

# PREVENTING CHRONIC DISEASE

PUBLIC HEALTH RESEARCH, PRACTICE, AND POLICY



Implementation Evaluation: Assessing Efficiency, Effectiveness, and Impact of Public Health Programs

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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.

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# Table of Contents

01. **The Contribution of Implementation Evaluation to the Field of Public Health**  
Calise TV, Gardner AJ. The Contribution of Implementation Evaluation to the Field of Public Health. *Prev Chronic Dis* 2023;20:230323.
  02. **Evaluating Uptake of Evidence-Based Interventions in 355 Clinics Partnering With the Colorectal Cancer Control Program, 2015–2018**  
Maxwell AE, DeGroff A, Hohl SD, Sharma KP, Sun J, Escoffery C, et al. Evaluating Uptake of Evidence-Based Interventions in 355 Clinics Partnering With the Colorectal Cancer Control Program, 2015–2018. *Prev Chronic Dis* 2022;19:210258.
  03. **Reducing Sodium Content of Foods Served in Arkansas's Largest School District: Evaluation of the Sodium Reduction in Communities Program**  
Long CR, Rowland B, Gannon M, Faitak B, Smith G, Clampitt J, et al. Reducing Sodium Content of Foods Served in Arkansas's Largest School District: Evaluation of the Sodium Reduction in Communities Program. *Prev Chronic Dis* 2022;19:220051.
  04. **Implementing and Evaluating a Stakeholder-Driven Community Diffusion–Informed Early Childhood Intervention to Prevent Obesity, Cuyahoga County, Ohio, 2018–2020**  
Gallagher J, Bayman EO, Cadmus-Bertram LA, Jenkins NDM, Pearlman A, Whitaker KM, et al. Physical Activity Among Rural Men: Barriers and Preferences. *Prev Chronic Dis* 2023;20:230046.
  05. **A Pilot Study of Integration of Medical and Dental Care in 6 States**  
Linabarger M, Brown M, Patel N. A Pilot Study of Integration of Medical and Dental Care in 6 States. *Prev Chronic Dis* 2021;18:210027.
  06. **Assess, Plan, Do, Evaluate, and Report: Iterative Cycle to Remove Academic Control of a Community-Based Physical Activity Program**  
Harden SM, Balis LE, Strayer T III, Wilson ML. Assess, Plan, Do, Evaluate, and Report: Iterative Cycle to Remove Academic Control of a Community-Based Physical Activity Program. *Prev Chronic Dis* 2021;18:200513.
  07. **A Dissemination Strategy to Identify Communities Ready to Implement a Pediatric Weight Management Intervention in Medically Underserved Areas**  
Golden CA, Hill JL, Heelan KA, Bartee RT, Abbey BM, Malmkar A, et al. A Dissemination Strategy to Identify Communities Ready to Implement a Pediatric Weight Management Intervention in Medically Underserved Areas. *Prev Chronic Dis* 2021;18:200248.
  08. **Evaluating the Implementation of a Before-School Physical Activity Program: A Mixed-Methods Approach in Massachusetts, 2018**  
Whooten RC, Horan C, Cordes J, Dartley AN, Aguirre A, Taveras EM. Evaluating the Implementation of a Before-School Physical Activity Program: A Mixed-Methods Approach in Massachusetts, 2018. *Prev Chronic Dis* 2020;17:190445.
  09. **Quality Improvement Coaching for Human Papillomavirus Vaccination Coverage: A Process Evaluation in 3 States, 2018–2019**  
Leeman J, Petermann V, Heisler-MacKinnon J, Bjork A, Brewer NT, Grabert BK, et al. Quality Improvement Coaching for Human Papillomavirus Vaccination Coverage: A Process Evaluation in 3 States, 2018–2019. *Prev Chronic Dis* 2020;17:190410.
  10. **An Evidence-Based Walking Program in Oregon Communities: Step It Up! Survivors**  
Perry CK, Campbell LP, Currier J, Farris PE, Wenzel ES, Medysky ME, et al. An Evidence-Based Walking Program in Oregon Communities: Step It Up! Survivors. *Prev Chronic Dis* 2020;17:200231.
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GUEST EDITORIAL

# The Contribution of Implementation Evaluation to the Field of Public Health

Tamara Vehige Calise, DrPh, MEd<sup>1</sup>; Antonio J. Gardner, PhD, MS, MCHES<sup>2</sup>Accessible Version: [www.cdc.gov/pcd/issues/2023/23\\_0323.htm](http://www.cdc.gov/pcd/issues/2023/23_0323.htm)

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## Introduction

Chronic diseases such as heart disease, diabetes, and cancer are the leading causes of death and disability in the United States, contributing largely to the \$4.1 trillion in health care costs spent per year across the nation (1). Once overlooked or considered as secondary influences on chronic diseases, social factors — education, lifestyles, living situations, financial conditions, cultural traditions, and governmental policies, among others — are now acknowledged as major contributors to health, affecting individuals, groups, and communities in positive and negative ways (2). Furthermore, these factors interact, influence, modify, and enable or constrain health interventions and program implementation across different settings. Many modern-day efforts work to change conditions, or the context within which health is produced, and may have multilevel and multidirectional interventions that perform independently and interdependently. Subsequently, the outcomes are the product of the complex interventions as well as the contexts in which they develop.

Judgements about strategies that address the social factors have traditionally been guided by randomized controlled trials (RCTs) — the “gold standard” — in identifying effective interventions (3). However, adjusting the influence of contextual factors as causal effects or controlling for these conditions in an attempt to reduce bias is nearly impossible, especially when “real life” changes in unpredictable and variable ways (4). Accordingly, there is concern that complex interventions deemed effective by RCTs may not reduce health inequities and, in fact, could widen them (5). The more we embrace diverse opportunities for ongoing learning and thoughtful conduct, appraisal, and synthesis of in-

formation used to generate evidence, the more effective we will be in addressing public health complexity rooted in effecting change (6).

## Purpose of the Special Collection

*Preventing Chronic Disease* (PCD), a peer-reviewed public health journal sponsored by the Centers for Disease Control and Prevention (CDC), promotes dialogue on the implementation and adaptation of evidence and practical experience to address inequities and improve population health (7). This special collection features 9 implementation evaluation (IE) articles — a type of article that PCD publishes — in which authors describe implementation and adaptations of interventions across a range of chronic disease risk factors that have been implemented and evaluated in real-world settings (8).

Dissemination and implementation models, theories, and frameworks are important in helping to understand context, understand how interventions work, and provide generalizable knowledge (9). Noticeable in this special collection is the use of frameworks, as well as the mixed-methods approaches to evaluation, and the alignment of work to theory. Whooten et al (10) and Harden et al (11) used RE-AIM (12) to systematically address the gap between research and practice. Although authors described physical activity (PA) programs and used elements of RE-AIM as metrics guiding their work, the approaches were different. Whooten et al (10) performed an exploratory concurrent-nested, mixed-methods evaluation of a preexisting before-school PA program. The authors highlighted adaptability and differences in implementation across the participating schools. Harden et al (11) documented adaptations made to an older adult PA program so that all audiences had access to relevant information that informs decision-making processes for training, delivery, and participation at the administrator, instructor, and participant levels. The authors presented contextual factors and processes that may be seen in the chronic disease morbidity and mortality reports more distally. Perry et al (13), who also reported on a PA program (among cancer survivors), used the Interactive Systems Framework for Dissemination and Implementation (14), which has similar elements to RE-AIM, to



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describe the context and processes that helped organizations implement the program.

