve intermediate outcomes outlined in the theory of change. On average, the percentage change was the lowest for child nutrition, where a mean increase of 4.7 best practices resulted in a 20% improvement, and highest for outdoor play and learning, where a mean increase of 2.4 best practices resulted in a 44% improvement. These improvements are proportionate to pre-assessment scores, so it is important to consider how much room ECE programs had to grow. ECE programs may have had more best practices to choose from with regard to outdoor play and learning, making it easier to improve in that area.

A key part of the ECELC included building collaborations across ECE programs and with community partners (20). National partners represented health care (Nemours), government (CDC), and nongovernmental organization (Gretchen Swanson Center for Nutrition) sectors, who worked with state-level implementation partners (eg, child care resource and referral networks and health departments) and participating ECE programs to implement healthier practices and policies. National, state, and local partners worked collaboratively to implement the initiative, gather the data, and demonstrate the effectiveness of the ECELC, thus building and applying a strong evidence base for adopting a learning collaborative model to promote the adoption of HEPA-based practice and polices among ECE programs (24). Findings from this evaluation may inform future research, especially efforts to measure any direct effect on population health, reactions or expectations for participation and performance among sectors (eg, health care, government, nongovernmental organization, states, localities), or catalytic changes and spillover effects to inform a clearer view of how multisector partnerships contribute to population health improvement (24).

In 2017, Richter et al urged scaling up of effective interventions for early childhood development by integrating into systems of health, education, and social and child protection, expressing that health and nutrition services are ideal starting points because of the relative affordability (25). Overall, programs participating in CACFP, QRIS, or Head Start/Early Head Start, or accreditation programs reported meeting significantly more best practices at pre-assessment compared with their counterparts that were not participating per each of these programs or initiatives. This expected finding was consistent with other scientific literature (26,27) and was likely a result of the availability of resources via federal funding and educational materials and trainings, especially for Head Start/Early Head Start and CACFP programs. CACFP, Head Start/Early Head Start, QRIS, and accreditation require ECE programs to adhere to a set of quality standards related to food, physical activity, and screen time, which may have promoted best policies and practices among ECE programs before the start of the ECELC, and also could have indicated ECE programs that were more equipped or ready to change. It is probable that compared with QRIS or accreditation, CACFP and Head Start/Early Head Start focus more on children's access to healthy environments.

Although these findings are unsurprising, they help illustrate how the ECELC can operate synergistically among other HEPA-based efforts among ECE settings. Conversely, differences in change scores by program characteristics were reported only in the topic areas of child nutrition and screen time for Head Start/Early Head Start and accredited programs, respectively, and participation in these external initiatives for these topic areas was associated with lesser improvement. When programs did not improve at the same rate, it may have been because they were already meeting more best practices at the start of the ECELC. Regardless, an opportunity exists to explore why seemingly high-quality programs voluntarily enroll in HEPA-based interventions, as well as how to reach ECE programs in greater need for improvement. That programs usually improved at the same rate whether they participated in external initiatives or not suggests that the ECELC may help fill a gap in resources, educational materials, and/or setting standards among all ECE programs.

The multisector learning collaborative model also helped facilitate ECE programs to be more ready to meet standards, a need that exists among CACFP programs (28,29). A next step for the multisector collaborative model may be to partner with leaders of external initiatives (eg, US Department of Agriculture, Head Start/Early Head Start, accreditation agencies) to incorporate elements of the learning collaborative model into existing frameworks. Overall, the lack of differences in change from pre-assessment to post-assessment across ECE program characteristics in combination with the improvement in best practices met in the overall sample suggests that the multisector partnership may be complementary and not duplicative to outside support. It also demonstrates that the learning collaborative model, including tailorable components like technical assistance (30), may be generalizable to both well-resourced and poorly-resourced ECE programs. More specifically, the learning collaborative model can tailor training approaches toward guiding poorly-resourced ECE programs from partial compliance of best practices (as identified on their NAP SACC) to full compliance (30). As for well-resourced ECE programs, technical assistance can be allocated toward providing program-specific feedback rather than providing nonprogram-specific resources or guidance.

Although currently no federal nutrition or physical activity standards are enforced in ECE programs and most states lack meaningful regulations related to HEPA (31), state-level promotion of HEPA in ECE may support best practices. At the same time, further development is needed across most states (32,33). For example, ECE programs in Missouri may have been exposed to the Missouri Eat Smart and MOve Smart Guidelines for Child Care, which recommends ECE programs meet rigorous dietary and physical activity standards above the minimum requirements (34). Considering ways to enforce HEPA standards in ECE programs through a state's QRIS, such as Arizona's Quality First system, may also encourage and promote meeting best practices. Although they were not asked about specific accrediting agencies, accredited programs in this study may have also been encouraged or incented to meet best practices. A study of 185 licensed, full-time ECE programs that were assessed about program structure, staff training and behavior, and sedentary environment also showed that accreditation through the National Association for the Education of Young Children was associated with more physical activity–promoting practices (35). Success in the ECELC underscores how implementing standards in ECE settings can be critical and ultimately contribute to reduced risk for obesity among children younger than 5 years.

The US Departments of Health and Human Services and the US Department of Education have stated that ECE programs and providers must receive proper education and training, as well as fair compensation, to promote high-quality experiences for all children in these settings (36). However, in general, the ECE system in the United States lacks resources and funding to support adequate training and compensation for early childhood educators across all settings, making it difficult to support and promote best practices (36). Furthermore, ECE providers are among the lowest-paid workers in the United States and often do not receive health insurance or retirement benefits (37). Although the ECELC was an effective multisector model to promote important changes to HEPA policies and practices in ECE programs, integrating obesity prevention programming in a way that creates additional workload without augmented compensation could potentially lead to challenges, such as resistance or increased employee turnover. A 2014 study conducted in Ohio determined that financial stability was crucial to quality in ECE settings, and that most programs that were considered high-quality had supplemental revenue streams (38). Authors suggested that states could support ECE by subsidizing programs to ensure that quality care is available for working families (38). Because state-level systems (eg, QRIS, health promotion initiatives) affect ECE programs, it may be feasible to explore necessary supports for integrating learning collaboratives into statewide efforts. This may involve estimating resources required (eg, human, technical, financial), considering who might perform key functions at the state-level to reduce overlap, ensure consistent evaluation over time, and determine feasibility and associated cost of these systems (39). In this study, state implementing partner agencies had existing relationships with ECE programs and were already providing them with support in other, nonhealth areas of program improvement. State implementing partner agencies have the opportunity to identify and build on local strengths and also focus on areas of greatest need, which may contribute to more effective HEPA promotion in a learning collaborative setting. Training and compensating ECE providers is a key aspect of the US labor force having access to quality child care, so another federal agency that may have a stake in supporting ECE providers would be the US Department of Labor.

These findings should be interpreted with caution because of the contextual differences across locations as well as measurement-based limitations. Although a strength of this intervention is that strategies were consistent throughout the 6 years of the intervention, the degree to which ECE programs received intervention components (ie, technical assistance) varied. In addition, the intervention was supported via funding (eg, ECE programs were incentivized by $500) and staff support. Reasons for programs enrolling or dropping out of the intervention were not tracked consistently, and participating programs may have been motivated to change. Despite these limitations, results from annual evaluations were used to inform the development and improvement of the ECELC, contributing to the spread and scaling of the intervention across multiple states with consistent results (40). The reproducibility of results provides evidence that this model allowed, as intended, for tailoring at the state, local, and ECE program levels, which may be a key component for ensuring sustained reach of the learning collaborative model. Although a more robust, less subjective measure would have been appropriate to assess intervention impact, NAP SACC is a stable and reasonably accurate instrument for use with child care interventions (18) and has been used widely in ECE settings. Because the NAP SACC pre-assessments occurred after the first learning session and the post-assessment occurred before the last learning session, “true” pre–post data were not collected. We were unable to use a control group and did not have the resources to fully explore and delineate other factors beyond the ECELC (eg, other initiatives or campaigns) that also may have contributed to the positive changes. Furthermore, we did not explore changes in behaviors at the child level, so we cannot comment on whether the ECELC reduced risk for obesity among young children, although expert opinion is that HEPA-promoting environments have the potential to influence individual behaviors (22). Last, this evaluation did not include a cost analysis, although the development of cost-effective adaptations to the delivery of the ECELC may help facilitate the adoption, support, and sustainability of the model in additional states, communities, and ECE programs.

This evaluation demonstrated that the innovative and collaborative partnership led to broad implementation of best practices related to breastfeeding and infant feeding, child nutrition, infant and child physical activity, outdoor play and learning, and screen time in ECE settings. The ECELC model was found to be complementary and not duplicative to existing programs and initiatives (eg, CACFP). Findings also suggest that the multisector learning collaborative model may be generalizable to both well-resourced and poorly resourced ECE programs and that an opportunity exists to engage additional sectors (ie, federal departments, state and local governments, state-level QRIS systems, and additional ECE programs) to collaborate and work toward shared goals, such as developing a healthy workforce through fostering early development. By implementing policies and practices in these settings, there is potential for reaching approximately 1 in 4 children aged 5 years or younger and their families. Development, implementation, and evaluation of policy and practice-based partnerships to promote HEPA among children attending ECE programs may contribute to obesity-prevention in the United States.

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Tables

Table 1. Characteristics of Early Childhood Education Programs (N = 1,173), Partnership to Implement the National Early Care and Education Learning Collaboratives Project in Childcare Settings in 10 US States, 2013–2017

Characteristic	No. (%)
Combination of age groups served[a]	
Preschoolers	260 (22.1)
Toddlers and preschoolers	229 (19.5)
Infants, toddlers, and preschoolers	684 (58.3)
Program type	
Nonprofit	554 (47.2)
Private	271 (23.1)
Head Start/Early Head Start	217 (18.5)
School-based	162 (13.8)
Faith-based	208 (17.7)
Military	9 (0.8)
Native American–tribal, migrant, or seasonal	5 (0.4)
Operating hours[a]	
Half-day care available	480 (40.9)
Full-day care available	1,086 (92.6)
24-Hour care available	20 (1.7)
Participated in Child and Adult Care Food Program	731 (62.3)
Accredited	393 (33.5)
Participated in state's Quality Rating and Improvement System	456 (38.9)
Food service[a,b]	
Breakfast	939 (80.6)
Morning snack	404 (34.4)
Lunch	1,018 (86.8)
Afternoon snack	1,051 (89.6)
Dinner	72 (6.1)

[a] Items may not total 1,173 because of nonresponse and differences in which data on characteristics were collected in each cycle.
[b] Forty-one programs reported that they did not serve snacks or meals.

Table 2. Overall NAP SACC Change Scores Per Topic Area (N = 1,173), Partnership to Implement the National Early Care and Education Learning Collaboratives Project in Childcare Settings in 10 US states, 2013–2017[a]

NAP SACC Topic Area	Pre-Assessment	Post-Assessment	Change Score[b]	Percentage Improvement
Breastfeeding and infant feeding	9.7	12.6	2.9	29.9
Child nutrition	23.3	28.0	4.7	20.2
Infant and child physical activity	8.0	11.3	3.3	41.3
Outdoor play and learning	5.5	7.9	2.4	43.6
Screen time	5.2	6.7	1.5	28.9

Abbreviation: NAP SACC, Nutrition and Physical Activity Self-Assessment for Child Care.

[a] Analysis included early childhood education programs that responded to at least one item in the corresponding section of NAP SACC at pre-assessment and at least one item in post-assessment.

[b] $P < .001$.

Table 3. ECE Program Characteristics Associated with NAP SACC Pre-assessment and Change Scores, Partnership to Implement the National Early Care and Education Learning Collaboratives Project in Childcare Settings in 10 US states, 2013–2017

NAP SACC Topic Area/ECE Program Characteristic	Difference at Pre-Assessment				Difference in Change Score			
	No[a]	Yes[b]	Estimated Difference in Score[c]	*P* Value	No[d]	Yes[e]	Estimated Difference in Score[f]	*P* Value
Breastfeeding and infant feeding								
CACFP	8.52	10.41	1.96	<.001	3.07	2.68	−0.48	.20
QRIS	9.15	10.22	0.85	<.001	2.66	3.04	0.61	.19
Head Start/Early Head Start	9.66	10.65	1.56	<.001	2.76	3.14	0.50	.43
Accreditation	9.33	10.41	1.18	<.001	3.03	2.48	−0.46	.23
Child nutrition								
CACFP	19.76	25.32	5.57	<.001	5.03	4.59	−0.46	.25
QRIS	23.00	23.53	0.44	.04	4.77	4.68	0.01	.69
Head Start/Early Head Start	22.02	28.24	6.79	<.001	5.09	3.49	−1.64	<.001
Accreditation	22.94	23.76	1.04	.002	4.79	4.84	−0.09	.83
Infant and child physical activity								
CACFP	7.22	8.45	1.24	<.001	3.20	3.37	0.15	.57
QRIS	7.66	8.51	0.76	<.001	3.25	3.31	0.07	.61
Head Start/Early Head Start	7.78	9.02	2.12	<.001	3.44	2.75	−0.64	.05
Accreditation	7.64	8.65	0.92	<.001	3.20	3.54	0.38	.18
Outdoor play and learning								
CACFP	5.19	5.67	0.46	.03	2.53	2.53	−0.10	.73
QRIS	5.30	5.81	0.59	.13	2.56	2.15	−0.37	.23
Head Start/Early Head Start	5.43	5.79	0.48	.02	2.47	2.54	0.17	.60
Accreditation	5.11	6.13	1.00	<.001	2.63	2.07	−0.56	.05
Screen time								
CACFP	4.86	5.36	0.49	<.001	1.42	1.51	0.05	.77
QRIS	4.95	5.57	0.62	<.001	1.55	1.35	−0.14	.43
Head Start/Early Head Start	5.05	5.70	0.87	<.001	1.47	1.46	0.04	.85
Accreditation	4.95	5.65	0.70	<.001	1.61	1.23	−0.39	.02

Abbreviations: CACFP, Child and Adult Care Food Program; ECE, early care and education; NAP SACC, Nutrition and Physical Activity Self-Assessment for Child Care; QRIS, quality rating and improvement system.

[a] The arithmetic mean of pre-assessment scores for programs without the characteristic (ie, non-CACFP).

[b] The arithmetic mean of pre-assessment scores for programs with the characteristic (ie, CACFP).

[c] Model-estimated pre-assessment score difference between levels of characteristic (yes and no) after controlling for differences due to time, cycle, child age groups served, and relevant interaction effects.

[d] The arithmetic mean of change scores for programs without the characteristic (ie, non-CACFP).

[e] The arithmetic mean of change scores for programs with the characteristic (ie, CACFP).

[f] Model-estimated change score difference between levels of characteristic (with and without) after controlling for differences due to time, cycle, child age groups served, and relevant interaction effects.

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ORIGINAL RESEARCH

Strengthening Linkages Between Public Health and Health Care in Nebraska

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PEER REVIEWED

Summary

What is already known about this topic?

Various linkage initiatives between public health and health care systems have been implemented throughout the United States.

What is added by this report?

This study was the first to investigate Nebraska's recent experiences in building linkages between public health and primary care in 2017 and 2018 from the viewpoint of local health departments.

What are the implications for public health practice?

The linkage programs and activities and their effect and the barriers, benefits, and opportunities for building linkages identified in this study can be used to shape stronger and broader local and national practices for future collaborations and system integration.

Abstract

Introduction

Effective collaboration between public health and the health care system is essential for connecting medical and community health–related resources and improving population health. We investigated the linkages between local health departments and primary care clinics in Nebraska.

Methods

We conducted a mixed-method study by using semistructured in-person and telephone interviews and surveys in 2017 and 2018 with directors of 19 Nebraska local health departments. Interviews and surveys assessed activities and programs that health departments implemented or planned with clinics in their jurisdictions. Barriers, benefits, and opportunities for building the linkages were identified.

Results

Strong linkages existed between local health departments and primary care clinics. Linkages focused on the control and prevention of chronic diseases and on traditional public health programs, including screening for cancer and other chronic diseases, vaccinations, worksite wellness programs, home visits, clinic and medication assistance referrals, health message development, electronic health records data analyses, staff education, and improvements in policies and procedures. The most frequently reported barrier was funding, and the most frequently reported benefit was patient behavior change. The opportunity most frequently reported was chronic disease health coaching.

Conclusion

Extensive linkages exist between Nebraska local health departments and the health care systems in their areas. Additional funding, effective workforce management, community needs assessments, and program evaluation can support joint initiatives to address community health priorities.

Introduction

The health care system is undergoing dramatic changes, from volume-based reimbursement to value-based reimbursement, to deal with the challenge of managing population health (1). One change is the emergence of new health care delivery models such as accountable care organizations and patient-centered medical homes (2,3). These models have strong financial incentives to reduce costs while improving the quality of care and health outcomes through better care coordination (4). To achieve these goals for both individuals and populations, public health practitioners and health care providers must eliminate the cultural divide that exists between them and form effective partnerships that connect medical and community resources.

Opportunities are increasing for public health agencies to work closely with the health care system by building linkages and collaborations. The Institute of Medicine's 2012 report explored promising integration models for the 2 systems, described the degree of integration, and developed principles for successful integration (5). Public health practitioners and health care providers have worked together to integrate their systems and health objectives (6). A 2013 nationwide survey found that 84% of state public health practitioners engaged in collaboration activities but that these activities were primarily client-oriented and focused on secondary rather than primary prevention (7). A 2016 study found that in communities that implemented population health activities involving multisector partners, resident death rates from cardiovascular disease, diabetes, and influenza were reduced (8). A recent report concluded that these partnerships are critical components of a comprehensive community wellness approach that will ensure seamless care and prevention for everyone (9). Linkages not only improve individual health, but also work upstream to address the policies and environmental and social factors that influence community and population health (10).

Nebraska ranked tenth among all states in America's Health Rankings in 2014 and thirteenth in 2017 (11). In public health funding, Nebraska ranked twentieth in 2017 with an expenditure of $95 per person (11). Nevertheless, in some health areas, such as obesity, infectious diseases, and disparity in health status, Nebraska was far below national averages and needed collaboration between health care and public health. We assessed linkage activities between local health departments and primary care clinics in Nebraska in 2017 and 2018.

Methods

We conducted a mixed-method study by using semistructured in-person and telephone interviews and surveys to assess linkage programs and activities between local health departments and primary care clinics. We collected data in 3 steps. First, we conducted in-person and telephone interviews with 19 Nebraska health department directors in 2017. The interview consisted of 12 semistructured questions on linkage activities that were planned or implemented with the clinics in the health department's jurisdiction. All interviews were recorded and transcribed, and common themes were identified. In July 2018 we administered a 19-question survey to assess the progress and effects of the departments' linkage activities (Table). Respondents could choose from answers provided that were based on information obtained from the 2017 telephone interviews, give other answers, or fill in the numbers or rating scores. The number of each given answer selected and the weighted rating scores were calculated, and the numbers were added. In August and September 2018 we conducted another round of interviews with 5 health department directors to gain more in-depth knowledge.

Results

Eighteen of 19 health department directors completed the first-round interview, and 16 responded to the survey. Responses showed that in addition to traditional programs (eg, tracking communicable and food-borne illness outbreaks, emergency preparedness, environmental health programs) several strong linkages with primary care clinics already existed in 5 areas we identified: the National Diabetes Prevention Program, screening services, worksite wellness programs, vaccination services, and other programs and activities. Ten health departments had formal agreements on linkage projects with clinics. Most linkage activities focused on control and prevention of chronic diseases. Because of limited resources and large geographic coverage areas, most health departments worked with only a few clinics.

Collaboration between health departments and clinics

National Diabetes Prevention Program. Fourteen of the 16 health departments that responded participated in one common linkage program, the evidence-based National Diabetes Prevention Program, which involves lifestyle improvement for patients with prediabetes through healthy eating, increasing physical activity, controlling stress, and losing weight. From July 1, 2017, through June 30, 2018, these 14 health departments screened 217 clients for prediabetes and referred 546 at-risk clients to primary care clinics (Table). Of the 14 health departments, 11 selected patients from self-referral, 10 from primary care clinics, 9 from health department programs, 8 from federally qualified health centers, 8 from worksite wellness programs, 7 from hospitals, and 7 from community organizations. Each health department employed a nurse or a community health worker to serve as the health coach for the 16-week program. Although most directors felt the program was successful, many said that it worked most efficiently when patients were referred into the program by primary care clinics and when patients' results from the program were shared with the clinics. Without patient referrals from clinics, health departments often struggled to enroll enough patients.

Screening services. Fifteen health departments offered screenings for diabetes, hypertension, and cholesterol at multiple community sites and worksites, and at the health department. Participants with abnormal readings were referred to clinics. All 16 were involved in promoting breast, cervical, and colorectal cancer screenings through multiple routes, including health coaching. Fifteen promoted screenings in social media campaigns, 15 in health fairs, 13 through traditional media, and 9 by using posters. Five health departments reported other methods, such as paying for transportation for low-income women or distributing free fecal occult blood test kits for colorectal cancer screening. Through screening services, health departments identified at-risk clients, referred them for follow-up with a health care provider, and assisted them in navigating the health care system. Cancer screening rates increased in both rural and urban areas in Nebraska from 2017 to 2018. However, sometimes health care providers sent little or no information back to health departments.

Worksite wellness programs. Twelve health departments reported providing worksite wellness programs. Although activities varied, all programs offered health education for high-risk behaviors (eg, tobacco use, alcohol use, obesity), and 11 health departments administered a health risk appraisal survey to identify worksite employee health needs and developed an action plan to address the needs. Eleven health department worksite programs provided screening for diabetes, hypertension, and cholesterol; 7 referred people to primary care clinics; and 7 provided technical assistance in developing health-related policies at worksites, such as offering nutritious options in company vending machines.

Health departments collaborated with community partners in developing worksite wellness programs. For example, in one rural community, after the health department conducted the health risk appraisal survey, the department partnered with a large employer, a physician clinic, and a hospital to develop a comprehensive wellness plan. During the implementation of the plan, the health department provided health promotion and education materials and resources, the clinic conducted screenings and follow-up consultation, and the hospital assessed occupational health risks.

Vaccination services. Eight of 13 health departments that offered vaccination services reported close partnerships with clinics for providing vaccinations. Because about half of the health departments provided a full range of vaccinations for children and influenza vaccinations for adults, clinics sometimes referred their patients to health departments for vaccinations. Increased vaccination rates were observed from 2017 to 2018. One common challenge was documenting the number of children who received appropriate vaccinations, because some clinics failed to report the numbers to the Nebraska State Immunization Information Registry and because of the incompatibility between the registry and the clinics' electronic health record systems.

Other programs and activities. Fifteen health departments also reported other activities, either working with clinics or targeting people in their community. Twelve educated clinic staff members about lead testing, emerging diseases (eg, Ebola, Zika virus), and re-emerging diseases (eg, tuberculosis). Twelve health departments assisted clinics in developing referral procedures for health-related community services. Nine departments helped clinics analyze electronic health records data to identify high-risk patients and encourage referrals into health department programs.

Moreover, health departments worked with clinics on conveying health messages. Seven departments developed educational materials that could be placed in physician offices. One sent out tip-of-the-month messages with clinic logos. Another department reviewed educational materials from clinics to ensure that they met health literacy standards. Eight departments helped clinics build relationships with care team extenders, such as pharmacists. Ten assisted clinics in developing quality improvement policies and procedures. To help high-risk clients, 3 health departments conducted home visits for children aged 3 years or younger and provided education to mothers about nutrition and breastfeeding. Five departments connected low-income clients with medication assistance programs to lower their drug costs.

Barriers to collaboration

The most significant barrier to building linkages that the 16 health departments surveyed reported was funding (14 departments), followed by administrative capacity in clinics (11 departments), compatibility of electronic health record systems (11 departments), clinic capacity (10 departments), and lack of vision (9 departments). Other barriers mentioned were limited health department capacity, public health not being physician-centric, and not having the same strategic priorities.

A major barrier mentioned was the cultural divide between health care providers and public health professionals. Public health workers emphasize disease prevention and focus on factors influencing health outcomes (eg, health behaviors, social determinants of health), whereas clinicians focus on treatment.

Another major barrier was the lack of capacity to connect health care and public health systems. Sharing information in a timely manner was sometimes difficult because of technology and workforce problems. Some health department did not have electronic health record systems that were compatible with those in clinics, and some departments did not have a workforce competent in information exchange. Many rural areas had shortages of both physicians and public health professionals, which made it more difficult to develop and maintain strong linkages. Fifteen of the 16 health departments used at least one community health worker to serve as a bridge. The common functions for these workers included connecting patients with medical and community services (14 departments), providing health education (12 departments), conducting chronic disease screenings (10 departments), and language translation (9 departments). Some workers also assisted patients in enrolling in Medicaid or exchange plans (4 departments), conducted home visits (4 departments), worked closely with care coordinators or other staff members of patient-centered medical homes (4 departments), and assisted in patient medication adherence (3 departments).

Another capacity issue was the lack of funding. Besides Medicaid and private insurers, linkage projects were and will likely continue to be funded by grants from the Nebraska Department of Health and Human Services. Most primary care clinics also rely on grants to build expertise in data analysis and care coordination. However, neither health departments nor clinics had any assurance that these funds would continue at the same level. The lack of sustainable funding produced substantial variability in programs and limited their reach. Some linkage projects were operating in only a few clinics in the local health department's district.

Attitudes and perceived opportunities

All 16 health departments recognized the benefits of working with clinics. Reinforcement of messages to patients for behavior change was identified by 14 departments, followed by better health outcomes (11 departments), increased referrals to their evidence-based community programs (10 departments), closing care loops (10 departments), increased collaboration with community-based physician extenders (9 departments), and reduced duplication of services (7 departments). Other benefits included filling gaps in vaccination for children, addressing community priorities, and ensuring evidence-based policies.

All 16 health departments also identified many new linkage opportunities. Fourteen departments identified opportunities to collaborate with clinics on chronic disease health coaching, 12 on lead screening, 11 on the development of evidence-based policies, 10 on mental health and substance abuse, 9 on prevention of opioid abuse, and 8 on dental health services. Some departments had already explored activities in mental and dental health. For example, one department screened children in schools for mental health. Some were working with clinics to ensure that patients with mental conditions made regular visits and adhered to medication regimens. Some departments organized training in the Mental Health First Aid program, a national certification program to teach skills for responding to the signs of mental illness and substance use. Because dental health was a priority need in most rural areas, and the number of patients visiting hospital emergency departments for dental issues increased, some departments provided various community dental preventive services (eg, fluoride varnish, dental sealants) to fill the gaps and reduce unnecessary dental expense.

Discussion

Our study showed that strong and varied linkages existed between health departments and primary care clinics. Programs such as the National Diabetes Prevention Program, worksite wellness programs, screening services, and vaccinations were provided by all health departments. Most departments also worked with clinics by providing education to clinic staff members, assisting in developing referral procedures, building relationships between clinics and care team extenders, developing educational messages, and assisting in quality improvement and data analysis of electronic health records. Only a few health departments engaged in activities such as medication adherence and assistance or home health visits.

Though linkages varied by type and range of activities, there was potential to build on past experiences and explore new opportunities. Health departments should pursue multiple funding options to build sustainable partnerships. One option is mandatory community benefit spending by nonprofit hospitals. A national investigation showed that spending by tax-exempt hospitals on community health improvement initiatives was inadequate and sometimes unrelated to community health needs (12), which was also echoed by a study conducted in Nebraska (13). Hence, if health departments partnered with nonprofit hospitals and hospitals spent more on community initiatives, additional funds would be available for linkage programs. Other options include generating revenue through donations or third-party reimbursement. By assisting clinics to participate in federal programs, such as the Chronic Care Management Program and the Medicare Pre-Diabetes Program, health departments could share the additional revenue from these programs (14).

To overcome barriers such as incompatibility of electronic health record systems and lack of a skilled workforce, more investment is needed in health information technology and workforce training. Some health departments initiated educational programs for medical students and residents. They could also partner with colleges of public health to train primary care providers in competencies of working under an integrated system. In some areas, community health workers can assist clinics' care coordinators to track high-risk patients who missed appointments and work with pharmacists to assist in medication adherence.

Collaboration activities between Nebraska health departments and primary care clinics were similar to those in other states. One study interviewed 40 public health and primary care practitioners from 4 states in 2014 and 2015 and classified barriers for collaboration into 3 types: institutional barriers (stressful work environments in clinics, different motivations from collaborating groups, billing issues, and isolated systems and jurisdictions), process-related barriers (lack of shared knowledge and understanding, poor and inconsistent communication, and inability to share data because of multiple data platforms), and resource-related barriers (shrinking resources, lack of shared strategic planning and priorities to address community needs, and lack of program sustainability) (15). These findings highlighted the urgent need for system and structural changes.

The Institute of Medicine identified 5 key levers for building an effective collaborative model based on a multistate, multipartner quality improvement collaborative on hypertension control (16). The levers were leadership at the local, state, and national levels; identification of community and clinical resources; having multiple data sources; having standardized protocols; and pursuing multiple financing options. To address barriers to collaboration, the institute suggested using a quality improvement approach, establishing a public health workforce skilled in health system transformation, and using strategic planning to identify resources. Briss (17) summarized several practical linkage experiences, such as incorporating risk behaviors assessment into clinic workflows by programming questions into the electronic health records systems and generating automatic reminders for the assessment. A Netherlands study in 7 neighborhoods described a stepwise approach to develop integrated district plans and promote collaboration between public health and primary care at the local level by using 2 central tools — district health profiles and policy dialogue (18). The key was to involve appropriate collaborators in dialogue (eg, general practitioners, residents) and invest sufficiently in sharing aims and data from stakeholders.

Given the shift from volume-based to value-based reimbursement, more clinics will likely adopt the patient-centered medical homes model or join accountable care organizations. The new models provide strong incentives to improve care coordination and population health outcomes. The changes in reimbursement and delivery models provide strong incentives to focus on population health and collaborate with local health departments and community organizations. As the goals of clinics and health departments become more similar, more research will be needed to identify the most effective models of collaboration and the programs and activities that produce the greatest health improvements.

Strong linkage projects that focused on prevention were between local health departments and primary care clinics in Nebraska. Although many projects were successful, some were concentrated in a few communities and clinics. As more clinics become patient-centered medical homes or join accountable care organizations, these linkage projects should grow. The major challenges are to expand the health department workforce and find new funding options to support linkage programs. Finally, once these linkage programs are implemented, it is critical to evaluate their impact. Colleges of public health and other academic institutions can play a useful role in this evaluation process.

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Table

Table. Responses to Survey of Nebraska Local Health Departments (N = 16), 2018

Survey Question	No. of LHDs Responding	Answer[a]
1. If you are involved in screening for prediabetes, please estimate the total number of clients screened by the department.	14	—
Number screened (received an HbA_{1C} blood test)		217
Number referred to physician clinics		546
Number referred by physician clinics		146
2. What source(s) of clients are referred into the pre-diabetes program?	14	—
Physicians clinic		10
Federally qualified health center		8
Hospital		7
Health department programs		9
Other community organizations		7
Worksite wellness program		8
Self-referral		11
Other		5
3. If you are involved in hypertension screening, please estimate the number of clients.	15	—
Number screened		2,637
Number referred to physician clinics		459
4. How have you been involved in promoting cancer screening? Please check all that apply.	16	—
Traditional media (newspapers, television, radio)		13
Social media (Facebook, Twitter)		15
Health fairs		15
Posters		9
Health coaching		16
Other (please specify)		5
5. If you issue fecal occult blood test kits, how many kits have been issued and how many people have been referred to a physician for follow-up?	16	—
Number of kits analyzed		1,792
Number of abnormal readings		34
Number of people referred to primary care clinics		34
6. If you have a worksite wellness program, what activities are provided? Please check all that apply.	12	—

Abbreviations: —, not applicable; EHR, electronic health record; LHD, local health department.

[a] Values are counts of health departments who selected that answer, total number, or weighted score depending on question types. The data were collected for the period from July 1, 2017, to June 30, 2018.

[b] Rating scale was 1 to 4: 1 = mutual awareness (clinic and health department informed about each other's activities), 2 = cooperation (sharing of some resource), collaboration (joint planning and execution), 3 = partnership (closely working on program level), 4 = partnership (close working relationship on a programmatic level; user perceives no separation). All health departments in Nebraska worked with 6 or fewer clinics during study period, and scales were weighted.

[c] Rating scale was 1 to 4: 1 = limited (consult) or no involvement, 2 = some involvement (provided data and helped data analysis, 3 = a member of the planning committee), and 4 = extensive involvement (prepared all or a large portion of the plan and helped shape the priorities). All health departments in Nebraska worked with 5 or fewer nonprofit hospitals during study period, and scales were weighted.

(continued on next page)

(continued)

Table. Responses to Survey of Nebraska Local Health Departments (N = 16), 2018

Survey Question	No. of LHDs Responding	Answer[a]
Health risk appraisal assessment		11
Screening (eg, for diabetes, hypertension, cholesterol)		11
Health education for high risk behaviors		12
Number that referred workers to primary care clinics		7
Technical assistance for policy changes		7
7. How many community health workers do you employ?	16	—
1		4
2		5
3		3
≥4		3
None		1
8. If you employ community health workers, what are their functions and activities? Please check all that apply.	15	—
Health coaching		12
Translation and interpretation		9
Screening (eg, for diabetes, hypertension, cholesterol)		10
Assist clients in enrolling in Medicaid or exchange plans		4
Medication management assistance		3
Home visits		4
Connect clients to medical and community services		14
Work closely with care coordinators or other staff members of patient-centered medical homes		4
Other (please specify)		6
9. If you provide a full range of vaccinations for children and influenza vaccinations for adults, is there a strong partnership with primary care clinics in your district to minimize gaps in coverage?	13	—
Yes		8
No		5
10. Are you involved in the following programs or activities with primary care clinics? Please check all that apply.	15	—
Home visitation programs for children		3
Connect low-income clients with medication assistance programs		12
Develop educational messages that are used by and prepared for physician clinics		7
Review clinic materials for literacy standards		4
Provide education to clinic staff members about emerging and re-emerging diseases		3
Assist clinics in analyzing data from electronic health records		4

Abbreviations: —, not applicable; EHR, electronic health record; LHD, local health department.

[a] Values are counts of health departments who selected that answer, total number, or weighted score depending on question types. The data were collected for the period from July 1, 2017, to June 30, 2018.

[b] Rating scale was 1 to 4: 1 = mutual awareness (clinic and health department informed about each other's activities), 2 = cooperation (sharing of some resource), collaboration (joint planning and execution), 3 = partnership (closely working on program level), 4 = partnership (close working relationship on a programmatic level; user perceives no separation). All health departments in Nebraska worked with 6 or fewer clinics during study period, and scales were weighted.

[c] Rating scale was 1 to 4: 1 = limited (consult) or no involvement, 2 = some involvement (provided data and helped data analysis, 3 = a member of the planning committee), and 4 = extensive involvement (prepared all or a large portion of the plan and helped shape the priorities). All health departments in Nebraska worked with 5 or fewer nonprofit hospitals during study period, and scales were weighted.

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Table. Responses to Survey of Nebraska Local Health Departments (N = 16), 2018

Survey Question	No. of LHDs Responding	Answer[a]
Assist clinics in coordinating behavioral health services		1
Build relationships between care team extenders (eg, pharmacists) and clinics		4
Assist in developing quality improvement policies and procedures		10
Assist in developing referral procedures for community services (eg, health coaching)		12
Other (please specify)		9
11. What are your new opportunities for linkages with primary care clinics in your district?	16	—
Mental health/substance abuse		10
Dental health services		8
Development of evidence-based policies		11
Lead screening		12
Chronic disease health coaching		14
Prevention of opioid abuse		9
Other (please specify)		2
12. How would you rate the level of integration with the primary care clinics in your county or district? Please rate for each clinic using 4-level scale[b].	15	—
Clinic no. 1		2.7
Clinic no. 2		2.6
Clinic no. 3		2.3
Clinic no. 4		2.4
Clinic no. 5		2.5
Clinic no. 6		2.6
13. Do you have any formal agreements (eg, contract, memorandum of understanding) on linkage projects with one or more physician clinics?	16	—
Yes		10
No		6
14. What are the barriers that you face when working with clinics?	16	—
Clinic capacity		10
Lack of vision		9
Administrative (LHD)		1
Administrative capacity		11
EHR status/EHR vendor support		11
Funding		14

Abbreviations: —, not applicable; EHR, electronic health record; LHD, local health department.

[a] Values are counts of health departments who selected that answer, total number, or weighted score depending on question types. The data were collected for the period from July 1, 2017, to June 30, 2018.

[b] Rating scale was 1 to 4: 1 = mutual awareness (clinic and health department informed about each other's activities), 2 = cooperation (sharing of some resource), collaboration (joint planning and execution), 3 = partnership (closely working on program level), 4 = partnership (close working relationship on a programmatic level; user perceives no separation). All health departments in Nebraska worked with 6 or fewer clinics during study period, and scales were weighted.

[c] Rating scale was 1 to 4: 1 = limited (consult) or no involvement, 2 = some involvement (provided data and helped data analysis, 3 = a member of the planning committee), and 4 = extensive involvement (prepared all or a large portion of the plan and helped shape the priorities). All health departments in Nebraska worked with 5 or fewer nonprofit hospitals during study period, and scales were weighted.

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Table. Responses to Survey of Nebraska Local Health Departments (N = 16), 2018

Survey Question	No. of LHDs Responding	Answer[a]
Other (please specify)		5
15. What are the benefits your LHD gains by working with primary care clinics?	16	–
An increase in referrals to your evidence-based community programs		10
Better health outcomes		11
Closing care loops		10
Increased collaboration with community-based physician extenders		9
Reduced duplication of services		7
Reinforcement of messages to patients for behavior change		14
Other (please specify)		4
16. How will linkage projects most likely be funded in the future? Please rank the options from 1 to 4 with 1 the most likely and 4 the least likely.	16	–
Grant funds		3.4
Medicaid funds		2.3
Private insurer funds		2.1
Revenue-generated program funds		2.1
17. How do you rate your level of involvement in helping the nonprofit hospitals in your district to develop their Community Health Needs Assessment and Implementation Plan? Please rate for each hospital using a 4-level scale[c].	16	–
Hospital no. 1		1.7
Hospital no. 2		1.8
Hospital no. 3		1.7
Hospital no. 4		2.2
Hospital no. 5		2.3
18. How do the priorities in your Community Health Improvement Plan compare with the priorities in the Community Health Needs Assessment of nonprofit hospitals in your area?	16	–
Priorities are the same or almost identical		14
About half of the priorities are the same		2
Most priorities are different		0
19. How closely matched are your implementation efforts with the nonprofit hospitals in your district?	16	–
Closely matched and cohesive		7
Somewhat matched but not cohesive		8
Not closely matched		1

Abbreviations: –, not applicable; EHR, electronic health record; LHD, local health department.

[a] Values are counts of health departments who selected that answer, total number, or weighted score depending on question types. The data were collected for the period from July 1, 2017, to June 30, 2018.

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SYSTEMATIC REVIEW

Mobile Mammography Participation Among Medically Underserved Women: A Systematic Review

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PEER REVIEWED

Abstract

Introduction
Although breast cancer deaths have declined, the mortality rate among women from medically underserved communities is disproportionally high. Screening mammography is the most effective tool for detecting breast cancer in its early stages, yet many women from medically underserved communities do not have adequate access to screening mammograms. Mobile mammography may be able to bridge this gap by providing screening mammograms at no cost or low cost and delivering services to women in their own neighborhoods, thus eliminating cost and transportation barriers. The objective of this systematic review was to describe the scope and impact of mobile mammography programs in promoting mammographic screening participation among medically underserved women.

Methods
We searched electronic databases for English-language articles published in the United States from January 2010 through March 2018 by using the terms “mobile health unit,” “mammogram,” “mammography,” and “breast cancer screening.” Of the 93 articles initially identified, we screened 55; 16 were eligible to be assessed and 10 qualified for full text review and data extraction. Each study was coded for study purpose, research design, data collection, population targeted, location, sample size, outcomes, predictors, analytical methods, and findings.