Other authors contributed to the knowledge base by exploring specific factors of context such as partnerships, community readiness, and implementation strategies. Calancie et al (15) acknowledged the layers of complexity to prevent childhood obesity by describing a coalition approach driven by the Stakeholder-Driven Community Diffusion theory (16,17) for implementing, assessing, and analyzing collaborative efforts. The authors not only narrate the ways they assessed changes in coalition member knowledge and understanding of the problem and solutions, but they also provide details on how data were used to generate and implement action within their community. Linabarger et al (18) also presented an approach to unpack the role of collaboration in the development and implementation of dental care. The article shares insight on the use of mixed-methods evaluation to assess collaboration between the chronic disease and oral health programs of state departments to collaboratively develop and implement joint projects. The evaluation identifies many factors that facilitated collaboration including investing in relationships, creating a collaborative norm, and meeting and communicating frequently, which could be applicable in other public health areas. Long et al (19) spoke of collaboration and capacity building between academics and school staff. Although more details would be helpful to understand implementation and the specific adjustments made from evaluation input, the article demonstrated the utility of ongoing data collection and dissemination to ensure the sustainability of a complex environmental strategy to reduce sodium intake in school lunches in a large district.

Golden et al (20) described community readiness as a contextual factor to implement a pediatric weight management program in medically underserved areas and shared lessons learned on potential barriers and facilitators in communities that could affect implementation efforts. Leeman et al (21) presented methods used to assess implementation of quality improvement coaching for improving human papillomavirus vaccination coverage, part of an RCT, in an effort to identify variations, including implementation and contextual factors, across 3 states.

Finally, the article by Maxwell et al (22) is a good example of the differences in uptake, implementation, integration, and sustainability of interventions proven effective in increasing colorectal cancer screening (CCS). The authors looked at implementation across 355 clinics partnering with the Colorectal Cancer Control Program and suggested that both technical and financial support, and the ability to integrate 6 of 8 strategies into electronic health records, may be key to implementation. They also indicated that clinics may require even more support and encouragement to add 2 of the evidence-based interventions into their practice. Maxwell

and her colleagues also reported that one of the evidence-based strategies is uniquely suited to reduce cancer disparities and may be of greater interest to clinics that serve populations with substantial barriers to CCS. These findings, in addition to the other studies published on this project, provide insight on context and may guide clinics in implementing or adapting approaches in their own settings.

## Implications for Public Health

Communicating the variation in implementation and effectiveness, as well as understanding the applicability of findings from one context to another, could help decision makers best use their resources to address the major contributors of chronic disease among their specific populations and across their communities. The work described in these articles focuses on processes, implementation within specific contexts, and contextual factors. Although this information is useful in its own right, we highlight 2 aspects that may improve the future reporting of IEs. First, although PCD has a checklist with approximately 40 items for authors to consider as they prepare their manuscripts (8), the level of detail presented on context and the consistency describing the intervention and implementation varied across the 9 articles. For example, several articles reported implementation adaptations and illustrated various changes, which may help those interested in the intervention understand context in terms of the organizational resources and community environment, as well as other factors.

Second, there has been a growing recognition of the importance of establishing guidance for reporting IEs, and the interactions between an intervention and its contexts (23). Checklists such as the Consolidated Standards of Reporting Trials (CONSORT) for RCTs and the Transparent Reporting of Evaluations with Nonrandomized Designs (TREND) were developed to help authors report in a consistent, transparent, and complete manner (24,25). Although these are useful contributions, a commonly used best practice on criteria to assess IEs or how context should be considered and reported does not exist, which may explain the variations in this series and the appraisal of studies against criteria not suitable for this type of evaluation.

Authors reported the limitations of their reported IEs, a standard dissemination best practice. However, several authors used efficacy and effectiveness study criteria. For example, Harden et al (11) acknowledged the importance of an iterative cycle like assess, plan, do, evaluate, and report; the desire to disseminate information so that audiences can make informed decisions; and the unpredictable timeline associated with the process. They explained that efficacy trials are not necessary if an adaptation does not threaten outcomes, yet stated their study was limited by the fact that randomization or causation could not be explored.

## Conclusion

Describing interventions and context is difficult given the possibilities and level of detail needed for those not directly affiliated to understand (26), but progress has been made. Criteria outlining the intervention and contextual categories, levels, or domains with which authors should judge their work and discuss when reporting evidence from IEs may be a great contribution to the field of public health. Consistency and details will make the evidence more useful to decision makers interested in implementing, adapting, sustaining, transferring, and scaling up interventions suited to address today's complex public health in their respective communities.

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## IMPLEMENTATION EVALUATION

# Evaluating Uptake of Evidence-Based Interventions in 355 Clinics Partnering With the Colorectal Cancer Control Program, 2015–2018

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## PEER REVIEWED

**Summary****What is already known about the topic?**

Evidence-based interventions, such as patient and provider reminders, provider assessment and feedback, small media, and patient navigation are effective in increasing colorectal cancer screening.

**What is added by this report?**

Our evaluation of primary care clinics that participated in the Centers for Disease Control and Prevention's Colorectal Cancer Control Program showed a high uptake of interventions that can be integrated into electronic medical records but limited uptake of patient navigation and community health workers.

**What are the implications for public health practice?**

Future research should further explore the use of patient navigation and community health workers in colorectal cancer prevention because these strategies are uniquely suited to reducing cancer disparities.

## Abstract

**Purpose and Objectives**

Colorectal cancer screening rates remain suboptimal in the US. The Colorectal Cancer Control Program (CRCCP) of the Centers for Disease Control and Prevention (CDC) seeks to increase screening in health system clinics through implementation of evidence-based interventions (EBIs) and supporting activities (SAs). This program provided an opportunity to assess the uptake

of EBIs and SAs in 355 clinics that participated from 2015 to 2018.

**Intervention Approach**

The 30 funded awardees of CRCCP partnered with clinics to implement at least 2 of 4 EBIs that CDC prioritized (patient reminders, provider reminders, reducing structural barriers, provider assessment and feedback) and 4 optional strategies that CDC identified as SAs (small media, professional development and provider education, patient navigation, and community health workers).

**Evaluation Methods**

Clinics completed 3 annual surveys to report uptake, implementation, and integration and perceived sustainability of the priority EBIs and SAs.

**Results**

In our sample of 355 clinics, uptake of 4 EBIs and 2 SAs significantly increased over time. By year 3, 82% of clinics implemented patient reminder systems, 88% implemented provider reminder systems, 82% implemented provider assessment and feedback, 76% implemented activities to reduce structural barriers, 51% implemented provider education, and 84% used small media. Most clinics that implemented these strategies (>90%) considered them fully integrated into the health system or clinic operations and sustainable by year 3. Fewer clinics used patient navigation (30%) and community health workers (19%), with no increase over the years of the study.

**Implications for Public Health**

Clinics participating in the CRCCP reported high uptake and perceived sustainability of EBIs that can be integrated into electronic medical record systems but limited uptake of patient navigation and community health workers, which are uniquely suited to reduce cancer disparities. Future research should determine how to



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promote uptake and assess cost-effectiveness of CRCCP interventions.

## Introduction

Screening reduces deaths related to colorectal cancer (CRC), the second-leading cause of cancer death in the US (1). However, despite recommendation by the US Preventive Services Task Force, CRC screening rates remain suboptimal (66% in 2018) (2); rates among uninsured and low-income populations are even lower. For example, in 2018, only about 30% of people who were uninsured and fewer than 50% of individuals who received care at Federally Qualified Health Centers, government-supported safety net clinics, were up to date with CRC screening (2,3).