Results
Of the 10 studies that qualified for review, 4 compared mobile mammography users with users of fixed units, and the other 6 characterized mobile mammography users only. All the mobile mammography units included reached underserved women. Most of the women screened in mobile units were African American or Latina, low income, and/or uninsured. Mobile mammography users reported low adherence to 1-year (12%–34%) and 2-year (40%–48%) screening guidelines. Some difficulties faced by mobile clinics were patient retention, patient follow-up of abnormal or inconclusive findings, and women inaccurately perceiving their breast cancer risk.

Conclusion
Mobile mammography clinics may be effective at reaching medically underserved women. Adding patient navigation to mobile mammography programs may promote attendance at mobile sites and increase follow-up adherence. Efforts to promote mammographic screening should target women from racial/ethnic minority groups, women from low-income households, and uninsured women. Future research is needed to understand how to best improve visits to mobile mammography clinics.

Introduction

With the exception of skin cancers, breast cancer is the most commonly diagnosed cancer in US women, accounting for 15.3% of new cancers (1). Although breast cancer deaths are declining, the mortality rate among women from medically underserved (hereafter, “underserved”) communities is disproportionally high compared with rates in the general US female population. For example, breast cancer death rates among African American women (28.7 per 100,000) are 37% higher than the national average (20.9 per 100,000), and women living in poverty are 1.46 times more likely to die from breast cancer than those who are more affluent (1,2). Underserved women are defined as women with poor access to health care; compared with women without barriers to health care access, they are disproportionately from racial/ethnic minority groups, have a relatively low income, and have less education (3). Low-income women from racial/ethnic minority groups are 1.5 times as likely as their non-Hispanic white counterparts and 1.3 as likely as their higher-income counterparts to be diagnosed with late-stage cancers, which in part explains their lower breast cancer survival compared with the general US female population (4,5). Screening mammography is the only proven tool for detecting breast cancer in its early stages, yet many women from underserved communities do not adequately use mammograms (5,6). For example, African American mammographic screening rates are 19% lower than rates for non-Hispanic white women, and women living in high-poverty areas are 50% less likely than women living in higher-income areas to have received a mammogram in the previous 2 years (7,8). Multiple factors contribute to the lower screening rates of underserved women, ranging from socioeconomic and cultural factors to health system barriers (9,10).

Mobile mammography is one strategy for improving access to screening mammography. These programs typically provide screening mammograms at no cost or low cost and deliver services to women in their neighborhoods, eliminating cost and transportation barriers. Although mobile mammography has been used for more than 3 decades, little is known about participation among underserved women. The purpose of this systematic review was to describe the scope and impact of mobile mammography programs in promoting mammographic screening participation among underserved women.

Methods

Data sources

We conducted an electronic search of PubMed, MEDLINE, CINAHL, Embase, and PsycINFO to identify journal articles published in the English language, in the United States, from January 1, 2010, through March 31, 2018, that reported on observational or intervention studies promoting screening mammography using a mobile mammography clinic. Search terms used were combinations of Medical Subject Heading (MeSH) and keyword terms: “mobile health unit,” “mammogram,” “mammography,” and “breast cancer screening.” We also conducted a title search on Google Scholar using the following terms: “mobile mammogram,” “mobile mammography,” “mammogram van,” “mammography van,” “mammogram bus,” “mammography bus,” and “mobile breast screening.” We adhered to the standards for systematic reviews as outlined in the PRISMA statement (11).

Study selection

Our interest in conducting this review was to understand the impact of mobile mammography on screening participation among underserved women in the United States. We considered articles eligible for initial inclusion if they focused on mobile mammography and provided a scientific abstract. Because the United States has a unique health care system that may influence the uptake of mammography among underserved women, we limited articles to studies conducted in the United States. We also restricted our selection to studies that included any group of underserved women in their sample. Because most mobile mammography programs are targeted to underserved women, we did not conduct a keyword search for underserved women but instead manually examined the abstracts to ascertain whether this criterion was met. Any of the following were considered underserved: any racial/ethnic minority group (eg, African American/black, Latina/Hispanic, Asian/Pacific Islander, Native American/American Indian) and regardless of race/ethnicity, any low-income, uninsured or underinsured, disadvantaged, rural, urban, or disabled group. We included an article if the research design was an observational study, clinical trial, or secondary data analysis. We excluded case reports, review articles, and editorials. We also excluded articles discussing only logistics of developing and/or maintaining mobile mammography programs (eg, cost-effectiveness, van development, staff training).

Two authors (S.V. and L.J.) performed independent reviews of the identified titles and abstracts to assess how well they fulfilled the inclusion criteria for full-text review. All disagreements were resolved by consensus. Next, these authors reviewed full-text articles and confirmed with another author (L.R.M.) which articles to include for full data extraction. One author (S.V.) reviewed bibliographies for all articles during full-text review to identify additional relevant articles.

Data extraction

Two reviewers (S.V. and L.J.) independently extracted data. The included studies were first categorized by whether the study 1) compared outcomes between mobile and fixed sites or 2) focused only on outcomes from mobile mammography sites. For each study, the 2 reviewers initially coded the study’s location, population targeted, sample size, research design, purpose, major findings, data collection, screening outcomes, predictors, and analytical methods. The authors also extracted data on screening guidelines, recency of screening, and adherence rates. Data were tabulated in the following categories: study location, underserved group targeted, sample size, research design, screening guidelines and recency of screening, adherence rate, study purpose, and major findings. Furthermore, in summarizing the results, the authors synthesized the literature and reported on findings according to the following topics: mobile versus fixed sites, sociodemographic characteristics of mobile unit users, repeat visits, screening adherence and recency of screening, screening outcomes, and perceived risk. All categories were approved by all authors. One author (L.R.M.) reviewed and confirmed extracted data. Because our systematic review was descriptive and not limited to clinical trials, we did not assess risk of bias or study quality.

Results

Searches returned 93 articles published from January 1, 2010, through March 31, 2018; we removed 38 duplicates, and 55 articles were screened (Figure). After eliminating 39 for not meeting study criteria, 16 were fully assessed for eligibility. Of these, 5 were excluded because they did not examine women's participation in mobile mammography, and 1 was removed because it was a dissertation under embargo. Of the 93 articles identified initially, 10 articles (11%) met selection criteria for full-text data extraction (Table). Four studies compared outcomes between mobile sites and fixed sites, whereas 6 studies focused on characteristics or outcomes from mobile sites only. One study took place in California, 3 in the Midwest, and 6 in the South. Three studies drew participants from urban areas, 4 from rural areas, and 3 from both urban and rural areas. The majority of underserved women targeted were African American (n = 6 studies) or Hispanic (n = 5 studies). Three studies targeted underserved women from Appalachia. One study focused on American Indians. The most common study designs were retrospective chart reviews (n = 4) and cross-sectional surveys (n = 4). Sample sizes ranged from 11 (women in qualitative focus groups) to more than 21,000 (a review of electronic medical records). All studies described the characteristics of women attending mobile mammography clinics.

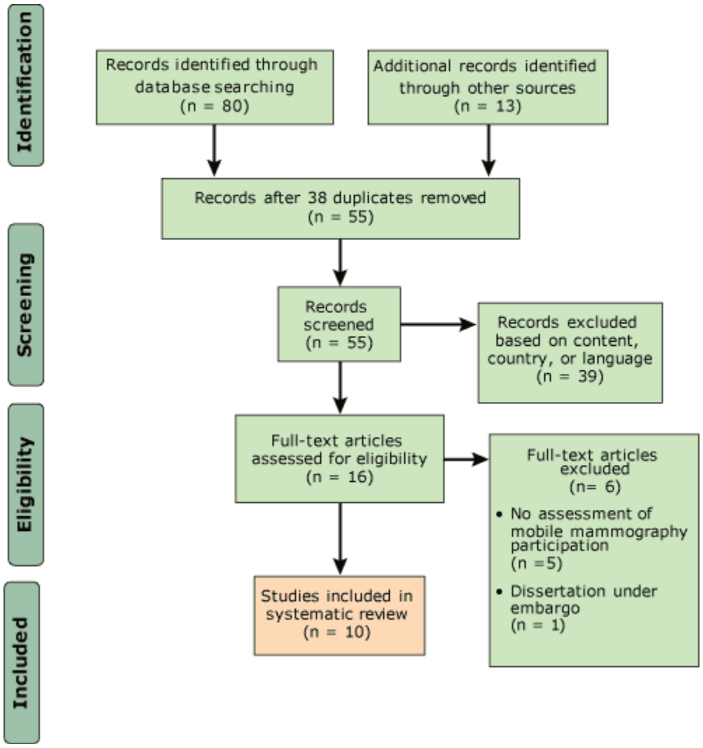

Figure. The process of including and excluding articles analyzed in a systematic review of mobile mammography among medically underserved women, United States, January 2010–March 2018.

Mobile sites versus fixed sites. Of the 4 studies that compared mobile sites with fixed sites, 2 studies (14,15) examined the rate of adherence to screening guidelines and found that mobile mammography users had lower previous rates of adherence than users at fixed sites (Table). Using a 1-year guideline for mammographic screening, one study (14) reported that 34% of mobile mammography users were currently adherent to screening guidelines, whereas 57% of users at fixed sites were. Similarly, another study (15) found that women using mobile mammography were 91% less likely than users at fixed sites to have had a screening mammogram within the past 2 years. Sociodemographically, mobile mammography users were more likely than users at fixed sites to be uninsured, have incomes below $25,000, be African American or Latina, and report being single (14,15). Furthermore, mobile mammography users were more likely to be obese and smoke and less likely to be adherent to other screening guidelines (eg, Papanicolaou [Pap] test) or have seen a primary care provider in the past year.

When we examined differences between how mobile users and fixed-site users evaluated mammography services, we found that mobile mammography users reported better communication from mobile-site staff members (eg, providing reasons for delays, appointment reminders) than users reported at fixed sites.

One study (13) identified 3 commonly cited barriers to screening mammography among users at mobile and fixed sites: fear of cost, fear of mammogram-associated pain, and fear of bad news. Mobile mammography users were less likely (odds ratio [OR], 0.77) than fixed-site users to report fear of receiving bad news, but they were more likely (OR, 1.63) to report fear of mammogram-related pain. Black women and Hispanic women, regardless of screening site, were more likely than non-Hispanic white women to report fear of mammogram-related pain (OR, 1.32 and 1.05, respectively) and fear of receiving bad news (OR, 2.46 and 2.98, respectively). Uninsured women from both types of sites were more likely (OR, 1.39) than insured women to report fear of mammogram-related pain.

Sociodemographic characteristics of mobile unit users. All 10 studies indicated that women who used mobile mammography clinics were from underserved groups. Most studies reported that users of mobile mammography identified as African American (48%–62%) or Hispanic (4%–11%) (13,14,16,17,19), had incomes below $25,000 (13,15,18,21), and/or were uninsured (14–16,18–20). One study documented use of mobile mammo- graphy by American Indians residing in the Northern Plains (20). Three studies included both urban and rural areas. One study (14) that compared mobile clinics with fixed sites found that although mobile mammography reached a greater percentage of urban women than rural women (71% vs 29%), a significantly greater proportion of urban women attended the stationary clinic than the mobile clinic (80% urban women at fixed sites vs 71% urban women at the mobile clinic, $P < .001$). Another study (17) reported women from rural areas were less likely (OR, 0.34) than women in suburban areas to make repeat use of mobile mammography. A third study (13) did not assess urban–rural differences in participation.

Repeat visits. Two studies reported on characteristics of women who made repeat use of mobile mammography (17,19). Both studies documented that most mobile mammography users did not return for future screenings: 54% to 75% of users in these studies used the mobile unit only once during an 8- to 10-year period. Repeat visits were more likely among African American women than among women of another race/ethnicity (non-Hispanic white, Hispanic, or other), among women who were uninsured or had Medicare than among women who had private insurance or Medicaid, or among women aged 50 to 65 than among women in other age groups group (<40, 40–50, >65). Hispanic women were the least likely racial/ethnic group to make repeat visits to mobile mammography units (17,19).

Screening adherence and recency of screening. Overall, rates of screening adherence among users of mobile mammography were low. Two studies found that only 12% to 34% of mobile mammography users had had a screening mammogram in the past year (14,18). Four studies found that 40% to 48% of mobile mammography users adhered to 2-year screening guidelines (15,18,20,21). Another study documented that only 29% of mobile mammography users had completed a screening mammogram within the past 5 years (16).

Adherence to screening was less common among women aged 40 to 49 than among women in other age groups (20,21). Women were also less likely to adhere to screening guidelines if they were also noncompliant with Pap testing guidelines or other preventive screenings (21). Higher adherence rates were found among women who were extremely or morbidly obese, had a family history of breast cancer, had previous breast problems, or had less knowledge of breast health (21).

Screening outcomes. Two studies documented screening outcomes among mobile mammography users (14,16). Mobile mammography users had higher rates of being recalled for further imaging than users at fixed sites (16% vs 13%). Compared with users at fixed clinics, mobile mammography users were more likely to have a mammogram categorized as 0 in the Breast Imaging Reporting and Data System (BI-RADS) (which means that additional imaging evaluation and/or comparison to a previous mammograms is needed), particularly women whose last screening was 5 years ago or more, women without a primary care provider, and women who identified as Hispanic or white (14,16). Additionally, women who needed follow-up were more likely to be Hispanic than non-Hispanic, younger than 50, have no insurance, smoke, or have a family member who received a cancer diagnosis when aged 50 or younger (16). Among women whose mammogram was categorized as BI-RADS 0, mobile mammography users were less likely than users of fixed sites to return for additional imaging: 17% of mobile site users and 3% of fixed site users did not return.

Perceived risk. Two studies reported on mobile mammography users' perceived 5-year risk of developing cancer (15,18). They were more likely than fixed site users to perceive a lower 5-year risk of developing breast cancer (15). One-third of mobile mammography users reported "don't know" when asked to assess their perceived risk (18). Women who responded they did not know their perceived risk were more likely to have lower incomes, be less educated, have Medicare or be uninsured, and to have less knowledge about breast cancer than women who reported either less perceived risk or greater perceived risk. Mobile mammography users who accurately reported their risk, compared with women who inaccurately reported their risk, tended to report lower perceived risk, were more educated, never had a biopsy, did not have a family history of cancer, were younger at first childbirth, and/or not nulliparous (18).

Discussion

Findings from the 10 studies examined in this review suggest that mobile mammography programs do reach underserved women. Most women using mobile mammography lacked insurance and were from racial/ethnic minority backgrounds (mainly African Americans and Hispanic) and low-income households. Mobile mammography users also tended to have low rates of adherence to screening guidelines: 12% to 34% adhered to the 1-year guideline and 40% to 48% adhered to the 2-year guideline. These rates are lower than national rates of 50% for the 1-year guideline and 64% for the 2-year guideline and well below the Healthy People 2020 goal of having 81% of women aged 50 to 74 screened (22,23). Our findings highlight disparities in breast cancer screening among underserved women and underscore the importance of using outreach strategies such as mobile mammography to improve access and adherence to screening mammography guidelines.

Women aged 40 to 49 are less likely than women in older age groups to adhere to screening guidelines (24). Controversy surrounding the age at which mammograms should begin may influence the screening practices of younger women (25). Some evidence suggests that underserved women, particularly African American women, would benefit from starting screening at age 40 or even earlier, contrary to recommendations of the US Preventive Services Task Force (26). Thus, it is critical to increase breast cancer risk knowledge among underserved women to resolve breast cancer disparities.

Our review revealed that mobile mammography users typically did not return to the same mobile unit for additional screenings and that Hispanic women were the least likely racial/ethnic group to make a repeat visit. Mobile mammography users may have a more transient lifestyle than users of fixed sites; many are from low-income households, and low income can result in transient living situations. Furthermore, some Hispanic women, such as those employed in the cattle and harvesting industries, may be more likely to move around to find work and thus be less likely to return for repeat screenings (23,27). Concerns about image qual- ity and poor service could also discourage women from revisiting mobile clinics (12). Further examination of women's perceptions of mobile mammography showed that although some users initially had negative views about the quality of mobile mammography services, users often reported more positive experiences than women at fixed clinics (12). Providing patient navigation and appointment reminders may help promote attendance at mobile mammography clinics (12). Thus, efforts should be made to educate communities about the quality of mobile mammography services to improve participation and retention. More research is needed to explore factors associated with nonrepeat visits among women using mobile mammography.

The studies we examined reported that mobile mammography users were more likely than fixed-clinic users to be recalled for additional imaging, particularly women who had not been screened in 5 years or more, women without a primary care provider, and women who identified as Hispanic or white. Higher recall rates among these women may have been due to a lack of previous images, making it difficult to determine whether findings were stable or required further evaluation. No study identified the type of mammographic technology used (eg, film-screen, full-field digital, digital breast tomosynthesis); thus, it is uncertain whether differences in mammographic technology could explain differences in recall rates among sites. Mobile mammography users who required additional imaging were also less likely than their fixed-site counterparts to adhere to follow-up. Health education, text reminders, and patient navigation are promising strategies for improving compliance and should be explored by mobile mammography programs (12,28). The lack of diagnostic imaging on mobile units may pose access barriers (eg, transportation, cost) to underserved women needing follow-up examinations. Adding diagnostic mammography capability and ultrasound units on mobile units could expand reach to underserved women and help minimize disparities in breast cancer detection and survival.

Mobile mammography users were less likely than users of fixed sites to understand their breast cancer risk or to perceive it accurately. Women with higher perceived breast cancer risk have been found to be more likely to obtain mammograms or adhere to screening mammogram guidelines (29,30). Women who underestimate their breast cancer risk, compared with women who overestimate or correctly estimate their breast cancer risk, tend to be from racial/ethnic minority backgrounds, have less income, and be less educated (18,29,30). Efforts to increase mammographic screening among underserved women could be enhanced by providing education on breast cancer risk. Such education is an area of research and public policy that should be addressed.

Our review has several limitations. First, we focused exclusively on published scientific literature. Other studies of mobile mammography may have been conducted but not published in scientific journals. The inclusion of scientific literature only may have led to publication bias, because studies with negative or null outcomes are less likely to be published. However, our use of studies in scientific journals only helped to ensure that the research examined was of reasonable quality. Second, most of our included studies were derived from programs conducted in the southern United States, which has a history of racial/ethnic health disparities. This factor could have skewed our results — particularly our finding that African American women are the underserved group most likely to use mobile mammography. Nevertheless, the ability of mobile mammography to reach underserved groups remains a key finding. Third, we found high rates of not having health insurance among mobile mammography users; it is not known whether such high rates will continue to prevail at mobile clinics. Although our included studies were published during implementation of the Affordable Care Act, some of the studies were conducted before the insurance mandate. However, given the interest among underserved women in using mobile mammography and the tenuous future of the Affordable Care Act, we believe mobile mammography will remain an important resource for women from underserved communities. Fourth, 7 of the 10 studies described mobile mammography clinics that were operated by university hospitals, which could have biased results and limited generalizability. Lastly, because no study conducted an intervention, we could not analyze pooled data to determine the effectiveness of the mobile mammography programs described.

Our findings have important implications for and highlight critical gaps in research on the use of mobile mammography among underserved populations. Mobile mammography programs can be used to resolve disparities in mammographic screening rates. Future efforts aimed at improving screening mammogram uptake should target women from low-income groups, women with low educational attainment, and women with no health insurance. Adding patient navigation to mobile mammography programs may help improve screening mammography completion and promote further evaluation of any resulting abnormal mammograms. Programs to promote screening should be delivered in a culturally congruent manner, and risk assessments should account for a woman's racial/ethnic background. Efforts are needed to educate communities about the quality of mobile mammography, the importance of follow-up, and individual breast cancer risk. Future research should focus on understanding why many women do not return to mobile mammography clinics after their initial visit.

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Table

Table. Results of Studies Examining Medically Underserved Women's Participation in Mobile Mammography, United States, January 2010–March 2018

Study Location	Underserved Group Targeted and Sample Size	Research Design	Screening Guideline and Recency of Screening	Adherence Rate	Study Purpose	Major Findings
Studies That Compared Mobile Sites With Fixed Sites						
Chen et al, 2016 (12)						
Santa Clara County, California: mobile mammography operated by nonprofit community health centers; fixed unit operated by county hospital	Uninsured or underinsured Latina, Asian, or African American women (n = 11). Non-Hispanic white women not included.	Mixed methods: focus groups and a demographic survey	Not reported	Not reported	Examine women's perceptions of mobile mammography and fixed mammography	Women's perceptions of mobile mammography: • Concerned about quality of images • Felt technologists were less meticulous at mobile sites than at fixed sites • Experienced better communication at mobile site (eg, notification of long wait times, telephone call reminders)
Fayanju et al, 2014 (13)						
St. Louis and southeastern Missouri: mobile mammography operated by university hospital; fixed unit operated by academic medical center	Low-income African American and Hispanic women; non-Hispanic white women also included (n = 9,082).	Cross-sectional survey: 6-item questionnaire about women's mammography experience	Not reported	Not reported	Investigate perceived barriers to use of screening mammograms	Three most commonly perceived barriers to screening mammography were • Fear of cost • Fear of mammogram-associated pain • Fear of getting bad news
						Fear of mammogram-related pain was more likely to be reported among • Women screened on van (OR, 1.63) than among women at fixed clinic sites • Black (OR, 1.32) and Hispanic (OR, 1.05) women than among non-Hispanic white women; and • Uninsured women than among insured women (OR, 1.39)
						Black (OR, 2.46) and Hispanic (OR, 2.98) women were also more likely to report fear of receiving bad news than were non-Hispanic white women.
Stanley et al, 2017 (14)						
Charleston, South Carolina, and surrounding areas: mobile mammography unit operated by university hospital; fixed unit operated by academic medical center	Hispanic and African American women; non-Hispanic white and "other" racial/ethnic women also included (n = 1,433 at mobile site; n = 1,434 at fixed site).	Retrospective review of electronic medical records	Past 1 year	Mobile, 34.5%; fixed, 56.9%	Evaluate characteristics of women who use mobile vs fixed mammography	• Mobile site had a higher recall rate than fixed site (16% vs 13%) • Among patients with a BI-RADS category 0, mobile unit patients were more likely than fixed-clinic users to not adhere to follow-up (17.0% at mobile unit vs 2.6% at fixed site)
Vyas et al, 2013 (15)						
West Virginia: mobile mammography unit operated by university	Low-income and/or uninsured Appalachian women; Appalachian	Cross-sectional survey: questionnaire consisting of	Past 2 years	Mobile, 48.2%; fixed, 92.3%	Compare characteristics of women who use	Women using mobile unit, compared with women using the fixed unit, were

Abbreviations: BI-RADS, Breast Imaging Reporting and Data System; OR, odds ratio.

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Table. Results of Studies Examining Medically Underserved Women's Participation in Mobile Mammography, United States, January 2010–March 2018

Study Location	Underserved Group Targeted and Sample Size	Research Design	Screening Guideline and Recency of Screening	Adherence Rate	Study Purpose	Major Findings
hospital; fixed unit operated by university medical center	women from other income groups and insured Appalachian women also included (n = 1,161 at mobile unit; n = 1,104 at fixed unit).	personal health history, menstrual and pregnancy history, family history of cancer, cancer risk assessment and screening history, views on breast cancer screening, breast cancer awareness, preventive care and wellness history, nutrition and exercise history, dental, smoking and alcohol consumption history, and demographics			mobile unit vs fixed mammography	• More likely to be obese (OR, 1.87), smoke (OR, 1.77), or not visit a doctor in the past year (OR, 1.38) • Less likely to report consuming alcohol (OR, 0.54) or having transportation barriers (OR, 0.50) • More likely to have lower adherence to other preventive screenings (OR, 1.60) and to have lower levels of perceived 5-year risk of developing breast cancer (OR, 0.48)
Studies Examining Mobile Mammography Sites Only						
Brooks et al, 2013 (16)						
Jefferson County, Kentucky: mobile mammography unit operated by private hospital	Uninsured African American and Hispanic women; non-Hispanic white women also included (n = 3,923).	Retrospective review of electronic medical records	Past 5 years	29%	Evaluate mammographic screening outcomes and their predictors	Women with abnormal mammograms (BI-RADS category 4,5, or 6) were more likely than women with normal mammograms (BI-RADS category 1, 2, or 3) to be • Aged <50 y (OR, 1.65) • Hispanic (OR, 1.87) • Uninsured (OR, 1.63) And less likely to report • Not smoking (OR, 0.65) • Not having a relative diagnosed with cancer before age 50 (OR, 0.64).
						Women with BI-RADS category 0 mammograms were less likely than women with BI-RADS category 1, 2, or 3 to • Have been screened within the past 5 years (OR, 0.64) • Be African American (OR, 0.68) And were more likely to not have a primary care physician (OR, 1.50)
Drake et al, 2015 (17)						
St. Louis, Missouri: mobile mammography unit operated by university hospital	African American women; non-Hispanic white women also included (n = 8,450).	Secondary data analysis: mammography outreach registry with data on patient demographics and quality of mammography experience	Not reported	Not reported	Identify factors associated with repeat use of mobile mammography	Repeat visits were more likely to occur among women who were • Aged 50–65 (OR, 1.15) vs aged 40–50 • Uninsured (OR, 1.32) vs insured • African American (OR, 1.26) vs non-Hispanic white Repeat visits were less likely among women who were • Aged <40 (OR, 0.34) vs aged 40–50 • Unemployed (OR, 0.86) vs employed

Abbreviations: BI-RADS, Breast Imaging Reporting and Data System; OR, odds ratio.

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Table. Results of Studies Examining Medically Underserved Women's Participation in Mobile Mammography, United States, January 2010–March 2018

Study Location	Underserved Group Targeted and Sample Size	Research Design	Screening Guideline and Recency of Screening	Adherence Rate	Study Purpose	Major Findings
						• Living in a rural area (OR, 0.49) vs suburban
LeMasters et al, 2014 (18)						
West Virginia: mobile mammography operated by university hospital	Low-income or uninsured Appalachian women; Appalachian women from other income groups and insured Appalachian women also included (n = 1,182).	Cross-sectional survey: questionnaire on demographics, personal health history, menstrual and reproductive history, family history of cancer, breast cancer risk perceptions, breast cancer knowledge, perceived benefits and barriers to mammography, anxiety about developing breast cancer, clinical preventive care, health status, and health behavior/ lifestyle	Past 1 year and 2 years	Past 1 year: 11.8%; past 2 years: 48.0%	Describe characteristics of women who responded "don't know" when asked about their perceived 5-year risk of developing breast cancer	Women who responded "don't know" to their perceived 5-year breast cancer risk, compared with women who made an accurate or inaccurate response, • Were from lower-income families • Had less education • Were uninsured or had Medicare • Reported less knowledge about breast cancer
Mizuguchi et al, 2015 (19)						
Jefferson County, Kentucky, and surrounding areas: mobile mammography operated by university hospital	Uninsured African American or Hispanic women; non-Hispanic white women and "other" racial/ethnic group also included (n = 21,857).	Retrospective chart review: electronic medical records and data from patient information history form	Not reported	Not reported	Assess repeat use of mobile mammography	• Most (54%) patients used mobile mammography only once. • African American and Hispanic women used mobile mammography at a disproportionately higher rate than non-Hispanic white women. • Uninsured women made up the largest percentage (43.1%) of mobile mammography users. • African American women (30.5%) and women with Medicare insurance (31.5%) had the highest frequency of ≥3 repeat screenings at the mobile clinic among all racial/ethnic groups studied (non-Hispanic white, Hispanic, other) and other insurance types (private, Medicaid, uninsured), respectively. • Hispanic women were least likely group to be repeat users
Roen et al, 2013 (20)						
Reservations in North Dakota, South Dakota, Nebraska, and Iowa: mobile mammography operated by Indian Health Service	American Indian women only (n = 1,771).	Retrospective chart review of mammogram records	Past 2 years	40%	Determine adherence to screening mammography	• Women aged 41–49 were less likely (OR, 0.65) to have been adherent to screening mammogram guidelines compared with women aged 65 or older. • American Indian women using mobile mammography reported lower adherence (39.9%) than did

Abbreviations: BI-RADS, Breast Imaging Reporting and Data System; OR, odds ratio.

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Table. Results of Studies Examining Medically Underserved Women's Participation in Mobile Mammography, United States, January 2010–March 2018

Study Location	Underserved Group Targeted and Sample Size	Research Design	Screening Guideline and Recency of Screening	Adherence Rate	Study Purpose	Major Findings
						American Indian women (59.8%), non-Hispanic white women (77.6%), and all ethnicities combined (74.3%) in the Breast Cancer Surveillance Consortium.
Vyas et al, 2012 (21)						
West Virginia: mobile mammography operated by university hospital	Low-income, uninsured Appalachian women; Appalachian women from other income groups and insured Appalachian women also included (n = 686).	Cross-sectional survey: questionnaire on personal health history, menstrual and pregnancy history, family history of cancer, cancer risk assessment and screening history, views on breast cancer screening, breast cancer awareness, preventive care and wellness history, nutrition and exercise history, dental, smoking and alcohol consumption history, and demographics	Past 2 years	46%	Identify predictors of adherence in women who use mobile mammography	Women who were adherent were more likely to • Be older (OR, 3.88) • Be extremely or morbidly obese (OR, 1.93 and 2.36, respectively) • Have a family history of breast cancer (OR, 1.87) • Have a history of breast problems (OR, 1.90) • Have low knowledge of screening (OR, 2.17) And less likely to: • Be nonadherent to Papanicolaou (Pap) guidelines (OR, 0.16) • Have low rates of completion of other preventive screenings (OR, 0.52)

Abbreviations: BI-RADS, Breast Imaging Reporting and Data System; OR, odds ratio.

PREVENTING CHRONIC DISEASE
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RESEARCH BRIEF

Responses to a Social Media Campaign Promoting Safe Fish Consumption Among Women

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PEER REVIEWED

Summary

What is already known about this topic?

Social media is a promising tool for disseminating health messages. The framing, content, and context of these messages can affect how well they reach and are used by target populations. Social media offers a cost-effective means of testing messages to ensure selection of those most effective before campaign launch.

What is added by this report?

To inform a health education campaign designed to increase awareness about safe fish consumption, we used social media to test 11 different message types within 5 different categories among 2 audiences. In a quick but controlled test, we identified clear preferences in 9 of 10 comparisons and evidence to suggest that more women prefer presentation of question format compared with narratives, marketing compared with patient education copy, and uncertain compared with certain copy. Pregnant women were more likely to prefer a message from experts while nonpregnant women preferred a message from physicians.

What are the implications for public health practice?

We demonstrated a quick and effective way to test public health messages. Our findings that some social media messages resonate better than others justify the need for public health practitioners to test messages before campaign launches. To be effective stewards of resources, public health practitioners can use our simple and inexpensive strategy to test messages and identify those with the highest engagement to use in campaigns.

Abstract

We used a framework to systematically evaluate which Facebook advertisements promoting safe fish consumption increased traffic to our website. Keeping images and headlines constant, we tested 11 message types in 5 categories between 2 audiences over a 24-hour weekday period. We identified clear preferences in 9 of 10 comparisons and evidence to suggest that more women prefer presentation of question format compared with narratives, marketing compared with patient education copy, and uncertain compared with certain copy. Our test of messages on a social media platform is a quick and inexpensive way to select the most engaging public health messages for broad dissemination.

Objective

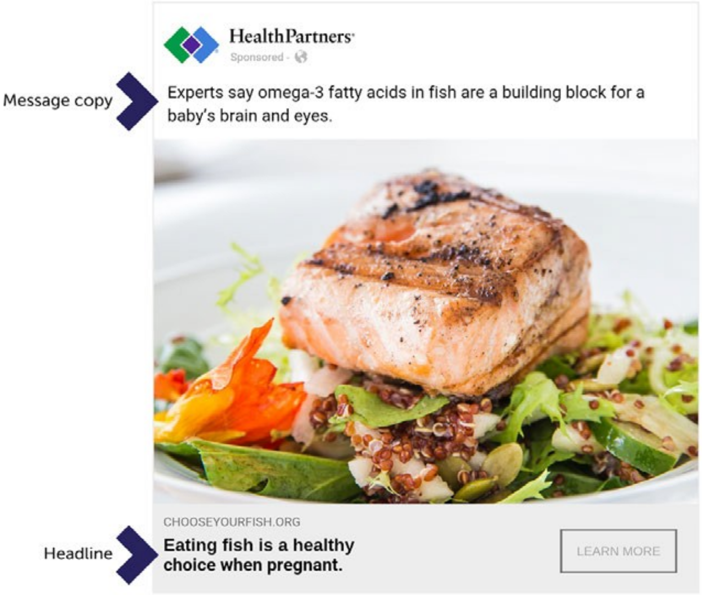
Fish contributes to visual and cognitive fetal development (1,2). With aligned missions, the Minnesota Department of Health and HealthPartners, an integrated health system, partnered to develop materials promoting safe fish consumption.

Sixty-eight percent of US adults use Facebook (3–6), which suggests that social media can widely disseminate health messages. Studies measure the reach and engagement of social media messages; however, few have described a methodic evaluation of content before message launch (5,7,8). Because message frame (9), content, and context affect reach (10), messages should be tested in advance. Social media offer a cost-effective means of testing (11). We evaluated the effectiveness of Facebook as a platform for low-resource, rapid message testing about safe fish consumption.

Methods

We launched a paid Facebook media campaign over a 24-hour weekday period in September 2018 to determine what effect advertising copy had on message success for 2 distinct audiences, pregnant women and nonpregnant women, in our target audience when images and headlines remained constant. The campaign compared responses to 11 message types in 5 categories in our 2 audiences (Table). In each message category, advertisement headlines and images were held constant by audience to ensure that engagement was evaluated solely on the basis of advertisement copy

(Figure). An editorial board with combined patient education, marketing, research, evaluation, and content expertise developed messages by using health communication literature, operational interests, and stakeholder opinion as selection criteria. In some instances, identical messages were used for multiple categories, but never within the same category. By using Facebook's proprietary "Likes and Interests" feature (12), we compared advertisement engagement of women in Minnesota aged 20 to 44 identified by Facebook as having an interest in pregnancy (pregnant, n = 440,000) to a similar group of women without an identified interest in pregnancy (nonpregnant, n = 990,000). The advertisement's target audience was refined by using this Facebook tool on the basis of user profiles and their connected content. These 2 audiences were chosen because women who are or could become pregnant were the target population for our fish consumption message.



Experts say omega-3 fatty acids in fish are a building block for a baby's brain and eyes.

CHOOSEYOURFISH.ORG

Eating fish is a healthy choice when pregnant.

Figure. Example Facebook advertisement used in the message testing campaign. The "expert" source ad shown here was most engaging for the audience of pregnant women.

Advertisements were released simultaneously by using Facebook's daily reach feature to minimize the chance that an advertisement was seen twice. Click-through rate (CTR), calculated by dividing the number of people who clicked on the advertisement by the number of people who saw it, measured engagement. For each audience, the CTR of each message type was compared by using χ^2 tests. Significance was set at $\alpha = 0.05$. Personnel and direct Facebook costs were summed to determine total implementation cost.

Results

The Facebook campaign reached 76,592 pregnant women and 86,816 nonpregnant women. No other demographic information was collected. We successfully identified a preference in 9 of 10 total tests ($P < .05$). The copy that resonated most with pregnant women had an expert source, with a 0.40% CTR (Table). The least engaging advertisements (CTR of 0.21% each) for this group were of the "Narrative," "Certain," and "Patient Education" message type: "Omega-3 fatty acids in fish are a building block for a baby's brain and eyes." The only set of advertisements that did not show clear preference were gain (ie, promoting the benefits of fish) and risk (ie, warning about negative effects of not eating enough fish) frame. For nonpregnant women, the advertisement with a physician source was most engaging with a 0.37% CTR, whereas the advertisement with risk framing was least engaging (CTR = 0.10%). For both audiences, question format, marketing, and uncertain advertisements were more engaging than their foils. Direct costs to run the advertisements on Facebook combined with 13 personnel hours needed to implement the tests and summarize the results brought the total implementation costs to under $2,500. This did not include image costs, because HealthPartners has an organizational subscription to the source of advertisement images used, or time to develop the advertisement copy.

Discussion

A team of multidisciplinary experts generated sets of test messages derivative of 1 common message across 5 categories, for a total of 11 message types. In a quick but controlled test, we identified clear preferences in 9 of 10 comparisons and evidence to suggest that more women prefer presentation of question format compared with narratives, marketing compared with patient education copy, and uncertain compared with certain copy. Pregnant women were more likely to prefer a message from experts and nonpregnant women preferred a message from physicians.

Future social media campaigns for safe fish consumption in Minnesota will use the messages and strategies found through our testing to be most engaging for each of our target populations. Although the findings about which message strategies are most useful for our topic and setting are limited to women who use Facebook and reside in Minnesota, the strategy to find relevant messages can be applied to any topic and setting. We recognize that there is no limit to the message strategies that can be tested, but we chose those that were directly pursuant to the literature, operational considerations, or stakeholder opinion. Furthermore, we do not offer an explanatory model for why the identified strategies were most effective or why the results differed by subpopulation. Nonetheless, our test of messages on a social media platform was a quick and inexpensive way to select the most engaging public health messages for broad dissemination.

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Table

Table. Five Message Categories Tested for Engagement (Via Click-Through Rate[a]) Among Pregnant and Nonpregnant Women in Minnesota, 2018

Category	Type	Pregnant Women			Nonpregnant Women		
		Message	Click-through Rate, %	*P* Value[b]	Message	Click-through Rate, %	*P* Value[b]
Narrative technique	Narrative	Omega-3 fatty acids in fish are a building block for a baby's brain and eyes.	0.21	<.001	Learn how eating fish may benefit your health.	0.17	<.001
	Question format	How can omega-3 fatty acids in fish affect a baby's brain and eyes?[c]	0.39		How can eating fish benefit your health?[c]	0.29	
Discipline of approach	Patient education	Omega-3 fatty acids in fish are a building block for a baby's brain and eyes.	0.21	<.001	Learn how eating fish may benefit your health.	0.17	<.001
	Marketing	Omega-3 fatty acids in fish — a building block for a baby's brain and eyes![c]	0.30		Eating fish benefits your health — learn how![c]	0.29	
Certainty	Certain	Omega-3 fatty acids in fish are a building block for a baby's brain and eyes.	0.21	.006	Learn how eating fish will benefit your health.	0.17	<.001
	Uncertain	Omega-3 fatty acids in fish can be a building block for a baby's brain and eyes.[c]	0.28		Learn how eating fish may benefit your health.[c]	0.22	
Framing	Gain	Omega-3 fatty acids in fish help with a baby's brain and eye development.	0.31	.30	Learn how eating fish could benefit your health.[c]	0.26	<.001
	Risk	Avoiding fish while you are pregnant may negatively impact your baby's brain and eye development.	0.34		Avoiding fish may mean you are missing out on important nutrients that are hard to get elsewhere.	0.10	
Source	Named clinician	"Omega-3 fatty acids in fish are a building block for a baby's brain and eyes." — Dr. Jane Smith, OB/GYN	0.30	<.001	"Eating fish may benefit your health." —Dr. Jane Smith, OB/GYN	0.24	<.001
	Physicians	Physicians say that Omega-3 fatty acids in fish are a building block for a baby's brain and eyes.	0.25		Physicians say that eating fish may benefit your health.[c]	0.37	
	Experts	Experts say that Omega-3 fatty acids in fish are a building block for a baby's brain and eyes.[c]	0.40		Experts say that eating fish may benefit your health.	0.30	

Abbreviation: OB/GYN, obstetrician/gynecologist.

[a] Calculated by dividing the number of people who clicked on the advertisement by the number of people who saw it.

[b] *P* value calculated by χ^2 test comparing each message type's click-through rate in audience.

[c] Messages in each message type that audiences found most engaging.

PREVENTING CHRONIC DISEASE
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ORIGINAL RESEARCH

FRESH: Long-Term Outcomes of a Randomized Trial to Reduce Radon and Tobacco Smoke in the Home

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PEER REVIEWED

Summary

What is already known on this topic?