The Community Preventive Services Task Force oversees rigorous, systematic reviews of the scientific literature to identify prevention strategies with evidence of effectiveness. On the basis of these reviews, the Task Force recommends the following evidence-based interventions (EBIs) to increase CRC screening: patient reminders, provider reminders, reducing structural barriers, provider assessment and feedback, small media, one-on-one education, and community health workers, including patient navigators (4) (Table 1). Few studies have evaluated the uptake and sustainability of EBIs in a large sample of health care clinics (5,6). Such data are needed to understand how these interventions affect population health, as well as how best to increase the scale of effective interventions. Scalability is defined as the ability of an efficacious health intervention to be expanded under real-world conditions to reach a large proportion of the eligible population (7).

In 2015, the Centers for Disease Control and Prevention (CDC) funded the Colorectal Cancer Control Program (CRCCP) with the goal of increasing CRC screening. Thirty awardees were required to partner with primary care clinics that serve high-need populations to implement EBIs to increase CRC screening. On the basis of recommendations from the Task Force, CDC named 4 EBIs as priority for implementation (patient reminders, provider reminders, reducing structural barriers, provider assessment and feedback). These 4 priority EBIs can be implemented at the health system level to change screening rates. CDC deemed the 4 other EBIs that focus on the individual level (small media, one-on-one education, community health workers, patient navigators) as optional supporting activities (SAs). Awardees could implement both EBIs and SAs.

## Purpose and Objectives

The primary purpose of this analysis was to determine the uptake and sustainability of EBIs and SAs in clinics participating in the CRCCP program over 3 years, from 2015 to 2018. We define up-

take as the initial decision to employ an EBI or SA in a clinic setting (also called adoption), while sustainability indicates integration of an EBI or SA into a clinic's ongoing operation (8). With regard to SAs, we were especially interested in the uptake of patient navigation by these clinics because most clinics in the CDC program are Federally Qualified Health Centers that provide care to underserved and under-resourced populations that experience health disparities, and patient navigation is a strategy intended to reduce disparities by helping patients overcome barriers to health care (9). Patient navigation is well accepted in these populations (10–13) and can be integrated into existing roles in clinical settings (14–16). The Task Force recently added patient navigation, conducted by patient navigators or community health workers, to their list of recommended interventions to promote CRC screening because it increases CRC screening rates (11,17). CDC defines patient navigation for CRC screening as individualized assistance offered to patients to help address barriers and facilitate timely access to quality screening and follow-up, as well as initiation of treatment services for people diagnosed with cancer. Patient navigation includes assessment of patient barriers, patient education, resolution of barriers, and patient tracking and follow-up. Patient navigation can be provided by health care providers (eg, nurses) or lay workers (eg, community health workers) (18).

## Intervention Approach

The CRCCP uses a 5-year funding cycle, and our analysis focused on the 2015 through 2020 cycle. The 30 funded awardees partnered with clinics and provided technical assistance and resources to implement Task Force–recommended EBIs. For this screening program, awardees were required to implement at least 2 of the CDC-prioritized EBIs, as well as SAs; however, awardees were not allowed to use SAs as stand-alone activities. In addition, small media, in particular, had to be paired with 1 of the 4 EBIs (eg, a mailed patient reminder could include a small media material). The screening program is based on several tenets, including integrating public health and primary care, focusing on populations with a high prevalence of disease, implementing sustainable health system changes, and using evidence-based approaches to maximize limited public health dollars (18,19). CRCCP provided an opportunity to study the uptake and sustainability of different EBIs and SAs in a large number of health system clinics that provide care to medically underserved patients and to consider their scalability. Previous studies of this program observed that the implementation of its strategies was associated with increased clinic-level screening rates (18,20).

## Evaluation Methods

CDC's Framework for Program Evaluation was applied to design the clinic survey on which this analysis is based (21). Other components of the CRCCP evaluation include an annual survey of awardees (22), cost effectiveness studies (23), case studies, and studies to explore specific components of CRCCP (18,24).

The clinic survey was based on prior surveys (5,25) and was completed by 1 representative per clinic, similar to other studies (25,26). Data collected in the surveys included clinic characteristics such as clinic type and size, EBIs and SAs in place at baseline and annually, use of CDC resources (eg, staff time, funds, materials) toward implementing EBIs and SAs, sustainability of EBIs and SAs, and baseline and annual CRC screening rates (21). Uptake was defined as EBIs and SAs that are in place and operational (in use) in a clinic at the end of the reporting period. Respondents were asked about sustainability using the question, "If in place, do you consider the EBI or SA as fully integrated into health system or clinic operations and sustainable?" "High quality implementation has been achieved and a supporting infrastructure is in place along with any financial support needed to maintain the EBI/SA. The EBI/SA has become an institutionalized component of the health system and/or clinic operation" was provided as an explanation. Respondents were not asked to consider the length of time that the strategy had been implemented in their responses. Definitions for EBIs and SAs that were given to survey respondents are provided (Table 1). Awardees compiled and reported data to CDC from annual clinic surveys for each participating clinic for each of the first 3 years, from 2015 to 2018.

## Statistical analysis

The study sample was limited to clinics that enrolled in the first year of CDC's screening program (2015–2016) and remained in the program for 3 years (N = 355 clinics, 85% of 417 clinics enrolled). We conducted a descriptive analysis to 1) identify the proportion of clinics implementing the 4 priority EBIs and 4 SAs for each year of the study period and 2) assess whether the EBIs and SAs were perceived as integrated and sustainable by the end of the study period. For each EBI and SA, trends in use between baseline and year 3 were analyzed by using the Cochran–Armitage test for trend. Analyses were conducted using SAS software, version 9.4 (SAS Institute Inc).

## Results

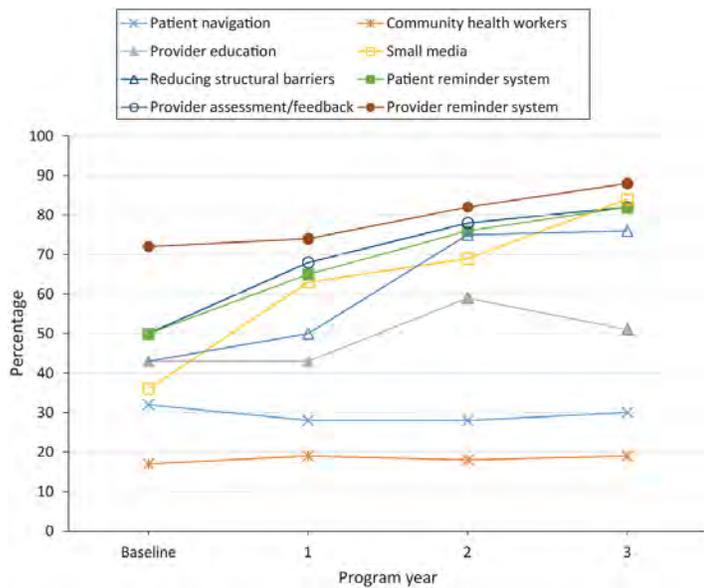
### Clinic characteristics

Most clinics were Federally Qualified Health Centers (73%), and clinic size varied. Some clinics had fewer than 500 patients aged

50 to 75 years (24%), and others had more than 1,500 patients (38%). The number of providers ranged from fewer than 5 providers per clinic (42%) to more than 20 providers (12%). Patient populations ranged from less than 5% uninsured, aged 50 to 75 (29% of clinics) to more than 20% uninsured patients (36% of clinics). Thirty-four percent of all clinics had access to free fecal testing kits. Most clinics used stool-based tests as their primary CRC screening test (56%); 29% referred patients for colonoscopy, and in 13% of clinics, the primary screening test varied by provider (Table 2).