Tobacco smoke and radon are major causes of lung cancer. However, few US residents view radon as an immediate health risk, and few test their homes for radon.

What is added by this report?

We provide results of a randomized controlled trial testing the efficacy of providing free in-person home radon and air nicotine test kits coupled with report back and a telephone problem-solving session as a means of reducing lung cancer risk.

What are the implications for public health practice?

The treatment effect was maintained for 9 months post intervention, suggesting a window of opportunity to promote radon mitigation or adoption of a smoke-free home policy.

Abstract

Introduction

Tobacco smoke and radon are the leading causes of lung cancer. The FRESH intervention was a randomized controlled trial of 515 homeowners to promote stage of action to reduce radon and air nicotine levels.

Methods

We studied 515 participants, 257 in a treatment group and 258 in a control group. Treatment participants received free radon and air nicotine test kits, report back, and telephone support, and those participants whose homes had high radon levels received a voucher for $600 toward mitigation. Both groups were asked to retest 15 months post intervention. We examined differences in stage of action to test for and mitigate radon and adopt a smoke-free–home policy and in observed radon and air nicotine values by study group over time.

Results

Homeowners in the treatment group scored higher on stage of action to test for radon and air nicotine and to mitigate for radon during follow-up than those in the control group at 3 months and 9 months, but the effect of the intervention diminished after 9 months. We saw no difference between groups or over time in observed radon or air nicotine values. Of homeowners in the treatment group with high radon levels at baseline, 17% mitigated, and 80% of them used the voucher we provided.

Conclusion

The null finding of no significant change in observed radon or air nicotine values from baseline to 15 months may reflect the low proportion of radon mitigation systems installed and the decline in stage of action to adopt a smoke-free home policy. Including a booster session at 9 months post intervention may improve the remediation rate.

Introduction

Approximately 221,200 new cases of lung cancer occur annually in the United States (1). Tobacco smoke and radon exposure are the 2 leading causes of lung cancer (2), and exposure to both (ie, synergistic risk) heightens the probability of developing the disease (3). The lifetime risk of radon-induced lung cancer is 62 per 1,000 ever-smokers versus 7 per 1,000 never-smokers (4). Exposure to radon may be more harmful for never-smokers exposed to secondhand smoke (5).

Residential radon exposure is a significant, modifiable risk factor for lung cancer death worldwide (6). However, few US residents view radon as an immediate health risk (7), despite high radon levels in 1 in 15 residences (8). Because radon is a colorless, odorless gas, many fail to recognize the potential for home exposure. In 1 study, 82% of respondents had heard of radon but only 15% had tested for its presence (9). In other research, rural family medical offices distributed 746 radon detection kits, but only 55% were returned (10). Because exposure to tobacco smoke plus radon increases lung cancer risk nearly tenfold (8), interventions are needed to reduce these risks.

Optimal reduction of risk from exposure to radon and secondhand smoke requires testing for radon and mitigating exposure if radon levels are elevated and adopting a smoke-free home policy. A radon mitigation system installed by a certified radon professional can reduce radon exposure (8). Our objective was to test the effects of an intervention consisting of home-testing for radon and secondhand smoke and personalized report back to the participant by trained research staff members. We assessed stages of action (11) for radon testing and radon mitigation and for air nicotine testing and adopting a smoke-free home. We hypothesized that homeowners who received their radon and air nicotine results and telephone-based problem solving would score higher on stages of action to test and remediate for radon and secondhand smoke, controlling for personal characteristics, compared with those who did not receive the intervention. We also hypothesized that observed radon and air nicotine values of participants in the treatment group would be lower post intervention than at baseline.

Methods

We assessed stage of action for radon testing and radon mitigation and for air nicotine testing and adopting a smoke-free home policy via a self-report survey at 3 months, 9 months, and 15 months post intervention. The study period, from first enrollment to last data collection, was January 2013 through August 2017.

Design and sample

Our target sample size was 275 participants per group before data collection (95% power to detect a medium effect size in the main effects of group and time and their interaction with an α level of .05). Recruitment ended just short of this goal ($N = 515$), but the robust degree of power for these planned comparisons suggested adequate enrollment. We divided participants between a treatment group ($n = 257$) and a control group ($n = 258$) by using stratified quota sampling. In each group, half of participants had 1 or more smokers in the home and half had no smokers in the home. Trained research staff members screened for eligibility, enrolled participants, randomly assigned them to a study group on site, administered the baseline survey, and delivered the first phase of the intervention in person.

Study participants were adults aged 21 or older with access to a telephone who could speak and read English and owned a single-family home that had not been tested for radon in the past 2 years. Only 1 participant per household was eligible for the study. Participants were recruited from central Kentucky primary care clinics, a pharmacy, and at community events. Age, sex, race/ethnicity, education, and employment status did not differ by recruitment location. We invited participants to complete subsequent surveys even if they had missed a previous one. The study was approved by the University of Kentucky institutional review board.

Intervention

FRESH (Freedom from Radon Exposure and Smoking in the Home) was a 2-step intervention. In the first step, we provided free radon and air nicotine test kits to the treatment group for home testing along with verbal, written, and YouTube video instructions for using the kits. Second, we consulted with participants by telephone to report back the test results and to help them solve problems related to high radon or air nicotine levels. To measure radon, we used short-term test kits from Air Chek, Inc (http://www.radon.com/). Participants sent the kit to the Air Chek laboratory in a postage-paid envelope. We assessed secondhand smoke exposure by using passive airborne nicotine samplers (12), which we sent to the Johns Hopkins School of Public Health Environmental Health and Engineering laboratory for analysis. Approximately 11 weeks after participants completed testing, trained research staff members conducted 20-to-25–minute telephone problem-solving sessions by using a standardized report-back protocol to assess the Precaution Adoption Process Model (PAPM) stage and the participant’s response to the test results. Researchers delivered queries (ie, asked questions) and messages tailored to the PAPM stage to share strategies for lowering radon (ie, mitigation) and secondhand smoke exposure (ie, adopting a smoke-free home policy). All participants in the treatment group whose homes tested high for radon received a voucher for $600 toward the cost of radon mitigation. The cost of radon mitigation depends on how the home is built and the extent of the radon problem (8). Participants in the control group could request free test kits (simulating standard public health practice) from the research team at a later date following enrollment in the study.

Measures

We categorized participants’ stage of action to test and remediate homes for radon and secondhand smoke as 1) unaware, 2) unengaged, 3) deciding, 4) action, and 5) maintenance. For ease of interpretation, we combined the original PAPM stages 3 to 5 (3, deciding about acting; 4, decided not to act; 5, decided to act) to define deciding. Researchers often combine PAPM stages depending on specific health behaviors (13).

Stage of action. We evaluated stage of action at baseline and at 3-month, 9-month, and 15-month intervals by using multiple survey questions for both radon and secondhand smoke and asked separate questions for testing and remediation. The scoring algorithm for the 4 stages of action measures are described elsewhere (14). At baseline, participants were not in maintenance for radon or air nicotine testing (a study requirement was not having been tested for radon in the past 2 years, and air nicotine tests were not commercially available). Scoring at each follow-up assessment was based on responses to the same stage of action questions and whether they had tested since baseline.

Radon and air nicotine values. Participants in the treatment group were given free short-term radon and air nicotine test kits and asked to test their homes at baseline. Participants in the control group could request test kits after enrollment. At 15 months post intervention, all study participants were mailed free test kits for both air contaminants. Baseline radon and air nicotine values were used to assign participants to risk groups (ie, tested high, tested low, or did not test/invalid result). We also used these test data to evaluate changes in radon and air nicotine levels from baseline to 15 months. Given skewness in the distributions, these values were log-transformed before analysis.

Teachable moment constructs. Lung cancer worry was assessed by using a 4-question scale (15). The first question ("How much do you currently worry about getting lung cancer someday?") was rated from 1 (not at all) to 5 (all of the time). The remaining 3 questions, including "How much do worries about lung cancer impact your mood?" were rated on a 4-point scale, from 1 (not at all) to 4 (a lot). Each of the questions was standardized by subtracting the overall mean from the individual score and dividing this difference by the overall standard deviation; these were then summed to represent overall lung cancer worry, with higher scores signifying greater worry (16). Lung cancer risk was measured by asking: "How would you rate your risk of developing lung cancer in your lifetime on a scale of 0 to 10?" Higher scores indicated greater perceived risk (17). Synergistic risk was measured by using a question that rated the perceived risk from being exposed to radon and smoking a pack of cigarettes per day compared with the risk of smoking a pack of cigarettes a day with no radon exposure on a 5-point scale ranging from 1 (much less risky) to 5 (much more risky). Health-related self-concept was measured by using the 8-question health-protective motivation subscale of the Health-Related Self Concept scale (18) to assess beliefs and attitudes toward health-enhancing behaviors and behavioral intentions. Responses were on a 7-point scale ranging from 1 (disagree entirely) to 7 (agree entirely). The negatively worded item (eg, "Generally, I am careless of my health") was reverse-coded before summing the items; higher scores indicated greater health-related self-concept. Cronbach's α was 0.91.

Self-efficacy. We measured self-efficacy by using a 3-question scale that measured ability ("I am able to test my home for radon to prevent lung cancer"), resources ("I have the time to test"), and ease of action ("I can easily test") (19) to assess confidence in taking each of 4 health actions: testing for radon, mitigating radon, testing for air nicotine, and adopting a smoke-free home policy. Respondents rated the 3 questions on a 5-point scale ranging from 1 (strongly disagree) to 5 (strongly agree). Self-efficacy scores were determined for each action. Cronbach's α were ≥0.83 for all 4 actions.

Smoking in the home. We assessed smoking in the home by asking, "Do you or any other members of your household smoke cigarettes, cigars, or pipes?" We collected demographic and personal factors on all study participants (age, sex, race/ethnicity, education, employment status, years living in current residence, and family history of lung cancer).

Risk status for radon and air nicotine. We categorized baseline test results as "tested high," "tested low," or "did not test/invalid result." On the basis of the Environmental Protection Agency action level for radon (8), home values at or above 4.0 picocuries per liter (pCi/L) were considered to test high for radon. Air nicotine values greater than 0.1 $\mu g/m^3$ were considered to test high for secondhand smoke (20).

Data analysis

Baseline comparisons between study groups and between completers and dropouts (ie, noncompleters) were made by using the 2-sample *t* tests or χ^2 tests of association. Linear mixed modeling evaluated the variables associated with changes over time in stages of action for testing and remediation for radon and secondhand smoke. Similarly, we assessed the factors associated with differences in radon and air nicotine log-transformed testing values at baseline and at 15 months. Baseline demographic and teachable-moment factors were included as covariates. Lung cancer worry and risk, synergistic risk, health-related self-concept, and self-efficacy were measured at each assessment (3 months, 9 months, 15 months) and included as time-dependent covariates in each model. Remediation models were also adjusted for risk status. The smoke-free home adoption model included only those participants with smokers in the home. The 4 stages of action models each had a significant interaction between treatment and time, rendering the main effects not interpretable; post-hoc pairwise comparisons were done on the interaction effects by using Fisher's least significant difference procedure. Data analysis was conducted using SAS, version 9.4 (SAS Institute Inc) with α = .05.

Results

The mean age of participants was 51 years. Most were non-Hispanic white women with college degrees (Table 1). Nearly one-fourth had a family history of lung cancer. Consistent with stratification, half lived with at least 1 smoker. Most (85.2%) participants in the treatment group completed baseline radon and air nicotine testing (Figure 1). Fewer (37.2%) in the control group completed testing. We maintained approximately 60% retention throughout the study (Figure 1). There was no difference in retention between treatment and controls at any follow-up (*P* > .10 for each χ^2 test comparison).

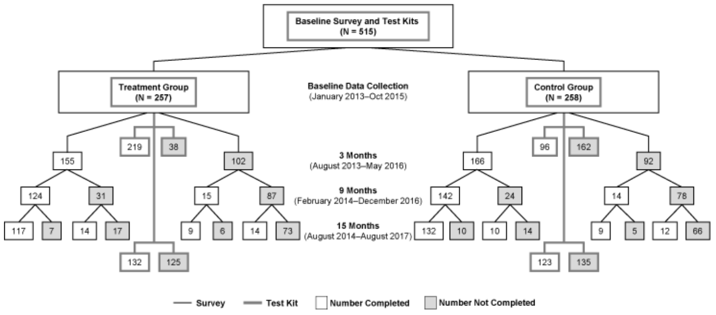

Figure 1. Flow diagram of enrollment and completion of surveys and testing for the baseline, 3-month, 9-month, and 15-month assessments of the FRESH (Freedom from Radon Exposure and Smoking in the Home) randomized controlled trial to reduce radon and secondhand smoke exposure in the home, Central Kentucky, Jan 2013–August 2017.

Baseline study group differences. We saw few differences in the study variables between the treatment and control groups at baseline with the exception of self-efficacy for radon testing (*P* = .004, with treatment exceeding controls by an average of 0.6) and risk group for each of radon and secondhand smoke. Risk group differences were significant because treatment group participants were more likely than controls to test for baseline radon and air nicotine (*P* < .001 for both). Among those who tested, we saw no difference between treatment and control groups in the proportion of test results that were high for either contaminant. We saw no differences between the treatment and control groups at baseline for either employment status or the length of time in current residence.

Differences between completers and noncompleters. Participants who completed the 15-month survey were older than noncompleters and more likely to have a college degree and not report smokers living in the home. Completers also had lower scores for lung cancer worry and risk but higher scores for synergistic risk perception and health-related self-concept (Table 1). Completers were more likely to have tested for the contaminants at baseline (59.7%) than noncompleters (30.8%; χ^2 = 40.5, *P* < .001).

Predictors of radon testing stage of action. Participants who were non-Hispanic white and had greater self-efficacy had higher stage-of-action scores for radon testing than nonwhite and Hispanic participants and those with lower self-efficacy (Table 2) (Figure 2). Post-hoc analysis indicated the groups did not differ at baseline (*P* = .460) or 15 months (*P* = .052), but the treatment group had a higher average compared with controls at both the 3-month and 9-month assessments (*P* < .001 for both comparisons) (Figure 2). Within each group, there was an increase in this outcome between baseline and 3 months and between 3 months and 9 months, followed by a decrease between 9 and 15 months (*P* < .001 for each comparison).

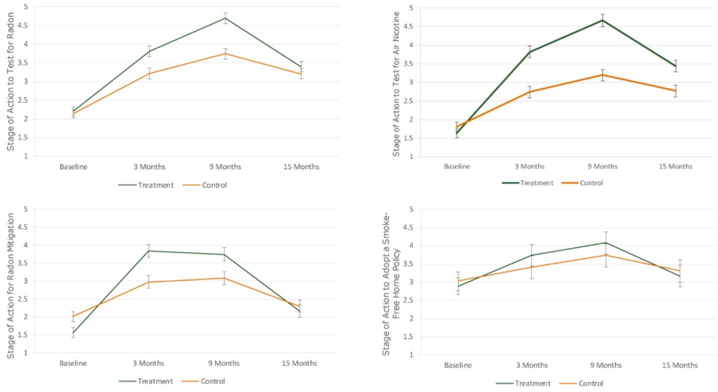

Figure 2. Adjusted means and 95% confidence intervals for the treatment and control groups on stage of action for testing and remediation outcomes for the baseline, 3-month, 9-month, and 15-month assessments of the FRESH (Freedom from Radon Exposure and Smoking in the Home) randomized controlled trial to reduce radon and secondhand smoke exposure in the home, Central Kentucky, January 2013–Aug 2017. Group means from models were adjusted for age, sex, race/ethnicity, education, employment, time living in current residence, smoking in the home, self-efficacy, lung cancer worry, lung cancer risk, synergistic risk, and health related self-concept. Brackets indicate confidence intervals.

Predictors of radon mitigation stage of action. Participants who had greater self-efficacy to mitigate radon exposure and who perceived greater synergistic risk were at a higher stage of action for radon mitigation relative to those with lower self-efficacy and with lower perceived synergistic risk scores (Table 2) (Figure 2). Compared with those who tested low for radon at baseline, those who tested high or did not test at all were at a lower stage of action to mitigate (*P* < .001 for both). Stage of action to mitigate was lower for treatment than controls at baseline ($P < .001$), but the group averages at 3 and 9 months were significantly higher for treatment than control ($P < .001$ for both) (Figure 2). By 15 months, there was no group difference ($P = .31$). Within each group, the increase from baseline to 3 months and the decrease from 9 to 15 months were significant ($P < .001$ for each comparison), but the change from 3 to 9 months was not ($P \geq .34$ for each group).

Predictors of air nicotine testing stage of action. Participants with smokers in the home and those with greater self-efficacy reported a higher average stage of action to test for air nicotine (Table 3) (Figure 2). Based on post-hoc testing, the 2 study groups were similar in stage of action for air nicotine testing at baseline ($P = .054$), but treatment exceeded controls at each follow-up ($P < .001$ for each comparison) (Figure 2). Within each group, we observed a significant increase from baseline to 3 months and another increase from 3 to 9 months, followed by a decrease from 9 to 15 months ($P < .001$ for each comparison).

Predictors of smoke-free home policy adoption stage of action. Among participants living with at least one smoker, those with at least a college degree and greater self-efficacy were more ready to adopt a smoke-free home; however, those with high baseline air nicotine were less ready to do so. Treatment and control groups did not differ on this outcome at any time point ($P > .14$ for each) (Figure 2). Within each group, there was an increase from baseline to 3 months ($P \leq .013$ for both) and a decrease from 9 to 15 months ($P \leq .01$ for both). From 3 to 9 months, there was an increase in stage of action to adopt a smoke-free home policy among treatment participants ($P = .04$), but the change from 3 to 9 months among controls was not significant ($P = .054$).

Predictors of radon and air nicotine. Observed home radon values ranged from 0.3 to 35.0 at baseline and 0.3 to 23.8 at 15 months. Observed air nicotine values ranged from 0.003 to 21.8 at baseline and from 0.005 to 21.4 at 15 months. The radon and air nicotine models contained the same covariates and fixed effects as the stage of action models for testing. Though each model was significant overall, the main and interaction effects for group (treatment vs control) and time (baseline vs 15 months) were not significant in either. Higher average radon level was associated with lower lung cancer worry, whereas higher average air nicotine level was associated with having smokers in the home, higher lung cancer worry, and lower health-related self-concept.

Of the 59 homeowners in the treatment group with high radon levels at baseline, 10 (17%) self-reported mitigating for radon at the end of the study; 8 of these redeemed vouchers. Of the 33 control group participants with high radon levels at baseline, 6 (18%) self-reported mitigating at study completion. Among those with smokers in the home, 58% of treatment and 55% of control participants reported adopting a smoke-free home policy at the end of the study. Neither of these remediation outcomes demonstrated a significant study group effect.

Discussion

Homeowners who received the FRESH intervention scored higher on stages of action to test for radon and secondhand smoke and to mitigate for radon at 3-month and 9-month follow-ups than those who did not, but by 15 months post intervention the group differences in these outcomes were no longer significant. Treatment group participants had higher stages of action to test for air nicotine even at 15 months, but we saw no differences in stage of action to adopt a smoke-free home policy between the groups at any time point. The decrease in stages of action between 9 and 15 months, regardless of outcome, suggests that the intervention had a diminishing effect by study end.

We planned the 15-month follow-up to provide ample time to mitigate. However, only 17% of participants in the treatment group with high radon levels reported mitigating their homes, even with a voucher to defray the cost. Control group participants reported the same mitigation rate (with no vouchers provided). We saw no significant change in radon or air nicotine values from baseline to 15 months. This null finding may reflect the low proportion of radon mitigation systems installed and the decline in stage of action to adopt and maintain a smoke-free home policy over time. Although stage of action to test and mitigate for radon improved over time, those most at risk (those with high radon levels) had low remediation rates, and the intervention did not affect actual remediation. Including a booster with an emphasis on radon mitigation for people with high radon levels after 9 months may improve the remediation rate, thereby decreasing exposure. Further research is needed to examine the disconnect between readiness to take action and actual remediation to reduce environmental exposure.

Treatment participants acquired the free test kits in person at baseline as an intervention component. Controls were asked to call for a free test kit at a later date (simulating standard public health practice). Home testing among treatment participants at baseline far exceeded what would be expected using standard practice (21). This highlights the value of distributing test kits in ambulatory health care settings to boost the likelihood of dual (radon and air nicotine) home screening. Comparative effectiveness research is needed to evaluate testing rates when test kits are distributed in alternative sites such as libraries or schools. One study determined that social marketing messages using digital signage technology in health departments was effective in increasing radon program participation (22).

In addition to the effects of the FRESH intervention, self-efficacy was a significant predictor for each stage-of-action outcome. Those who believed that they had the ability to test or remediate were more likely to indicate readiness to take action. This underscores the need for providing clear instructions and interventions to boost confidence in lung cancer prevention activities, such as using YouTube videos, easy-to-understand test kit instructions, and strategies to reduce barriers (including cost) to mitigating for radon and adopting a smoke-free home. Given that the monetary vouchers had a modest effect on the rate of radon mitigation, promoting access to low-interest loan providers and discount pricing provided by mitigation companies could increase affordable radon mitigation, which may enhance self-efficacy for this outcome.

Participants with high radon and air nicotine levels at baseline had lower stage-of-action scores for radon mitigation and for adopting a smoke-free home over time. Further research is needed to understand the complex psychological factors and other barriers to remediation among people whose homes test positive for environmental exposures (23). Interestingly, increased synergistic risk perception was a significant predictor of higher stage-of-action scores for radon mitigation over time. This has implications for public health education and community awareness, because the general public is not alert to the health risks of radon exposure or the combined risk of exposure to radon and tobacco smoke (7,9). Perceived risk creates a teachable moment that can lead to behavior change (24). In the case of lung cancer prevention, our findings support the critical role of informing the public of the risk of tobacco smoke plus radon in prompting action to reduce exposure. Health care providers need to speak with patients about these combined environmental hazards (25). Further investigation is needed to understand the role of perceived synergistic risk, if any, in prompting adoption of smoke-free home policies. As public health and health care systems integrate lung cancer risk reduction messaging, synergistic risk perception and its association with action to adopt smoke-free home policies must be evaluated.

Participants who did not complete the study scored higher on baseline lung cancer worry and perceived risk, and lower for synergistic risk and health-related self-concept. Previous studies noted that cancer worry and perceived risk are differentially associated with the avoidance of health behaviors related to screening and health maintenance (26). Further research is needed to explore the barriers to radon testing and mitigation among people with lung cancer worry and high perceived risk, such as the challenges posed by identifying a certified radon professional, scheduling and completing the mitigation process, and arranging mitigation payment. The addition of a booster session after 9 months could allow an opportunity to tailor the intervention to people who experience greater lung cancer worry or perceived risk.

Our study had strengths and limitations. A strength of the study design was its large sample and its stratification by home smoking. The intervention, easily delivered in primary care settings, was shown to be an effective way to promote home testing and remediation. A study limitation was attrition, as with most longitudinal trials, although we had consistent retention throughout the follow-up regardless of study group. Another limitation was that our sample was predominantly non-Hispanic white people with a college degree, so these results may not be broadly generalizable. Future studies would benefit from a more diverse sample. Furthermore, we did not evaluate cigarette pack-years among current and former smokers. Smoking history may affect study outcomes. This limitation is somewhat reduced because home smoking status was not associated with stage of action to test or mitigate for radon. Finally, because radon and air nicotine measurements may be higher in cold months (27), the report-back intervention may be more effective if initial radon and air nicotine testing is timed for when these contaminants are likely to be highest.

Providing free test kits in person in primary care settings, telephone support, and report back of results improved readiness to take action to remediate for radon and secondhand smoke. This low-cost intervention would likely benefit from a booster session at 9 months and a mechanism for linking people with high home radon levels with financial assistance for mitigation. These enhancements to our intervention would increase self-efficacy to take action to remediate the home for radon and secondhand smoke.

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Tables

Table 1. Baseline Characteristics of Participants (N = 515) in the FRESH Trial and Comparison of Completers and Noncompleters, Central Kentucky, January 2013–August 2017[a]

Characteristic	Potential Range[b]	Total sample (N = 515)[c]	Completers (n = 317)[c]	Noncompleters (n = 198)[c]	*P* Value
Age, mean (SD)	—	51.2 (12.7)	52.4 (12.4)	49.4 (12.9)	.009[d]
Sex					
Male	—	166 (32.2)	101 (31.9)	65 (32.8)	.82[e]
Female	—	349 (67.8)	216 (68.1)	133 (67.2)	
Race/ethnicity					
Non-Hispanic white	—	437 (85.2)	273 (86.7)	164 (82.8)	.23[e]
Non-white or Hispanic	—	76 (14.8)	42 (13.3)	34 (17.2)	
Education					
Less than college degree	—	199 (38.7)	99 (31.3)	100 (50.5)	<.001[e]
College degree	—	315 (61.3)	217 (68.7)	98 (49.5)	
Employed for wages					
Yes	—	308 (59.9)	197 (62.1)	111 (56.3)	.19[e]
No	—	206 (40.1)	120 (37.9)	86 (43.7)	
Years living in home, mean (SD)	—	13.3 (10.9)	14.1 (10.8)	12.3 (11.0)	.07[d]
Family history of lung cancer					
Yes	—	123 (23.9)	67 (21.1)	56 (28.3)	.06[e]
No	—	392 (76.1)	250 (78.9)	142 (71.7)	
Smokers in the home					
Yes	—	256 (49.7)	141 (44.5)	115 (58.1)	.003[e]
No	—	259 (50.3)	176 (55.5)	83 (41.9)	
Study group					
Treatment	—	257 (49.9)	154 (48.6)	103 (52.0)	.45[e]
Control	—	258 (50.1)	163 (51.4)	95 (48.0)	
Self-efficacy, radon testing, mean (SD)	5–15	13.1 (2.2)	13.2 (2.1)	12.9 (2.3)	.11[d]
Radon mitigation, mean (SD)	5–15	10.4 (2.7)	10.6 (2.7)	10.0 (2.7)	.02[d]
Secondhand smoke testing, mean (SD)	5–15	12.9 (2.2)	13.0 (2.1)	12.7 (2.2)	.13[d]

Abbreviations: —, not applicable; SD, standard deviation.

[a] A randomized controlled trial of 515 homeowners to promote stage of action to reduce radon and air nicotine levels. Completers and noncompleters refer to participants surveyed at 15 months to assess stage of action for radon testing and radon mitigation and for air nicotine testing and adopting a smoke-free home.

[b] Range of scores depending on the self-report scale.

[c] Values are number (percentage) unless otherwise indicated. Percentages may not sum to 100 because of rounding. For some variables, the number of observations does not total to the column total because of missing data for a small number of participants.

[d] Calculated by using 2-sample *t* test.

[e] Calculated by using χ^2 test of association.

[f] Because the number of response options for the lung cancer worry questions was not uniform across items, each question was standardized by subtracting the mean and dividing by the standard deviation prior to adding the items together. For this reason, the range for lung cancer worry includes negative values and the mean is close to 0.

[g] There were 3 risk groups, based on baseline testing, for each of radon and air nicotine: those who tested high, those who tested low, or those who did not test or who had an invalid result.

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Table 1. Baseline Characteristics of Participants (N = 515) in the FRESH Trial and Comparison of Completers and Noncompleters, Central Kentucky, January 2013–August 2017[a]

Characteristic	Potential Range[b]	Total sample (N = 515)[c]	Completers (n = 317)[c]	Noncompleters (n = 198)[c]	*P* Value
Adopting a smoke-free policy, mean (SD)	5–15	13.8 (2.7)	14.0 (2.6)	13.4 (2.8)	.02[d]
Lung cancer worry,[f] mean (SD)	−3 to 14[c]	<0.1 (3.2)	−0.6 (2.7)	1.0 (3.7)	<.001[d]
Lung cancer risk, mean (SD)	0–10	3.8 (2.5)	3.5 (2.4)	4.4 (2.6)	<.001[d]
Synergistic risk, mean (SD)	1–5	3.8 (1.0)	4.0 (0.9)	3.7 (1.0)	.002[d]
Health related self-concept, mean (SD)	8–56	46.4 (8.2)	47.5 (7.6)	44.7 (9.0)	<.001[d]
Risk group, radon[g]					
High	—	92 (17.9)	73 (23.0)	19 (9.6)	<.001[e]
Low	—	178 (34.6)	138 (43.5)	40 (20.2)	
Invalid or did not test	—	245 (47.5)	106 (33.4)	139 (70.2)	
Risk group, secondhand smoke					
High	—	66 (12.8)	43 (13.6)	23 (11.6)	<.001[e]
Low	—	184 (35.7)	146 (46.1)	38 (19.2)	
Invalid or did not test	—	265 (51.5)	128 (40.4)	137 (69.2)	

Abbreviations: —, not applicable; SD, standard deviation.

[a] A randomized controlled trial of 515 homeowners to promote stage of action to reduce radon and air nicotine levels. Completers and noncompleters refer to participants surveyed at 15 months to assess stage of action for radon testing and radon mitigation and for air nicotine testing and adopting a smoke-free home.

[b] Range of scores depending on the self-report scale.

[c] Values are number (percentage) unless otherwise indicated. Percentages may not sum to 100 because of rounding. For some variables, the number of observations does not total to the column total because of missing data for a small number of participants.

[d] Calculated by using 2-sample *t* test.

[e] Calculated by using χ^2 test of association.

[f] Because the number of response options for the lung cancer worry questions was not uniform across items, each question was standardized by subtracting the mean and dividing by the standard deviation prior to adding the items together. For this reason, the range for lung cancer worry includes negative values and the mean is close to 0.

[g] There were 3 risk groups, based on baseline testing, for each of radon and air nicotine: those who tested high, those who tested low, or those who did not test or who had an invalid result.

Table 2. Differences in Stages of Action for Radon Testing and Mitigation, Participants in Treatment (n = 257) and Control (n = 258) Groups by Participant Characteristics, Calculated by Linear Mixed Models, the FRESH Intervention,[a] Central Kentucky, January 2013–August 2017

Variable	Stage of Action[b]			
	Radon Testing (n = 499)		Radon Mitigation (n = 499)	
	F	*P* Value[c]	F	*P* Value[c]
Age	2.73	.098	1.43	.23
Male	0.35	.55	<0.01	.96
Non-Hispanic white	4.00	.046	0.07	.80
College education	1.64	.20	1.09	.30
Employed for wages	1.20	.27	1.78	.18
Years living in home	0.50	.48	2.05	.15
Family history of lung cancer	0.32	.57	0.03	.86
Smokers in the home	2.89	.089	1.13	.29
Self-efficacy	47.29	<.001	36.18	<.001
Lung cancer worry	0.04	.83	0.23	.63
Lung cancer risk	<0.01	.97	0.88	.35
Synergistic risk	3.21	.074	15.42	<.001
Health-related self-concept	3.82	.051	0.13	.71
Risk group	—	—	85.73	<.001
Time	426.88[b]	<.001	226.62[b]	<.001
Treatment	49.90[b]	<.001	9.57[b]	.002
Treatment × time	23.21	<.001	34.12	<.001

Abbreviation: —, not applicable.

[a] FRESH was a randomized controlled trial to promote stage of action to reduce radon and air nicotine levels in the home.

[b] Regressions modeling stage of action to test for radon and radon mitigation ranging from 1 (unaware) to 5 (maintenance over time). Main effects were not interpretable in either model given the presence of a significant interaction effect; means for the interaction effect are shown in Figure 2. Although the full sample size was 515, 16 participants missing 1 or more variables in the models could not be included in the multivariable analysis.

[c] *P* values calculated by type 3 tests of fixed effects in the mixed models.

Table 3. Differences in Stages of Action for Air Nicotine Testing and Adopting a Smoke-Free Home Policy, Participants in Treatment (n = 257) and Control (n = 258) Groups by Participant Characteristics, Calculated by Linear Mixed Models, the FRESH Intervention,[a] Central Kentucky, January 2013–August 2017

Characteristic	Stage of Action[b]			
	Secondhand Smoke Testing (n = 499)		Adopting a Smoke-Free Home Policy (n[c] = 247)	
	F	*P* Value[d]	F	*P* Value[d]
Age	1.53	.22	0.02	.89
Male	0.46	.50	0.09	.77
White/non-Hispanic	1.18	.28	0.15	.70
College education	0.64	.42	3.61	.058
Employed for wages	0.29	.59	0.36	.55
Years living in home	0.02	.88	0.24	.63
Family history of lung cancer	0.12	.72	0.81	.37
Smokers in the home	26.41	<.001	—	—
Self-efficacy	52.72	<.001	31.79	<.001
Lung cancer worry	1.06	.30	0.01	.92
Lung cancer risk	<0.01	.96	1.65	.20
Synergistic risk	2.00	.16	2.20	.14
Health-related self-concept	<0.01	.99	0.41	.52
Risk group	—	—	5.01	.007
Time	439.97[e]	<.001	29.33[e]	<.001
Treatment	126.78[e]	<.001	0.32[e]	.57
Treatment x time	63.01	<.001	3.14	.026

Abbreviation: —, not applicable; FRESH, Freedom from Radon Exposure and Smoking in the Home intervention.

[a] FRESH was a randomized controlled trial to promote stage of action to reduce radon and air nicotine levels in the home.

[b] Although the full sample size was 515, 16 participants missing 1 or more variables in the models could not be included in the multivariable analysis.

[c] This model was restricted to those with smokers in the home (n = 256; 9 were omitted because of missing 1 or more variable values in the model).

[d] *P* values calculated by type 3 tests of fixed effects in the mixed models.

[e] Regressions modeling stage of action to test for secondhand smoke and adopt a smoke-free home ranging from 1 (unaware) to 5 (maintenance over time). Main effects not interpretable in either model given the presence of a significant interaction effect.

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RESEARCH BRIEF

Relationship Between Adherence to Antihypertensive Medication Regimen and Out-of-Pocket Costs Among People Aged 35 to 64 With Employer-Sponsored Health Insurance

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PEER REVIEWED

Summary

What is already known about this topic?

Only 40% to 74% of patients treated for hypertension take medications as prescribed. Patients' out-of-pocket costs for medications can affect medication adherence.

What is added by this report?

We found a substantial proportion of people aged 35 to 64 with employer-sponsored health insurance to be nonadherent to antihypertensive medications (41%). People paid an average $6 for a 30-day supply of medication in 2014, and those paying higher out-of-pocket costs had a greater likelihood of being nonadherent.

What are the implications for public health practice?

The results highlight room for improvement in medication adherence among patients with employer-sponsored health insurance, even if facing small out of pocket costs.

Abstract

We used administrative claims data from 2014 on people with employer-sponsored health insurance to assess the proportion of patients taking antihypertensive medications, rates of nonadherence to these medication regimens, and out-of-pocket costs paid by patients. We performed multivariate logistic regression analysis to examine the association between out-of-pocket costs and nonadherence. Results indicated that patients filled the equivalent of 13 monthly prescriptions and paid $76 out of pocket over the calendar year; the likelihood of nonadherence increased as out-of-pocket costs increased (adjusted odds ratios ranged from 1.04 to 1.78; $P < .001$). These findings suggest a need for improvement in adherence among patients with employer-sponsored insurance.

Objective

Hypertension is a leading risk factor for cardiovascular disease, and only 40% to 74% of people with diagnosed hypertension are adherent to prescribed medication (1–3). Nonadherence can result in uncontrolled hypertension, which increases the risk of acute cardiovascular disease events (4,5). People who take many different drugs, experience side effects from hypertension medication, have comorbidities, or face high out-of-pocket costs are more likely to be nonadherent (6). No recent studies among the privately insured population of the United States describe rates of nonadherence and actual out-of-pocket payments for antihypertensive medications.

Methods

We used 2014 administrative claims data from the IBM MarketScan Commercial Database (IBM Corp), which provided de-identified health care claims data for enrollees and their dependents in employer-sponsored health insurance plans. We limited the study sample to adults aged 35 to 64 who were continuously enrolled with prescription drug coverage in 2014 (N = 3,362,633). We focused on 2014 after using the IBM Treatment Pathways online tool (IBM Corp), which reported stable trends of proportions of patients with any hypertension diagnosis (25%−26%) and proportions of patients filling an antihypertensive medication prescription (29%−30%) in 2010 through 2014.

We identified people with hypertension by the appearance of *International Classification of Diseases, 9th Revision* (ICD-9), diagnosis codes (401.x–405.x) on at least 2 outpatient or 1 inpatient or emergency department claim, and we identified cardiovascular disease events resulting in an inpatient or emergency department visit by using ICD-9 codes from the Center for Medicare and Medicaid Services' Chronic Conditions Warehouse for ischemic heart disease, acute myocardial infarction, cerebrovascular disease, and heart failure (398.91, 402.x–404.x, 410.x, 411.x–413.x, 414.0x, 414.12, 414.2, 414.3, 414.8, 414.9, 428.x, 430.x, 431.x, 433.x1, 434.x, 436.x, 997.02) (7). We measured adherence to antihypertensive medications among enrollees with at least 1 antihypertensive drug claim in 2014. We identified antihypertensive medications by Redbook drug codes for therapeutic class (except for angiotensin II receptor blockers, which we identified by using National Drug Codes, because they were not identified in Redbook by therapeutic class) (8). We measured the proportion of days covered (days covered equaled the patient's supply of medication from the day of the first filled prescription through the end of the calendar year), divided by the number of days in that same period, calculated for each medication class, and then averaged across number of medication classes per person. Enrollees with less than 80% of days covered were considered nonadherent, a cutoff used in many studies (4,9). We report total out-of-pocket cost (sum of copayments, coinsurance, or deductibles) and total payments for antihypertensive medications. We also reported number of filled prescriptions and out-of-pocket and total medication costs for a 30-day equivalent supply of antihypertensive medications (eg, 15 days of supply becomes 0.5 of a 30-day fill). Out-of-pocket costs was converted to a categorical variable ($0, <$5, $5–<$10, $10–<$15, $15–<$20, $20–<$50, and ≥$50).

We used multivariate logistic regression to estimate the association between category of out-of-pocket cost and the likelihood of being nonadherent and presented these data as odds ratios. We used Stata 12 SE (StataCorp, LLC) to analyze data.

Results

In 2014, 22% of adults aged 35 to 64 (N = 2,897,548) were diagnosed with hypertension (Table 1). Among the 27% (N = 3,462,582) of adults who filled prescriptions for antihypertensive medications, 41% (N = 1,428,298) of those who filled a prescription were nonadherent to their antihypertensive medication regimen. Nonadherence decreased with age and was higher for women than men and for people using branded medications than those using generic ones. Regionally, nonadherence was highest among people living in the South.

Patients filled an average of 13 monthly antihypertensive medication prescriptions during the calendar year and paid on average $5.78 out of pocket per 30-day supply and $76 annually. Total costs (patient and insurer) for antihypertensive medications were $17 per 30-day supply and $229 annually. People who used branded medications had the highest out-of-pocket costs ($13.60 per 30-day supply) and highest total costs ($40.73 per 30-day supply). Patients in health maintenance organizations had higher out-of-pocket costs that those in other types of insurance plans. Residents of rural areas also had higher out-of-pocket costs than those paid by those in urban areas, but they used less expensive medications.

About 90% of patients incurred out-of-pocket costs for medications, but 83% paid less than $10 per 30-day supply of antihypertensive medications. However, 30% of patients paid the full costs of their medications (approximately $41 in annual out-of-pocket costs for an average of 10 fills during the calendar year.).

We calculated the unadjusted and multivariate-adjusted odds ratios for the association between nonadherence and patient characteristics (Table 2). The likelihood of nonadherence increased as out-of-pocket costs increased (odds ratios, compared with those with no out-of-pocket costs, ranged from 1.04 for those paying less than $5, to 1.78 for those paying more than $50).

The likelihood of nonadherence was greatest among patients who used branded antihypertensive medications and those living in the South and was smallest among those with a hypertension diagnosis in 2014 and patients aged 55 to 64. When we restricted the sample to patients with a hypertension diagnosis as a sensitivity analysis, the associations were similar in magnitude and significance.