### Uptake of strategies to promote CRC screening

Uptake of strategies to promote CRC screening among clinics varied widely at baseline and throughout the study. At baseline, 50% of clinics used patient reminder systems, 72% implemented provider reminder systems, 50% used provider assessment and feedback, and 43% implemented activities to reduce structural barriers. Significant increases were observed in the uptake of all 4 EBIs in the first 3 years of the program ( $P < .001$  for all 4 EBIs). In year 3, 82% of clinics implemented patient reminder systems, 88% implemented provider reminder systems, and 82% implemented provider assessment and feedback. At baseline, SA use was generally low; 17% of clinics used community health workers, 32% offered patient navigation, 36% used small media, and 43% delivered provider education. Among SAs, professional development and provider education increased significantly, from 43% to 51% ( $P = .001$ ), and use of small media increased significantly, from 36% to 84% ( $P < .001$ ) of clinics in year 3 (Figure and Table 3).



**Figure.** Percentage of clinics that partnered with the CDC Colorectal Cancer Control Program using evidence-based interventions to promote colorectal cancer screening, analyzed using the Cochran–Armitage trend test, 2015–2018 (N = 355).

A substantial number of clinics implemented or resumed new strategies and discontinued or paused strategies during the study period (Table 3). Overall, the proportion of clinics that changed their EBI use from the prior year ranged from 27% to 36% in the first year. These fluctuations tended to decrease in subsequent years, from 13% to 19% of clinics in year 3. SA implementation fluctuated similarly. Only 28% of clinics had patient navigation in place in the second and third year (after baseline) of the program, but almost the same proportion, 25% to 26% of clinics either newly implemented or discontinued patient navigation in the same program years. In the third year, the proportion of clinics that changed their patient navigation status (either new or discontinued) decreased to 10%.

In the first year of the program, clinics that implemented 2 EBIs (n = 64) also implemented on average 1.4 SAs; those that implemented 3 EBIs (n = 102) implemented an average 1.7 SAs, and those that implemented 4 EBIs (n = 110) implemented an average 2.1 SAs. Concurrent implementation of EBIs and SAs was very similar in all program years. Not all clinics, however, implemented 2 priority EBIs in the first year. The percentage of clinics that implemented fewer than 2 EBIs ranged from 22% in the first year to 11% in the second year and to 4% in the third year.

### Integration of strategies to promote CRC screening and sustainability

Among clinics that had EBIs and SAs in place by the end of each year, most considered those EBIs and SAs fully integrated into health systems or clinic operations and sustainable with or without CRCCP resources, especially in years 2 and 3 (Table 4). Sustainability and integration into clinic operations during the 3-year period increased most for activities that largely focused on providers, such as provider reminder systems, an increase of 14 percentage points from 79% in year 1 to 93% in year 3. Similarly, full integration of provider assessment and feedback increased 27 percentage points, from 69% to 96% of clinics; full integration of professional development or provider education increased by 16 percentage points, from 76% to 92% of clinics, followed by full integration of small media for an increase of 11 percentage points from 81% to 92% of clinics. Sustainability and integration into clinic operations did not substantially change with patient navigation (5 percentage point increase from 87% to 92% of clinics) and for community health workers (a 3 percentage point decrease, from 99% to 96%) (Table 4).

### Implications for Public Health

To our knowledge, this is one of only a few studies examining the uptake of evidence-based interventions to promote CRC screening in a large sample of clinics in 30 states. A 2012 study of 44 Federally Qualified Health Centers in 4 Midwestern states found that 41% of clinics had no CRC screening tracking system, although 79% reported using electronic health records (25). A 2016 cross-sectional survey of 56 Federally Qualified Health Centers in 7 states found that 73% of them implemented patient reminder systems, 77% implemented provider reminder systems, and 82% implemented provider assessment and feedback. The same study found that fewer clinics used patient navigators (50%) and small media (62%) (26). Our study builds on previous research in 3 ways: 1) by corroborating results regarding the implementation of these strategies, 2) by adding information on the uptake of 8 different EBIs and SAs, and 3) by assessing these strategies, their changes in implementation, and their sustainability and integration over a 3-year period in a large sample of clinics.

Overall, we observed significant uptake of 4 priority EBIs and 2 SAs, suggesting that the CRCCP contributed to increasing implementation of these strategies in the participating clinics. Our data suggest that for all strategies experimentation took place in early years of the program until clinics settled on strategies that worked for their particular contexts. In addition, many clinics required more than a year to implement at least 2 priority EBIs. Clinics that

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implemented fewer EBIs also tended to implement fewer SAs, and vice versa.

The strong and consistent uptake of priority EBIs by CRCCP clinics may exist, in part, because CDC requires that clinics implement 2 of the 4 priority EBIs, awardees provide technical assistance and implementation support to clinics, and for some clinics, financial support is provided by awardees. Another explanation is that some EBIs and SAs can be integrated into clinical practice through clinics' electronic health records systems. For example, by using data from electronic health records, patient reminder letters can be generated and personalized with each patient's name and address, preferred language, the name of the patient's primary care provider, and their history of CRC screening (eg, type and time of most recent test). Although it takes resources to program electronic health records and to set up these strategies initially, clinic health information technology and automated calling and texting systems can support implementation (27,28). Whether clinics can maintain these interventions solely with their own resources after CRCCP technical and financial support has ended remains to be seen.

Implementation of patient navigation and use of community health workers, on the other hand, was much lower than the priority EBIs and remained low over time. CDC's focus on the 4 priority EBIs and on sustainability could be the reason for low implementation of these activities. Patient navigation is resource intensive, requiring ongoing funding and dedicated staff. In one study, trained nurse navigators spent an average of 124 minutes per patient to deliver a 6-step protocol by telephone to navigate patients for colonoscopy (29). In addition, the costs of patient navigation can be substantial. An economic analysis of detailed activity-based cost information that was systematically collected in a subset of CRCCP clinics showed costs per person screened ranging from \$24 to \$40 in 14 clinics that implemented multicomponent interventions that included patient reminders and provider assessment and feedback. The cost per person screened was \$134, however, in a clinic that included patient incentives and patient navigation in addition to patient reminders (30). In contrast, some studies have reported that patient navigation resulted in cost savings, especially for endoscopic facilities (31,32). A study that compared patients who were navigated to a screening colonoscopy with non-navigated patients at 1 endoscopy clinic found that navigated patients were significantly more likely to complete colonoscopy and to have adequate bowel preparation. The group of navigated patients also had significantly fewer no-shows and cancellations than the group of non-navigated patients (33). A business case has been made to support patient navigation in some clinical systems that led to increased revenues because of increased patient retention, physician loyalty, reduction in emergency department visits, hos-

pitalizations, and reduced burdens on oncology providers (34). Some of these benefits of patient navigation, however, might not be immediate and might not be assessed. If they are assessed, benefits might not be attributed to patient navigation. As most CRCCP clinics are Federally Qualified Health Centers that might not realize many of the potential economic benefits because patients often go to endoscopy providers. CDC is planning to conduct comparative effectiveness studies to further elucidate cost-effectiveness and other barriers to implement patient navigation. For now, reimbursement through health insurers might be required to increase the scalability of this strategy in primary care settings serving populations most likely to benefit from patient navigation.

Many of the strategies that clinics are implementing, including provider reminders, patient reminders, provider assessment and feedback, and small media, have the potential to promote CRC screening for all patients, and they were associated with screening rate improvements in the first year of the CRCCP (18). With the CRCCP focus on Federally Qualified Health Centers that serve populations with high disease burden, strategies also have the potential to reduce cancer disparities. Patient navigation in particular can focus on patients who have substantial barriers to CRC screening and the least access to care (9,35). This intervention strategy, therefore, is uniquely suited to reduce cancer disparities. Cancer disparities reduction was demonstrated in a statewide CRC screening program in Delaware, population 982,895: 23% Black residents and 69% White residents. The Delaware program included financial coverage for CRC screening, treatment, and patient navigation by nurse coordinators. Statewide CRC screening rates increased from 48% among Black residents and from 58% among White residents in 2001 to 74% in both groups in 2009, and the program resulted in reduced disparities in CRC incidence and mortality (36). Future program evaluations could take a population health equity approach (36,37) by examining patient data of CRCCP clinics to determine if program strategies reduced disparities in CRC screening, stage at diagnosis, incidence, mortality, and which specific strategies contributed to the reduction in CRC disparities. Another set of analyses could examine trends in cancer disparities in the catchment areas of participating clinics during the implementation of CRCCP. An analysis that takes a population health equity approach would add a new perspective to the CRCCP program evaluation and provide crucial information on the value of all program strategies, including EBIs and patient navigation, in reducing CRC disparities. Further research is needed to gain a better understanding of the reasons clinics decide to implement some strategies over others and reasons other strategies are discontinued. Data from these analyses could guide future initiatives to increase CRC screening at a population level.

Our study included a data set with a limited number of variables and did not assess theoretical constructs, such as those of the Consolidated Framework for Implementation Research that might explain uptake and sustainability. Furthermore, many clinics could not provide data on the racial and ethnic characteristics of patients, and we were not able to examine if those characteristics were related to the uptake of intervention strategies, particularly patient navigation. Future studies should assess theoretical constructs that are relevant for implementation to illuminate the determinants of implementation and sustainability (38). We also did not have information about the quality of EBI and SA implementation, which likely varies considerably across clinics. Although respondents were encouraged to consult with their team, surveys were completed by one person per clinic who might not have had complete information. Responses may be influenced by respondent role in the clinic (eg, CRC champion versus a quality improvement specialist) and might also suffer from social desirability bias. Respondents were instructed to not report reducing structural barriers as a patient navigation activity, but it is possible that some respondents conflated these 2 strategies, because patient navigators often conduct work related to reducing structural barriers. Finally, CDC's mandate that clinics implement at least 2 priority EBIs could have dictated to some extent the selection of strategies (priority EBIs versus optional SAs).

Our analysis focused on the uptake of 8 different strategies, all recommended by the Community Preventive Services Task Force, in a large number of clinics. Those clinics chose which EBIs and SAs to implement in the context of seeking to meet CRCCP program requirements. Primary care clinics participating in the CRCCP significantly increased implementation of 4 priority EBIs (patient reminder systems, provider reminder systems, provider assessment and feedback, and activities to reduce structural barriers) and 2 optional SAs (provider education and small media) to increase CRC screening over the first 3 program years. Uptake may be facilitated through technical and financial support provided by CRCCP awardees and integration of these strategies into clinic electronic health records systems. Implementation of patient navigation and community health workers remained flat over time, likely due, in part, to the need for ongoing funding for staff. Although use of patient navigation and community health workers may be effective strategies for reaching a clinic's most underserved patients, additional support or encouragement may be required for clinics to add these services.

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Tables

**Table 1. Definitions of Evidence-Based Interventions and Supporting Activities in the CDC Colorectal Cancer Control Program Clinic Survey, 2015–2018**

Evidence-based interventions	Definitions provided to participants
Patient reminder system	System to remind patients when they are due for screening that is in written form (letter, postcard, email) or by telephone voice messages (including automated messages).
Provider reminder system	System to inform providers that a patient is due (or overdue) for screening. Reminders can be provided in different ways, such as in patient charts or by email.
Provider assessment and feedback	System to both evaluate provider performance in delivering or offering screening to clients (assessment) and present providers with information about their performance in providing screening services (feedback).
Reducing structural barriers	Clinic has assessed structural barriers to colorectal cancer screening and has addressed barriers through 1 or more interventions. Structural barriers are noneconomic burdens or obstacles that make it difficult for people to access cancer screening. Reducing structural barriers does not include patient navigation or community health workers.
<b>Supporting activities</b>	
Small media	Materials used to inform and motivate people to be screened for cancer, including videos and printed materials, letters, brochures, and newsletters.
Professional development and provider education	Activities may include distribution of provider education materials, including screening guidelines and recommendations, or continuing medical education opportunities.
Community health workers	Lay health educators with a deep understanding of the community who are often from the community being served. Community health workers work in community settings, in collaboration with a health promotion program, clinic, or hospital, to educate people about cancer screening, promote cancer screening, and provide peer support to people referred to cancer screening.
Patient navigation	Patient navigators typically assist clients in overcoming individual barriers to cancer screening. Patient navigation includes assessment of client barriers, client education and support, resolution of client barriers, client tracking, and follow-up. Patient navigation should involve multiple contacts with a client.

Abbreviation: CDC, Centers for Disease Control and Prevention.

**Table 2. Characteristics of Clinics Partnering With the CDC Colorectal Cancer Control Program Evaluation (N = 355), 2015–2018**

Characteristics	N (%)
Federally Qualified Health Center or community health center	258 (72.7)
Health system–owned or hospital-owned	49 (13.8)
Health department, tribal health center, or other	32 (9.0)
Private or physician owned	16 (4.5)
Number of clinic patients aged 50–75 y	
<500	85 (23.9)
500–1,500	137 (38.6)
>1,500	133 (37.5)
Number of primary care providers	
<5	150 (42.3)
5–20	159 (44.8)
>20	44 (12.4)
Missing	2 (0.5)
Percentage of uninsured patients aged 50–75 y	
<5	104 (29.3)
5–20	94 (26.5)
>20	129 (36.3)
Missing	28 (7.9)
Access to free fecal testing kits	
Yes	121 (34.1)
No	209 (58.9)
Unknown	25 (7.0)
Type of primary colorectal cancer screening tests	
Stool-based tests	197 (55.5)
Colonoscopy referral	103 (29.0)
Varies by provider	47 (13.2)
Unknown	8 (2.3)

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**Table 3. Use of Priority Evidence-Based Interventions and Supporting Activities in Clinics Partnering With the CDC Colorectal Cancer Control Program (N = 355), 2015–2018**

Evidence-based intervention type	Program year	Clinics that changed evidence-based interventions use from prior year <sup>a</sup> , N (%)	Evidence-based interventions in place <sup>b</sup>	
			N (%)	P value for trend <sup>c</sup>
Patient reminder system	Baseline	NR	177 (50)	<.001
	Year 1	128 (36)	231 (65)	
	Year 2	86 (24)	271 (76)	
	Year 3	45 (13)	290 (82)	
Provider reminder system	Baseline	NR	254 (72)	<.001
	Year 1	96 (27)	262 (74)	
	Year 2	54 (15)	290 (82)	
	Year 3	45 (13)	311 (88)	
Provider assessment and feedback	Baseline	NR	178 (50)	<.001
	Year 1	129 (36)	243 (68)	
	Year 2	61 (17)	276 (78)	
	Year 3	66 (19)	290 (82)	
Reducing structural barrier activities	Baseline	NR	153 (43)	<.001
	Year 1	121 (34)	176 (50)	
	Year 2	129 (36)	265 (75)	
	Year 3	56 (16)	269 (76)	
Patient navigation	Baseline	NR	114 (32)	.53
	Year 1	91 (26)	101 (28)	
	Year 2	88 (25)	101 (28)	
	Year 3	35 (10)	106 (30)	
Community health workers	Baseline	NR	60 (17)	.52
	Year 1	45 (13)	69 (19)	
	Year 2	14 (4)	63 (18)	
	Year 3	12 (3)	69 (19)	
Professional development and provider education	Baseline	NR	152 (43)	<.001
	Year 1	153 (43)	151 (43)	
	Year 2	90 (25)	211 (59)	
	Year 3	83 (23)	182 (51)	
Small media	Baseline	NR	127 (36)	<.001
	Year 1	160 (45)	225 (63)	
	Year 2	65 (18)	246 (69)	
	Year 3	73 (21)	297 (84)	

Abbreviations: CDC, Centers for Disease Control and Prevention; NR, not reported.