Discussion

We found that nonadherence to antihypertensive medication regimens was common and was most common among patients with higher out-of-pocket costs. A 2016 study estimated that patients with commercial insurance paid about $4.13 in copayments per antihypertensive medication prescription filled in 2014, slightly lower than the out-of-pocket cost estimate reported in our study, which provides a more comprehensive estimate that includes copayments, coinsurance, and deductibles (10).

Numerous experimental and quasi-experimental studies have found a causal relationship between lowering patients' out-of-pocket costs and reducing medication nonadherence (11). Our study shows an association between out-of-pocket costs and nonadherence among enrollees in employer-sponsored insurance plans. However, nonadherence is influenced by many other factors unrelated to cost, such as number of pills to be taken (eg, 1 daily medication versus combination medications) or the burden of filling prescriptions (eg, increasing the number of doses per prescription, delivering prescriptions by mail) (6,10,12). The data we used were collected for administrative purposes and were not nationally representative. In addition, claims data have many documented limitations, including that prescriptions filled do not measure actual medication used.

Our study findings show that there is room for improving adherence to antihypertensive medications among patients with employer-sponsored insurance and that patients who faced higher out-of-pocket costs had a greater likelihood of being nonadherent.

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Tables

Table 1. Characteristics of Sample of Adults Aged 35 to 64 (N = 3,362,633), Study of Relationship Between Nonadherence to Antihypertensive Medication (AHM) Regimen and Enrollment in an Employer-Sponsored Health Insurance Plan, United States, 2014[a]

Variable	No. Enrollees	Diagnosed With Hypertension, N (%)	Treated With AHM, N (%)	Nonadherent Among Treated, N (%)	Number of AHM Prescriptions Filled[b,c]	Out of Pocket Cost, AHM, $[d]		Total Cost, AHM, $[b,e]	
						30-Day Supply	Annual Supply	30- Day Supply	Annual Supply
Total	13,035,703	2,897,548 (22)	3,462,582 (27)	1,428,298 (41)	13.2	5.78	76.24	17.34	228.57
Age, y									
35–44	4,067,167	436,240 (11)	576964 (14)	3,187,186 (52)	10.1	5.93	59.67	17.02	171.15
45–54	4,759,074	10,21,153 (21)	1,237,594 (26)	2,756,655 (43)	12.5	5.86	73.22	17.36	217.02
55–64	4,209,462	1,440,155 (34)	1,648,024 (39)	2,409,621 (36)	14.8	5.70	84.30	17.40	257.35
Sex									
Male	6,073,363	1,469,555 (24)	1,690,278 (28)	2,442,685 (40)	13.7	5.81	79.55	17.67	241.87
Female	6,962,340	1,427,993 (21)	1,772,304 (25)	2,448,195 (43)	12.7	5.75	73.08	16.99	215.89
Insurance plan[f]									
PPO	7,438,985	1,806,612 (24)	1,996,135 (27)	2,286,115 (41)	13.2	5.84	77.14	18.26	241.06
HMO	1,342,925	290,178 (22)	351,450 (26)	3,261,165 (43)	13.1	6.23	81.77	16.45	216.07
CD/HD	2,158,440	445,098 (21)	519,476 (24)	3,159,601 (42)	12.8	5.42	69.40	15.35	196.63
Other[g]	1,240,828	333465 (27)	372,064 (30)	3,243,771 (41)	13.5	5.94	80.44	16.54	223.83
Region[h]									
Northeast	2,708,175	503,112 (19)	665,342 (25)	3,047,219 (38)	13.7	5.13	70.18	17.02	232.63
Midwest	2,685,343	577697 (22)	708,806 (26)	3,025,079 (38)	13.6	5.14	70.04	14.57	198.38
South	5,156,805	1,378,328 (27)	1,533,458 (30)	2,604,672 (44)	12.9	6.40	82.32	19.13	246.10
West	2,156,128	345,237 (16)	454,118 (21)	3,196,654 (41)	12.9	5.23	67.36	15.68	202.14
Geographic area									
Urban	11,269,871	2,441,266 (22)	2,810,705 (25)	1,807,038 (41)	13.2	5.66	74.41	17.33	228.05
Rural	1,765,832	456,282 (26)	551,928 (31)	3,141,037 (42)	13.3	6.00	79.94	16.87	224.55
Type of AHM used[i]									
Generics only	3,041,215	1,855,141 (61)	3,041,215 (100)	1,216,486 (40)	12.8	4.41	56.45	10.72	137.23
Ever use branded	421,367	290,743 (69)	421,367 (100)	223,325 (53)	16.1	13.60	219.03	40.73	655.75

Abbreviations: CD/HD, consumer driven or high deductible health plan; HMO, health maintenance organization; HTN, hypertension; PPO, preferred provider organization.

[a] Data are from IBM's MarketScan Commercial Database.

[b] Outliers (negative values and ≥99th percentile for annual AHM cost and total payment) and missing values excluded.

[c] 30-day equivalent fills.

[d] This includes copayments, coinsurance, and deductibles.

[e] Total payments include all payments made, including insurer payments, copayments, coinsurance, deductibles, and coordination of benefits payments.

[f] Plan type was missing for 7% of the sample.

[g] Other includes comprehensive, exclusive provider organization, and point of sale plans.

[h] Region was missing for 3% of the sample.

[i] This splits AHM users into 2 mutually exclusive groups: those who only filled prescriptions for generic AHMs in 2014 (88%) and those who ever filled a prescription for a branded AHM in 2014 (12%).

Table 2. Odds of Nonadherence to an Antihypertensive Medication Regimen in Relation to Out-of-Pocket Costs, Adults Aged 35 to 64 Enrolled in an Employer-Sponsored Health Insurance Plan, United States, 2014[a]

Variables	Unadjusted Odds Ratio (95% CI)	*P* Value	Adjusted Odds Ratio[b] (95% CI)	*P* Value
Out-of-pocket cost, 30-day supply of antihypertensive medication, $				
0	1 [Reference]			
<5	0.99 (0.98–1.00)	.003	1.04 (1.04–1.05)	<.001
5–<10	1.35 (1.34–1.37)	<.001	1.36 (1.35–1.37)	<.001
10–<15	1.60 (1.58–1.61)	<.001	1.51 (1.49–1.52)	<.001
15–<20	1.77 (1.74–1.79)	<.001	1.50 (1.48–1.52)	<.001
20–<50	1.89 (1.87–1.92)	<.001	1.44 (1.42–1.46)	<.001
≥50	2.45 (2.39–2.52)	<.001	1.78 (1.73–1.83)	<.001
Age, y				
35–44	1 [Reference]			
45–54	0.69 (0.68–0.69)	<.001	0.69 (0.68–0.69)	<.001
55–64	0.52 (0.51–0.52)	<.001	0.51 (0.51–0.51)	<.001
Sex				
Male	1 [Reference]			
Female	1.14 (1.13–1.14)	<.001	1.14 (1.14–1.15)	<.001
Hypertension diagnosis in 2014				
No	1 [Reference]			
Yes	0.89 (0.89–0.90)	<.001	0.88 (0.87–0.88)	<.001
Cardiovascular disease event in 2014				
No	1 [Reference]			
Yes	2.00 (1.97–2.02)	<.001	2.12 (2.09–2.15)	<.001
Type of AHM used[c]				
Generic AHMs only	1 [Reference]			
Any use of branded AHMs	1.72 (1.71–1.73)	<.001	1.52 (1.51–1.52)	<.001
Type of insurance plan				
PPO	1 [Reference]			
HMO	1.07 (1.06–1.08)	<.001	1.07 (1.06–1.08)	<.001
CD/HD	1.03 (1.02–1.03)	<.001	1.05 (1.04–1.06)	<.001
Other	1.01 (1.00–1.01)	.15	1.04 (1.03–1.04)	<.001
Region				
Northeast	1 [Reference]			
Midwest	1.03 (1.02–1.04)	<.001	1.02 (1.02–1.03)	<.001
South	1.31 (1.30–1.31)	<.001	1.24 (1.23–1.25)	<.001

Abbreviations: CD/HD, consumer driven or high deductible health plan; CI, confidence interval; HMO, health maintenance organization; PPO, preferred provider organization.

[a] Data are from IBM's MarketScan Commercial Database.

[b] Adjusted for variables listed in the table.

[c] This splits AHM users into 2 mutually exclusive groups: those who only filled prescriptions for generic AHMs in 2014 (88%) and those who ever filled a prescription for a branded AHM in 2014 (12%).

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(continued)

Table 2. Odds of Nonadherence to an Antihypertensive Medication Regimen in Relation to Out-of-Pocket Costs, Adults Aged 35 to 64 Enrolled in an Employer-Sponsored Health Insurance Plan, United States, 2014[a]

Variables	Unadjusted Odds Ratio (95% CI)	*P* Value	Adjusted Odds Ratio[b] (95% CI)	*P* Value
West	1.18 (1.17–1.19)	<.001	1.16 (1.15–1.17)	<.001
Geographic region				
Rural	1 [Reference]			
Urban	0.98 (0.97–0.98)	<.001	0.99 (0.98–1.00)	.002

Abbreviations: CD/HD, consumer driven or high deductible health plan; CI, confidence interval; HMO, health maintenance organization; PPO, preferred provider organization.

[a] Data are from IBM's MarketScan Commercial Database.

[b] Adjusted for variables listed in the table.

[c] This splits AHM users into 2 mutually exclusive groups: those who only filled prescriptions for generic AHMs in 2014 (88%) and those who ever filled a prescription for a branded AHM in 2014 (12%).

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IMPLEMENTATION EVALUATION

Do Employees From Less-Healthy Communities Use More Care and Cost More? Seeking to Establish a Business Case for Investment in Community Health

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PEER REVIEWED

Summary

What is already known on this topic?

Peer-reviewed literature discusses economic consequences of poor health and the association between community health, the built environment, and individual health.

What is added by this report?

Minimal research has directly examined the effect of poor community health on employees' medical costs, use of emergency departments, and hospitalizations. We explored whether employed adults and their adult dependents living in less-healthy communities in the greater Philadelphia region used more care and had higher costs than employees from healthier communities.

What are the implications for public health practice?

Our findings suggest a need for more primary care access. Business leaders expressed interest for guidance on how to invest in community health improvement.

Abstract

Introduction

Few studies have examined the impact of community health on employers. We explored whether employed adults and their adult dependents living in less-healthy communities in the greater Philadelphia region used more care and incurred higher costs to employers than employees from healthier communities.

Methods

We used a multi-employer database to identify adult employees and dependents with continuous employment and mapped them to 31 zip code regions. We calculated community health scores at the regional level, by using metrics similar to the Robert Wood Johnson Foundation (RWJF) County Health Rankings but with local data. We used descriptive analyses and multilevel linear modeling to explore relationships between community health and 3 outcome variables: emergency department (ED) use, hospital use, and paid claims. Business leaders reviewed findings and offered insights on preparedness to invest in community health improvement.

Results

Poorer community health was associated with high use of ED services, after controlling for age and sex. After including a summary measure of racial composition at the zip code region level, the relationship between community health and ED use became nonsignificant. No significant relationships between community health and hospitalizations or paid claims were identified. Business leaders expressed interest in further understanding health needs of communities where their employees live.

Conclusion

The health of communities in which adult employees and dependents live was associated with ED use, but similar relationships were not seen for hospitalizations or paid claims. This finding suggests a need for more primary care access. Despite limited quantitative evidence, business leaders expressed interest in guidance on investing in community health improvement.

Introduction

Peer-reviewed literature discusses the economic consequences of poor health and the association between community health, the built environment, and individual health (1–4). The literature also cites rising costs and lost productivity to employers offering health plan benefits (5,6). Minimal research has examined the effect of poor community health on employees' medical costs, use of emergency departments (EDs), and hospitalizations. Employers assess the prevalence of illness, service utilization rates, and costs of disease for employees and their dependents but typically do not explore associations between employee health and community health (7,8).

Studies show that 20% of poor health status in impoverished populations is attributable to clinical care, with the remaining 80% attributable to social, economic, and environmental determinants (9,10). Where people live also affects mortality outcomes (10–13). This evidence is an impetus for public and private sectors and the health sector to invest in revitalizing unhealthy communities (14–19).

Although an estimated 80% of employers offer benefits including health management services, the effect on employees' health status and employer health benefit costs is limited (7,20–22). Employers across business sectors increasingly recognize the impact of community health on employee health, absenteeism and productivity, and the need for a population health approach and investing in community development initiatives (12,15). The Dow Chemical Company, General Electric, Campbell Soup Company, Kaiser Permanente, General Dynamics, Bath Iron Works, and Let's Move! Active Schools are among the organizations that have initiated projects to address poor community health (7,15,23).

Our study objective was to assess whether employees and their adult dependents living in less healthy communities use more ED and hospital inpatient services and experience higher total claims costs than employees and dependents from healthier communities, among a sample of employees in southeastern Pennsylvania. This research may inform employers about where to invest in communities to improve the built environment and increase access to resources to support healthy living.

Methods

Sample

We acquired data from a multi-employer data warehouse, maintained by a benefit consulting organization, containing individual-level data about employees of large employers in southeastern Pennsylvania and their dependents (N = 64,252). The data included demographic characteristics, health care use, and medical cost variables from 2016. We removed data with negative values from the set which were present because of adjustments made from prior time periods. We excluded individuals who did not live in the 5 southeastern Pennsylvania counties (Bucks, Chester, Delaware, Montgomery, Philadelphia) or who only had post office box addresses (n = 61,516). We limited the data set to adults (n = 46,925) with continuous health insurance coverage for the year 2016 (n = 35,845). Finally, we removed 7 people with extreme values of use and cost (n = 35,838).

Measures

Individual level. Variables included in the analyses were those describing demographics (age, sex [male or female], and relative status [employee, spouse, or adult child]), medical claims costs, number of inpatient hospitalizations, and number of ED visits. We treated sex and relative status as categorical variables. All other variables were treated as continuous.

Zip code region level. Using Environmental Systems Research Institute's ArcGIS version 10.3 mapping software (Esri), the zip codes in southeastern Pennsylvania were aggregated to create 31 zip code regions (zip regions), which have been used previously by the City of Philadelphia and the Public Health Management Corporation (PHMC) to summarize local health data (24). We developed a summary community health variable (Health Index) based on methods used by the Robert Wood Johnson Foundation (RWJF) County Health Rankings, but using local measures available at the zip code level aggregated to zip regions based on proximity. We replicated the structure of the County Health Rankings health outcomes and health factor domains, which included health outcomes, health behaviors, clinical care, social and economic environments, and physical environment. Each domain was composed of 5 to 9 component measures. We found local data at the zip code level, such as the PHMC Household Health Survey (25) and US Census data (26) to cover 66.6% of the component measures included in the RWJF County Health Rankings methodology. We then weighted the measures and domains per RWJF Health Rankings methods (27).

To link individual- and zip region–level data, we used ArcGIS to geocode adult employees and dependents by address to identify the zip region in which they resided in 2016. We used a consensus-based approach among all stakeholders and researchers involved to identify the statistical analysis plan, including treatment of variables and the outliers among the outcome variables. Based on analyses of the existing data and knowledge of the outcome variables, we eliminated cases with the following characteristics: >$800,000 in medical claims (n = 1), >15 inpatient hospitalizations (n = 1), and >20 ED visits (n = 5). The final sample was 35,838.

We conducted a focus group to present data findings to financial and human resource business executives convened by The CFO Alliance, representing employers from various sectors of the economy and of differing sizes. The Thomas Jefferson University institutional review board granted approval for the study.

Statistical analysis

We conducted descriptive statistical analyses using SPSS version 23 (IBM Corporation) and statistical modeling using SAS version 9.4 (SAS Institute, Inc). We used descriptive statistics to summarize each individual- and zip region–level variable, including counts, proportions, means, and standard deviations. We used simple linear regression to explore relationships between demographics, the Health Index variable, and each dependent variable. Independent variables that showed a significant bivariate relationship (at $P < .10$) with dependent variables were retained for multilevel analysis. We tested bivariate relationships between the 5 domains that comprised the Health Index and each dependent variable. We used multilevel linear modeling to identify the direct effects of individual-level demographics (age and sex) and the group-level factor of community health (Health Index) on the dependent variables: medical claims costs, number of inpatient hospitalizations, and number of ED visits, respectively (fixed effects). We also conducted multilevel models to see if each domain individually predicted each of the dependent variables. Because the individual-level data set did not include a variable for race, we controlled for the proportion of white residents at the zip region level using American Communities Survey 5-year estimates (2011–2015).

We considered using zero-inflated models because of the high proportion of zero values in the dependent variables, especially for inpatient hospitalizations. Because zero-inflated models cannot distinguish between variance at the individual and group levels, we used multilevel linear modeling. We calculated an intraclass correlation coefficient (ICC) to estimate the amount of variance in outcomes that were accounted for by zip regions. We assessed whether clusters of families should be considered in the models by randomly selecting an individual per household, conducting the models again, and checking model coefficients and ICCs. Results were similar, so we ignored household clustering. A random effect for intercepts was included for zip regions. The sample size per zip region ranged from 79 to 3,984, with a mean of 1,156. Significance was set at $P < .05$ for multilevel models.

Results

Most of the sample of employees and adult dependents was female (55.6%) and of working age (18–39, 40.5%; 40–59, 44.1%) (Table 1). The age range was 18 to 94 years. The sample was unequally geographically distributed, with most living in Delaware (29.2%) and Bucks (24.6%) Counties. The mean medical claims cost among the sample was $4,803.41. In 2016, the mean number of ED visits per person was 0.31, and the mean number of inpatient hospitalizations per person was 0.07.

We identified community health disparities among the 31 zip regions in southeastern Pennsylvania (Figure 1). Overall, Philadelphia County zip regions had the highest Health Index scores, denoting the poorest health, followed by zip regions in eastern Delaware County and southern Bucks County.

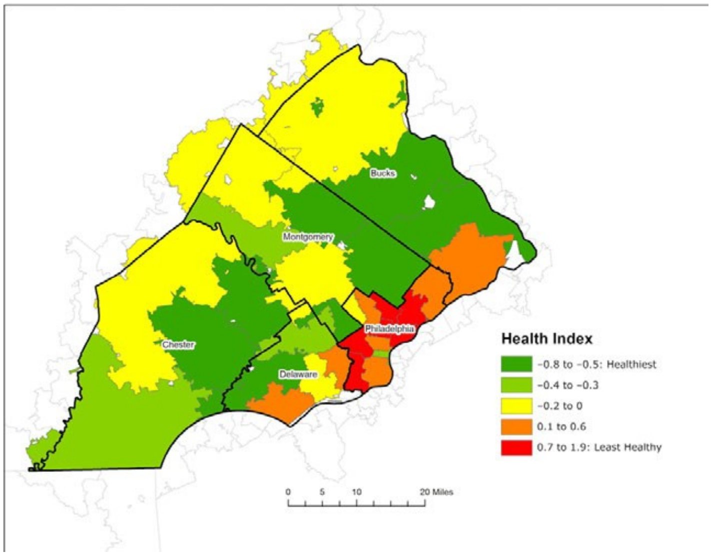

Figure 1. The Health Index by zip region (n = 31), southeastern Pennsylvania, 2016. Data sources: PHMC Household Health Survey and American Communities Survey, 5-Year Estimates 2011–2015.

We found a clear positive relationship between the Health Index and mean ED visits (Table 2). This relationship was confirmed through simple linear regression (data not shown), which identified a significant relationship between the Health Index of the zip region in which individuals lived and mean ED visits. Mean ED visits by zip region increased by 0.064 for each 1-unit increase in Health Index (denoting poorer community health) ($\beta = 0.064$, $P = .009$). Figure 2 shows the relationship between Health Index and mean ED visits by zip region. Healthier zip regions (green and yellow) had lower mean ED visits (smaller dots), whereas zip regions with poorer health (red and orange) have higher mean ED visits (larger dots).