<sup>a</sup> Clinics that implemented or resumed evidence-based interventions and support activities that were not in place in the prior year or that paused or discontinued those interventions and activities that were in place in the prior year.

<sup>b</sup> Indicates evidence-based interventions and support activities are in place and operational (in use) in clinics at the end-of-program year, regardless of the quality, reach, or current level of functionality.

<sup>c</sup> Two-sided P value, Cochran–Armitage trend test.

**Table 4. Integration and Perceived Sustainability of Priority Evidence-Based Interventions and Supporting Activities in Clinics Partnering With the CDC Colorectal Cancer Control Program (CRCCP) (N = 355), 2015–2018**

Intervention	Clinics that have specific EBI/SA in place <sup>a</sup> by end of program year, N (%)	Fully integrated EBI/SA in place <sup>b</sup>		
		Yes, with or without CRCCP resources %	No, %	Unknown or missing, %
<b>Priority EBIs</b>				
Patient reminder systems				
Year 1	231 (65)	84	13	3
Year 2	271 (76)	95	3	2
Year 3	290 (82)	93	3	4
Provider reminder systems				
Year 1	262 (74)	79	13	8
Year 2	290 (82)	94	4	2
Year 3	311 (88)	93	3	4
Provider assessment and feedback				
Year 1	243 (68)	69	17	14
Year 2	276 (78)	93	3	4
Year 3	290 (82)	96	1	3
Activities to reduce structural barriers				
Year 1	176 (50)	91	2	7
Year 2	265 (75)	97	0	3
Year 3	269 (76)	98	1	1
<b>Supporting activities</b>				
Patient navigation				
Year 1	101 (28)	87	7	6
Year 2	101 (28)	93	0	7
Year 3	106 (30)	92	3	5
Community health workers				
Year 1	69 (19)	99	0	1
Year 2	63 (18)	98	0	2
Year 3	69 (19)	96	0	4
Professional development and provider education				
Year 1	151 (43)	76	15	9
Year 2	211 (59)	88	0	12
Year 3	182 (51)	92	0	8
Small media				
Year 1	225 (63)	81	12	7
Year 2	246 (69)	96	0	4
Year 3	297 (84)	92	2	6

Abbreviations: CRCCP, Colorectal Cancer Control Program; EBI, evidence-based interventions; SA, supporting activities.

<sup>a</sup> Indicates whether EBI/SA are in place by end of program year, regardless of quality, reach, or level of functionality.

<sup>b</sup> Indicates whether EBI/SA are fully integrated (institutionalized) by end of program year into the health system or clinic operations with supporting infrastructure and financial support to maintain the EBI/SA.

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### IMPLEMENTATION EVALUATION

# Reducing Sodium Content of Foods Served in Arkansas's Largest School District: Evaluation of the Sodium Reduction in Communities Program

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PEER REVIEWED

#### Summary

##### What is already known on this topic?

Increased sodium intake in childhood is associated with cardiovascular characteristics that may lead to adult hypertension-related cardiovascular disease; however, approximately 75% of children exceed sodium intake guidelines.

##### What is added by this report?

We evaluated changes over 5 years in sodium amounts served in school lunches as an outcome of a Sodium Reduction in Communities program in Arkansas's largest school district. The study contributes new evidence showing reductions in sodium were sustained from years 1 to 5.

##### What are the implications for public health practice?

Our study provides evidence for sustained sodium reductions in a large, diverse school district, pointing to the potential benefit of implementing similar strategies in other school districts and related settings.

## Abstract

### Purpose and Objectives

The Centers for Disease Control and Prevention's Sodium Reduction in Communities Program aims to reduce dietary sodium intake through policy, systems, and environmental approaches. The objective of our study was to evaluate changes in sodium levels over 5 years (2016–2021) in food served in school lunches as an

outcome of a Sodium Reduction in Communities program in Arkansas's largest school district.

### Intervention Approach

We collaborated with Springdale Public Schools (SPS) to reduce dietary sodium intake in school lunches through increased implementation of 1) food service guidelines, 2) procurement practices, 3) food preparation practices, and 4) environmental strategies. These activities were maintained from year 1 through year 5. Implementation priorities were informed each year by evaluation findings from the preceding year.

### Evaluation Methods

We collected lunch service records and information on nutritional content of menu items for the 30 schools under the direction of SPS's Child Nutrition Department. We used a pretest–posttest quantitative evaluation design to analyze annual changes in the sodium content of meals, from baseline through year 5.

### Results

From baseline through year 1, SPS reduced sodium served per diner, per entrée offered, and per entrée served. These reductions were maintained from baseline through 5 years of follow-up. Mean sodium per 1,000 kcal per diner served was 1,740 mg at baseline and was lower in each of the 5 follow-up years: 1,488 mg (14% decrease) in year 1; 1,495 mg (14% decrease) in year 2; 1,612 mg (7% decrease) in year 3; 1,560 mg (10% decrease) in year 4; and 1,532 mg (12% decrease) in year 5. Energy served per diner remained stable.

### Implications for Public Health

Our study provides evidence for sustained sodium reduction strategies in a large ethnically and socioeconomically diverse school district, pointing to the potential benefit of implementing



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similar strategies in other school districts. The study also shows how program evaluation can be used to support sustainability.

## Introduction

Excess sodium intake is associated with hypertension and with cardiovascular disease (1–3), the leading cause of death in the US (4). Reducing excess sodium intake decreases hypertension (1,2) and is associated with decreased morbidity and mortality from cardiovascular disease (1–3). Increased sodium intake is associated with elevated blood pressure in childhood (5), which is associated with cardiovascular characteristics that may lead to adult hypertension-related cardiovascular disease (6). Reducing sodium intake can lower children's blood pressure (6).

The 2020–2025 *Dietary Guidelines for Americans* identifies the daily recommended limit for sodium intake as 1,500 mg for people aged 4 through 8 years, 1,800 mg for people aged 9 through 13 years, and 2,300 mg for people aged 14 years or older (7). Children aged 1 through 18 in the US consume a mean of 2,905 mg sodium daily (8), and approximately 75% exceed the sodium intake guidelines (9). Strategies are needed to reduce children's excess sodium intake (10).

The Centers for Disease Control and Prevention (CDC) initiated the Sodium Reduction in Communities Program (SRCP) in 2010 to reduce sodium intake in the US through policy, systems, and environmental approaches to improve access to reduced-sodium food products (11). Sites where SRCP has been implemented support sodium reduction strategies in food service venues that serve large populations, such as worksites, hospitals, schools, and universities. Each SRCP site evaluates the effectiveness of sodium reduction strategies in its venues.

The University of Arkansas for Medical Sciences (UAMS) received a 5-year SRCP award in 2016 to support implementation of sodium reduction strategies in northwest Arkansas. UAMS selected schools as a venue because they serve children in northwestern Arkansas communities at heightened risk for hypertension, including Marshallese populations, Latino populations, and populations with low incomes and food insecurity (12–14). Prior to applying for an SRCP project, UAMS met with local Marshallese and Latino communities and local food system groups (ie, community groups, a culinary arts program, and food vendors) to clarify which communities might benefit most. These meetings identified potential venues (eg, schools) and local priorities (eg, increasing availability of reduced-sodium foods for low-income and food-insecure populations). The group engagement process has been discussed in previous publications (13,15).

Springdale Public Schools (SPS) was the first school district to implement the project's sodium reduction strategies in the region and was the focus of this study. At baseline (2016–2017 school year), SPS included 29 schools under the direction of the Child Nutrition Department. At baseline, SPS's enrollment was 21,527 students in kindergarten through grade 12, making it the second largest school district in Arkansas. In 2018–2019, SPS became the largest school district in Arkansas. Among all SPS students at baseline, 46% were Latino, 35% were White, and 12% were Native Hawaiian or Pacific Islander, most of whom were Marshallese. At baseline, 71% of SPS students were eligible to receive free or reduced-price meals (16).

## Purpose and Objectives

Our initial evaluation from baseline to year 1 follow-up was discussed in a previous publication and showed reductions in mean sodium content served per diner and per entrée (13). This study includes a second, third, fourth, and fifth year of follow-up to evaluate changes in sodium served over time (ie, to investigate the extent to which reductions were sustained in years 2, 3, 4, and 5 of the program). This study also evaluates changes in the energy content of foods served.

## Intervention Approach

At baseline (2016–2017), SPS set a goal to move toward early compliance with anticipated US Department of Agriculture (USDA) National School Lunch Program sodium limits (eg,  $\leq 740$  mg per lunch for grades 9–12). At that time, USDA scheduled implementation of these limits for 2022–2023; however, in 2018–2019 the agency postponed implementation, and limits have since been increased (limits of  $\leq 1,280$  mg per lunch for grades 9–12 are now scheduled to go into effect in July 2023) (17–19). In addition, SPS set a target in 2016–2017 to reduce the sodium content of lunch entrées offered to meet USDA Smart Snacks in Schools guidelines of 480 mg or less (20). Entrées were defined as foods meeting the USDA National School Lunch Program's classification of "meats/meat alternates." The meats or meat alternatives category of a school meal includes meat, poultry, cheese, yogurt, eggs, peanut butter, and other protein-rich foods served as the main dish (21).

As in many school districts, policy decisions at SPS are made at the district level to guide nutrition programs in each district school, taking into account grade-level differences in student preferences and USDA school meal nutrition standards (19). District-level decisions about food service guidelines, procurement practices, menu planning, recipes, and cafeteria environments are implemented at each school in the district. Menus vary somewhat by

grade level: 5 different lunch menus are offered per day at elementary, middle, junior high, high school, and a public charter school. Because SPS has significant Hispanic/Latino and Marshallese student populations, it makes an effort to incorporate culturally relevant foods into its menus. For instance, street tacos and elote (Mexican street corn) are served regularly throughout the school because of their popularity among local Hispanic/Latino communities. Teriyaki chicken and lo mein are served regularly because of their popularity among local Marshallese communities, whose cuisine often incorporates many Asian cultural influences.

Our SRCP intervention began by supporting SPS in selecting district-level sodium strategies and activities and then supporting implementation of activities at the district level and at each school within the district. The intervention at SPS included 4 sodium reduction strategies: 1) food service guidelines that address sodium, 2) procurement practices to reduce sodium content in purchased items, 3) food preparation practices to reduce sodium content of meals and menu items, and 4) environmental strategies and behavioral economics approaches to reduce sodium intake (eg, designing “Healthy Food, Healthy Future, Healthy Lunch” serving line signage to highlight healthy low-sodium choices, such as the salad bar). Implementation priorities were informed each year by evaluation findings from the preceding year. Sodium reduction activities (Table 1) affected each school, although some activities varied by grade level (eg, taste test procedures were different for first grade vs high school students).

Child nutrition directors met with UAMS staff 8 to 12 times per year in all 5 years of the project. These directors, along with cafeteria managers and frontline staff, participated in annual hands-on training in all 5 years. UAMS staff conducted the trainings in collaboration with instructors from Brightwater: A Center for the Study of Food and from the University of Arkansas Human Nutrition and Hospitality Management program. Trainings demonstrated food preparation practices to lower sodium in meals (eg, teaching knife skills to prepare fresh produce and preparing reduced-sodium salad dressings and sauces from scratch). Trainings also provided opportunities for information sharing between members of the UAMS staff and the SPS child nutrition staff.

By the end of year 1, SPS implemented activities encompassing all 4 strategies. Each year, the UAMS staff supported the SPS child nutrition staff in developing a work plan to ensure sustained implementation of each of the strategies. For example, the child nutrition director and team prioritized adding low-sodium items to their bid and procurement orders (eg, low-sodium spaghetti sauce), adjusting recipes to reduce sodium content in particular items (eg, using no-salt-added canned tomatoes in salsas), and of-

fering training that taught practical and innovative ways of preparing reduced-sodium meals throughout years 1 through 5. SPS sustained each sodium reduction intervention activity through year 5.

A key aspect of implementation of this intervention was processing cafeteria service records and nutrition data shared by the school district. At baseline and during year 1, SPS provided these data in PDF (portable document format), and UAMS staff manually entered the data into Microsoft Excel (Microsoft Corp) for analysis. As the relationship between UAMS and SPS solidified, the staff of the two worked together to implement a process to export cafeteria service records and nutrition data in Excel format, which precluded the need for manual data entry. In year 4, UAMS staff developed code in R (R Foundation for Statistical Computing) to scrape necessary data from the exported data files for easier data management and analysis. A second important aspect of implementation was school district operational changes resulting from the COVID-19 pandemic. For year 4, interactions between school district staff and UAMS staff were conducted primarily via online video. In year 4, school meals were prepared and delivered in various ways. Meals were boxed and available daily at schools for pickup for students during the initial school closures early in the pandemic. Once schools re-opened, the district maintained boxed meals for virtual students but also initiated hybrid in-school delivery methods, including in-classroom meal service, cafeteria service, prepackaged meals, and individually prepared and portioned meals. Despite these operational changes, intervention activities were similar to previous years, and to preserve comparability with findings from previous years, the evaluation approach was identical.

## Evaluation Methods

Lunch menu data were collected annually from 29 SPS schools at baseline and year 1. Years 2 through 5 included data from 30 SPS schools, adding data from any district school that began following the district’s standard meal pattern in year 2. Baseline data were collected over 2 weeks in December 2016, prior to implementation of the intervention. From 2017 through 2021, annual follow-up data were collected for 2 weeks each October to minimize any potential seasonal variability. School district staff provided the number of diners and number of each menu item served for each day of observation. For each menu item, the name, ingredients, serving sizes, and nutrition information were provided from the school district’s records maintained in PrimeroEdge (Cybersoft Technologies, Inc). As a result, missing data were minimal (approximately 1% of all food items were missing nutrition information). Sodium (in mg) and energy (in kcal) were obtained for each menu item. When nutrition information was not available in PrimeroEdge, the information was collected from product web-

sites, prior years' records, or comparable school food formulated items in the USDA's FoodData Central database (22). Nutritional content across all 6 data collection periods was calculated by using Excel 2019 (Microsoft Corp). This evaluation was determined to be exempt by the UAMS Institutional Review Board (#206008).