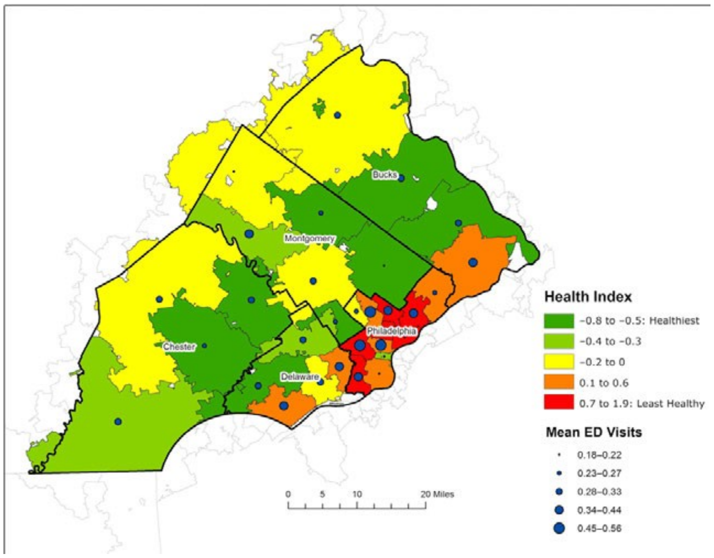

Figure 2. Mean number of emergency department visits by the Health Index among adults that live in zip regions in southeastern Pennsylvania. Abbreviation: ED, emergency department. Data sources: PHMC Household Health Survey and American Communities Survey, 5-Year Estimates 2011–2015.

No clear descriptive or bivariate statistical relationship for mean hospitalizations or mean total claims by health of zip region was found, including overall Health Index or any of the health domains. Thus, we explored relationships between community health and the ED visits outcome only using multilevel modeling.

We used multilevel models to explore the relationship between the Health Index of zip regions and frequency of ED visits after controlling for individual-level demographics (age and sex) (Table 3). Most of the variation in ED visits was at the individual level (ICC = 0.002). Model 1 identified an inverse relationship between age and ED frequency; as age decreased, the frequency of ED visits increased (β = −0.002, SE = 0.0003). Being female was associated with increased frequency of ED visits (β = 0.055, SE = 0.010). After controlling for individual-level demographics, we found that a 1-unit increase in the Health Index (representing poorer community health) was associated with increased frequency of ED visits by 0.077 (β = 0.077, SE = 0.019). However, after including a summary measure of the proportion of white residents by zip region in the multilevel model (Table 3), the significant relationship between Health Index and ED visits became nonsignificant.

Each of the Health Index domains (health outcomes, health behaviors, clinical care, social and economic environment, and physical environment) significantly predicted ED visits except clinical care. The significant relationships also became nonsignificant after controlling for the proportion of white residents (data not shown).

Executives in the focus group were not surprised by an association between ED use and community health but were surprised that a similar relationship was not found for the other outcome variables (hospital use and total paid claims). They expressed a high level of interest in understanding the health needs of the communities in which their employees live and wanted to see developing evidence about how to identify need, where to invest, and how to measure the return on investment. Most executives agreed that there is opportunity to use community and population health improvement to drive increased corporate philanthropy locally.

To inform future studies, employers also expressed an interest in statistical analyses of these data relative to family income, opioid use, end-of-life claims, and other disease states, such as diabetes and cancer. Several of the financial and human resource executives expressed relief that the hypothesis regarding total claims cost was not proven. The prevailing view of most employers was that a positive finding would be more likely to lead to community health investment than community abandonment. Employers expressed that a strategic plan and guidance on how to implement change in their companies and communities, leveraging models from other communities and using existing financial and educational resources and government incentives for support, would be useful.

Discussion

Although many studies have investigated the relationships between community health and individual health, this is one of the first to explore the outcomes of employee use of services and dir- ect medical costs. We found that employees living in areas with poorer community health (and the domains of community health including poorer health outcomes, health behaviors, social and economic environment, and physical environment) had higher ED utilization. No relationships were found between community health and hospital utilization or total medical cost (paid claims). Analyses suggest that other intervening variables such as racial composition of a community may help to explain the community health–ED utilization relationship. Nonetheless, for employers, community health serves as an important descriptive marker for ED utilization.

Public Health 3.0 challenges the public health community to develop partnerships with multiple sectors, including the business community, and to plan and implement public health improvement initiatives (28). The study provides information that can drive collaborative efforts between employers and other public health stakeholders. Given that ED use is a direct and indirect cost (lost productivity) concern for many employers (5,29), the findings may help to focus future efforts on reduction of ED use by employees and dependents in less-healthy communities. These efforts can include reducing barriers to primary care services through investing in worksite or community-based primary care clinics, expanding coverage for retail clinics and urgent care centers, and offering telemedicine services. For example, General Electric invested in patient-centered medical homes and technology, resulting in increased access to preventive/ambulatory health services, fewer ED visits, and increased worker productivity (7,21). Employers should work with researchers to develop and provide employee education about the importance of primary care and understanding appropriate use of the ED; such programs are implemented by the Massachusetts Employer-Led Coalition to Reduce Health Care Costs (30) and the Midwest Health Initiative (31), among others.

One concern expressed by team members in designing this study, and by reviewers of the original grant proposal, was that the potential finding that workers from less-healthy communities cost more could lead some employers to relocate their businesses or introduce biases into their employee recruitment and hiring processes. However, many employers are physically, culturally, or otherwise tied to their communities, and expressed a commitment to fostering healthy communities. The challenge is not to prove the impact of community health on employers, but rather to demonstrate which actions and investments are most likely to have a measurable positive impact on health to yield a return on investment.

This study has several limitations. First, demographic characteristics of the individuals in the study, beyond age, sex, and relative status, were not available for analysis. This is a clear limitation as individual-level demographics (such as race/ethnicity or income) could have confounded our results. Where possible, we used aggregate, community-level demographics to remove some of the potential for confounding, but we do not know if, or to what extent, individual employees were exposed to community-level risk factors that make up the domains which composed the Health Index. We also did not have information on co-insurance (eg, Medicare) or the type of benefit plan design (eg, health maintenance organization, preferred provider organization, consumer-driven health plan, high-deductible health plan), which would determine cost-sharing among the employee, employer, and payer. Second, we focused our analysis on employees and adult dependents who were covered during a 12-month period. This approach allowed us to summarize results of employees that were regularly and continuously employed and covered by insurance, but it removed employees whose employment was not continuous, possibly some who may have stopped working due to poor health. Additionally, we did not remove pregnant women or those with acute or chronic conditions, as part of the increased costs of the employees' care that was incurred by employers. Third, we used modified RWJF County Health Rankings methods to create the Health Index variable. For two-thirds of the measures we found appropriate local data at the zip code level, but one-third of the measures were not identified. Thus, the Health Index domains may not mirror the health outcome and health factor domains generated by the RWJF County Health Rankings methods. Fourth, although we examined health across 31 zip code clusters from 5 counties in southeastern Pennsylvania, the clusters with the poorest health were confined largely to Philadelphia County, which also had the smallest number of cases. Therefore, the study may have had limited power to examine community health as an independent risk factor for utilization, and results may not be generalizable to broader geographies and less-urban regions. Fifth, our outcome variables were highly skewed because of zero values. We used means to describe our outcome variables (as opposed to medians) because the major goal of the study was analytic: to identify the relative relationships between community health and our outcome variables. Sixth, the analysis was based on cross-sectional data from 1 year, so results are limited to associations only and causation between variables cannot be inferred.

Despite these limitations, results suggest that community health was correlated with employee health among our sample of employees in southeastern Pennsylvania, at least with regard to ED utilization rates. Future research should further explore the mechanisms behind these relationships and develop and test strategies for business investment in building healthier communities. Additionally, future studies exploring these relationships should consider the influence of benefit plan design, which may offer insight into relationships of employee out-of-pocket costs relative to ED use and hospitalizations.

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Tables

Table 1. Demographic and Outcome Variables of Adult Employees and Dependents in Southeastern Pennsylvania, 2016

Variable	Value[a]
Female sex (N= 35,838)	19,925 (55.6)
Age, y (N= 35,838)	
18–39	14,495 (40.5)
40–59	15,820 (44.1)
≥60	5,523 (15.4)
County (N= 35,838)	
Bucks	8,800 (24.6)
Chester	6,993 (19.5)
Delaware	10,461 (29.2)
Montgomery	6,791 (19.0)
Philadelphia	2,793 (7.8)
Relative status (N = 35,838)	
Employee	19,606 (54.7)
Spouse	10,405 (29.0)
Child (>18 y)	5,827 (16.3)
Medical claims cost, mean (standard deviation), $ (n = 35,833)[b]	4,803.41 (18,105.18)
Number of emergency department visits (n = 35,837)[b]	0.31 (0.93)
Number of inpatient hospitalizations (n = 35,837)[b]	0.07 (0.37)

[a] Values are mean number (%) unless otherwise indicated.
[b] Negative values removed per outcome analysis.

Table 2. Summary Statistics of Mean Emergency Department Visits, Inpatient Hospitalizations, and Total Medical Claims Costs Among Employees and Adult Dependents (N = 35,838), by Zip Region Quartiles and Health Index, Southeastern Pennsylvania, 2016

Zip Code Region	Mean No. Emergency Department Visits Per Adult	Mean No. Hospitalizations Per Adult	Mean Total Paid Claims Per Adult, $
1st Quartile (healthiest zip regions)	0.273	0.071	4,645
2nd Quartile	0.284	0.064	4,144
3rd Quartile	0.339	0.071	4,438
4th Quartile (least healthy zip regions)	0.443	0.060	4,008

Table 3. Multilevel Linear Regression Model Predicting Emergency Department Visits Among Employees and Adult Dependents (N = 35,838), Southeastern Pennsylvania, 2016

Independent Variable	Model 1		Model 2	
	β	Standard Error	β	Standard Error
Individual level				
Age	−0.002	0.0003[a]	−0.002	0.0003[a]
Female (Reference group: male)	0.055	0.010[a]	0.055	0.010[a]
Zip region level				
Health index	0.077	0.019[a]	0.009	0.031
% White	—	—	−0.002	0.001[b]

Abbreviation: — , not applicable.

[a] $P < .001$

[b] $P < .01$

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ESSAY

Health Care Industry Insights: Why the Use of Preventive Services Is Still Low

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Chronic diseases are a tremendous burden to both patients and the health care system. In 2014, 60% of adult Americans had at least one chronic disease or condition, and 42% had multiple diseases (1). Chronic diseases, including heart disease, cancer, chronic lung disease, stroke, Alzheimer's disease, diabetes, osteoarthritis, and chronic kidney disease, are the leading causes of poor health, long-term disability, and death in the United States (2,3). One- third of all deaths in this country are attributable to heart disease or stroke, and every year, more than 1.7 million people receive a dia- gnosis of cancer (2). During the past several decades, the preval- ence of diabetes increased dramatically; in 2015 more than 29 mil- lion Americans had diabetes and another 86 million adults had prediabetes, increasing their chance of developing type 2 diabetes (3). Diabetes increases the risk of developing other chronic diseases, including heart disease, stroke, and hypertension, and is the leading cause of end-stage renal failure (4).

Chronic diseases can profoundly reduce quality of life for patients and for their families, affecting enjoyment of life, family relationships, and finances (5). Working can be difficult for people with chronic diseases: rates of absenteeism are higher and income is often lower among people who have a chronic disease compared with people who do not have one. Functional limitations can be distressing, and depression, which can reduce a patient's ability to cope with pain and worsen the clinical course of disease, is a common complication (6).

Chronic diseases are also the leading drivers of health care costs in the United States (2). In 2016, total direct costs for health care treatment of chronic diseases were more than $1 trillion, with diabetes, Alzheimer's, and osteoarthritis being the most expensive (2,7). If lost economic productivity is also considered, the total cost of chronic diseases increases to $3.7 trillion, which is close to one-fifth of the entire US economy (7,8). These costs are expected to increase as the population ages — projections indicate that by 2030, more than 80 million people in the United States will have at least 3 chronic diseases (7).

Clinical preventive strategies are available for many chronic diseases; these strategies include intervening before disease occurs (primary prevention), detecting and treating disease at an early stage (secondary prevention), and managing disease to slow or stop its progression (tertiary prevention). These interventions, combined with lifestyle changes, can substantially reduce the incidence of chronic disease and the disability and death associated with chronic disease (9). However, clinical preventive services are substantially underutilized despite the human and economic burden of chronic diseases, the availability of evidence-based tools to prevent or ameliorate them, and the effectiveness of prevention strategies (9–11). For example, in 2015, only 8% of US adults aged 35 or older received all recommended, high-priority, appropriate clinical preventive services, and nearly 5% received none (12).

Interview Study

It is far better to prevent disease than to treat people after they get sick (13). This is particularly true for chronic diseases, which are associated with suffering, large numbers of deaths, and high health care costs (2,7). Given the gap between the burden of chronic diseases and the utilization of preventive services, we set out to obtain from health care industry experts their perspectives on the levers and influencers that have the potential to increase utilization of clinical preventive care. The objective of our study was to gather experience-based insights that would be valuable to policy makers in developing strategies, programs, and partnerships across the health care industry to increase utilization of preventive services. We selected a qualitative interview study design for this investigation, which was conducted from December 2017 to June 2018. This project involved domain experts rather than human subjects as defined by 45 CFR part 46, and therefore institutional review board approval was not required.

Recruitment of experts

We first identified experts with a background in working with decision makers in health care. We then narrowed our selection to 12 experts, each of whom had at least 10 years of experience in working with one or more types of organizations, including health systems, hospitals or physician groups, commercial payers, or state Medicaid agencies. We then conducted a short screening interview to confirm appropriate expertise and willingness to participate. After this initial selection process, we scheduled a 1-hour semistructured interview with each of 9 participants. Before beginning the interviews, the participants confirmed that they had no conflicts of interest that might bias their comments and that they would not disclose any confidential or proprietary information about the organizations for which they currently or previously worked. We tabulated details of their expertise (Table 1).

Interview questions

Increasing uptake of preventive services requires multifaceted strategies, including but not limited to organizational leadership, education, measurement, and reimbursement. With this in mind, we developed an interview guide (Table 2), which included a series of questions focused on how payers, health systems, and physicians determine their clinical and business priorities for resource allocation and quality improvement efforts. We asked about opportunities to include incentives for the use of preventive services under current and emerging designs of models for payment and delivery. We included questions about examples of successful implementation of preventive services strategies or models and about clinical–community linkages that focus on chronic disease prevention.

Although primary prevention was not excluded, much of the discussion focused on secondary and tertiary prevention related to health care system interventions and community interventions linked to clinical services. Throughout the interviews, the participants were encouraged to draw from their experiences with organizations of various capacities and not to focus only on high-level performers or models that would be difficult for average organizations to adopt and replicate. Each interview was conducted via teleconference and facilitated by the first author (S.L.), a senior scientist with expertise in qualitative research methods.

Interview Findings

Across all interviews, 4 findings emerged as major levers or influencers of preventive care. These findings cut across all health care industry sectors and organization types.

Financial and economic considerations. The most prominent theme was finances. All interviewees highlighted the importance of financial and economic considerations when organizations determine priorities and make decisions. These decisions include where to invest resources, what health benefits to cover, or how to bill for clinical services. In the words of one interviewee, “With no margin, there is no mission.”

Use of metrics to drive change in the health care system. The second finding was related to metrics and the importance of using metrics to drive change in the health care system. Interviewees stressed that measures continue to play a crucial role in the delivery of care, but the “right” metrics — outcome-focused, aligned across payers, and with sufficient financial incentives or risk — are needed to drive uptake of chronic disease preventive services. One participant, emphasizing that reporting and monitoring can drive change, noted, “Once external reporting is in place, measured outcomes are prioritized.” However, interviewees cautioned about the “metrics fatigue” that is plaguing health care providers, the misalignment of measures for reporting and quality ratings, and the current lack of financial risk for outcome measures associated with preventive care; in other words, payments to providers are not based on improvements in their patients’ health status.

Role of health care payers. The third finding focused on the role of health care payers (commercial payers/health plans, Medicaid, and particularly Medicare) in influencing uptake of preventive care services. Findings coalesced around the opportunities for payers to drive change in practice. As risk-bearing entities, they provide the payment models and the influence and incentives that can affect uptake of chronic disease preventive services. Several interviewees highlighted the importance of data for payers. As one expert explained, “Payers have the data that can often drive adoption or uptake of programs and interventions.”

Rapid changes in health care reimbursement models. The fourth finding focused on the pace of change in health care reimbursement models. The shift from volume-based reimbursement has been at the forefront of debate and discussion for years, but for typical health care delivery organizations, the transition to value-based reimbursement is still in early stages and is uneven across payers. As a result, the transition has not reached the “tipping point” for providers to change their practice patterns. As one interviewee observed, “There is some emphasis on value-based care, including focus on outcomes and reduced spending, but the view is generally short-term.” The health care industry will continue to move in the direction of value-based care, but changes in provider practice vary across systems and markets. There is also considerable room for continuing experimentation and evaluation to determine what reimbursement models work best and for whom.

Discussion

Industry experts participating in this stakeholder interview process made it clear that most players in the health care system are aware of recommended preventive care services and understand the benefit of preventing disease for the patient and the larger health care system. Underutilization of preventive services is largely the result of an implementation gap rather than an information gap; in other words, providers do not prioritize preventive care services although they know that preventive services can reduce the incidence and burden of chronic diseases. A major reason the implementation gap exists is that financial incentives do not align with a focus on preventing chronic diseases. Currently, most providers, including hospitals and physicians, are paid to treat rather than to prevent disease. Payers have the potential to increase utilization of preventive services with value-based payment models and contractual requirements that include reporting on preventive health quality measures.

As the participants in our study offered their perspectives on the barriers and influences surrounding the coverage and delivery of preventive care services, much of the conversation focused on the influence of financial considerations on uptake of preventive care. However, participants generally agreed that financial incentives alone are unlikely to result in positive changes in the absence of a multipronged approach to increasing preventive services among people at risk of or living with chronic diseases. A multipronged approach would include strong organizational leadership, shifts in institutional culture, team-based care, systems of care that accommodate preventive services, and willingness of patients to seek out and engage in preventive care.

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Tables

Table 1. Areas of Focus of Subject Matter Experts (N = 9) Participating in a Qualitative Interview Study Designed to Gather Information for Developing Strategies, Programs, and Partnerships Across the Health Care Industry to Increase Utilization of Preventive Services, 2018

Industry Sector	Role	Areas of Focus
Payers	Set payment models for preventive services or programs	• Health plan collaborations with focus on value-based care transformation, population health, and consumerism • Policies, processes, strategies, and information technology systems associated with successful Medicaid and Children's Health Insurance Program programs, and other human services programs
Health systems	Develop and manage delivery of preventive services	• Quality management for large health systems, including implementing health information technology and electronic health record transformations • Strategy and operations effectiveness of health systems, including care management, vendor management, system design and implementation, post-merger integration, enterprise cost reduction • Clinical transformation among health systems with focus on pay for performance and patient safety
Providers and physicians	Deliver or prescribe preventive services	• Customer/patient experience strategies and digital transformation for health care providers • Physician services design and implementation, including clinical integration, patient retention and physician loyalty, physician alignment, productivity and compensation, regulatory compliance, and ambulatory operations

Table 2. Interview Questions Used in a Qualitative Interview Study Designed to Gather Information for Developing Strategies, Programs, and Partnerships Across the Health Care Industry to Increase Utilization of Preventive Services, 2018

Theme	Questions
Organizational leadership and decision making	• How do health systems, payers, or providers determine their priorities (eg, deciding which strategies to focus on and what metrics to pay attention to, holding their physicians accountable for certain strategies, prioritizing certain interventions over others)? • What are the primary drivers in the current health care delivery system – including both payment and delivery model designs – that shape guidelines, standards of care, or financial incentives?
Facilitators and barriers (measurement and reimbursement)	• Could you describe facilitators and barriers that a typical health system faces when considering or implementing chronic disease prevention services? • What additional opportunities (eg, performance measures, reimbursement structures) can be leveraged to drive uptake of prevention services among health system stakeholders? • Under the current and emerging designs for models of payment and delivery, what are opportunities to better incentivize preventive services?
Successful models of prevention	• Among the health systems you have worked with, are you familiar with successful implementation of preventive services, strategies, or models? • Are you aware of any health systems that have implemented innovative community prevention programs or models that focus on chronic disease prevention?