Total sodium content was calculated for all food served, including sides and condiments, across the observation period for each year. Mean sodium served per diner was calculated by dividing the total sodium content of all food items served by the total number of diners served during the observation period for each year.

To evaluate potential unintended consequences of the sodium reduction strategies on energy content, the mean of energy served per diner was calculated across the observation period for each year. The mean was calculated by dividing the total energy content of all food items served by the total number of diners served during the observation period.

To evaluate changes in sodium served relative to changes in energy, the mean number of mg of sodium per 1,000 kcal served per diner was calculated across the observation period for each year. This number was calculated by multiplying the mean mg of sodium served per diner by the quotient of the mean energy served per diner divided by 1,000.

Sodium mg per 1000 kcal = (1000/mean energy, kcal) \* mean sodium, mg

A similar approach was taken to evaluate changes in the entrées offered on the menu. Mean sodium per entrée offered, mean energy per entrée offered, and sodium per 1,000 kcal per entrée offered were calculated across the observation period for each year. The calculations for entrées offered focused on menu-level changes (ie, not weighted by the number of entrées actually served to diners), so data for each entrée were included only once during each observation period.

To evaluate changes in entrées served, mean sodium per entrée, mean energy per entrée, and sodium per 1,000 kcal per entrée were calculated across the observation period for each year. These calculations took into account the number of times each entrée was actually served to a diner, so these calculations were weighted by the total number of each entrée actually served during the observation period.

We quantified the number and proportion of unique entrées offered and entrées served that met USDA's Smart Snack in Schools (20) entrée sodium guideline of 480 mg or less for each year of observation.

## Results

For baseline and follow-up years 1 through 5, we measured the mean number of diners per lunch service and the results of the sodium and energy analyses (Table 2). The mean sodium served per diner was 1,140 mg at baseline and was lower in each of the 5 follow-up years: 978 mg (14% decrease) in year 1; 1,018 mg (11% decrease) in year 2; 1,062 mg (7% decrease) in year 3; 1,050 mg (8% decrease) in year 4; and 1,053 mg (8% decrease) in year 5. To ensure that changes in sodium served were not due to decreases in energy served, we tracked sodium mg per 1,000 kcal served per diner. Across the evaluation period, mean energy served per diner ranged from 655 kcal (baseline) to 687 kcal (year 5). Mean sodium per 1,000 kcal per diner served was 1,740 mg at baseline and was lower in each follow-up year: 1,488 mg (14% change) in year 1; 1,495 mg (14% change) in year 2; 1,612 mg (7% change) in year 3; 1,560 mg (10% change) in year 4; and 532 mg (12% change) in year 5.

Per entrée offered, the mean sodium was 709 mg at baseline and was lower in each of the 5 follow-up years: 614 mg (13% decrease) in year 1; 620 mg (13% decrease) in year 2; 633 mg (11% decrease) in year 3; 631 mg (11% decrease) in year 4; and 630 mg (11% decrease) in year 5. Across the evaluation period, mean energy per entrée offered ranged between 314 kcal (baseline) and 356 kcal (year 5). Mean sodium per 1,000 kcal per entrée offered was 2,262 mg at baseline and was lower in each follow-up year: 1,881 mg (17% decrease) in year 1; 1,863 mg (18% decrease) in year 2; 1,863 mg (18% decrease) in year 3; 1,802 mg, (20% decrease) in year 4; and 1,767 mg (22% decrease) in year 5.

Per entrée served, the mean sodium was 668 mg at baseline and was lower in each of the 5 follow up years: 587 mg (12% decrease) in year 1; 573 mg (14% decrease) in year 2; 609 mg (9% decrease) in year 3; 535 mg (20% decrease) in year 4; and 580 mg (13% decrease) in year 5. Across the evaluation period, mean energy per entrée served ranged from 313 kcal (year 4) to 345 kcal (year 5). Mean sodium per 1,000 kcal per entrée served was 2,126 mg at baseline and was lower in each follow-up year: 1,711 mg (20% decrease) in year 1; 1,764 mg (17% decrease) in year 2; 1,815 mg (15% decrease) in year 3; 1,707 mg (20% decrease) in year 4; and 1,681 mg, (21% decrease) in year 5.

At baseline, 22% (24 of 107) of unique entrées offered met the USDA Smart Snacks guideline of 480 mg of sodium or less. The percentage of unique entrées offered that met this guideline increased in year 1 (32%; 37 of 116) and remained above baseline in year 2 (34%; 44 of 131), year 3 (32%; 41 of 129), year 4 (37%; 32 of 87), and year 5 (36%; 43 of 118).

At baseline, 21% (41,703 of 196,138) of entrées served met the USDA Smart Snacks guideline of 480 mg of sodium or less. The percentage of entrées served that met this guideline increased in year 1 (27%; 44,421 of 167,251) and remained above baseline in year 2 (31%; 54,440 of 173,983), year 3 (30%; 52,002 of 172,219), year 4 (48%; 58,202 of 122,137), and year 5 (37%; 57,997 of 155,793).

## Implications for Public Health

From baseline to year 1, results of the SRCP intervention in SPS schools indicate reduced sodium served per diner, per entrée offered, and per entrée served. These reductions were sustained from years 1 to 5. Analyses of sodium mg per 1,000 kcal indicate that these reductions cannot be attributed to reduction in the energy content of food served. SPS's school lunch program served a mean of 1,053 mg of sodium per diner in year 5, which is an 87 mg reduction from baseline. The year 5 mean result is in line with USDA National School Lunch Program sodium targets per lunch scheduled to go into effect in July 2023 (ie,  $\leq 1,280$  mg per lunch for grades 9–12,  $\leq 1,225$  mg per lunch for grades 6–8, and  $\leq 1,110$  mg per lunch for grades K–5) (19).

The year 5 mean of 1,532 sodium mg per 1,000 kcal served per diner exceeds the chronic disease risk reduction levels for sodium indicated in *Dietary Guidelines for Americans 2020-2025* (ie, 1,800 mg of sodium per day aged 9–13 years; 2,300 mg sodium/day aged  $\geq 14$  years) (7). However, this year 5 mean is a reduction of 208 sodium mg per 1,000 kcal from baseline. Simulation studies suggest that sodium reductions of this magnitude among US adults would produce significant increases in national productivity and significant reductions in national medical costs (23,24).

An important finding from our study is that sodium reductions were maintained from baseline through 5 years of follow-up. Across all measures, the amounts of sodium served or offered decreased markedly from baseline to year 1. From year 1 through year 5, sodium levels continued to decrease or returned partway toward baseline levels. The initial sodium reductions were largely maintained despite school district staff turnover and despite shifts in local, state, and national school nutrition policies related to the COVID-19 pandemic in years 4 and 5. Other challenges encountered included changing National School Lunch Program guidelines for sodium, shifting availability of healthy food from vendors (some of which was due to the COVID-19 pandemic), and demands on staff time needed to prepare healthy foods like fresh fruits and vegetables. Successful maintenance was due to lasting policy, systems, and environment changes the school district implemented during years 1 and 2 of the intervention (eg, compre-

hensive food service guidelines that included sodium reduction standards and practices).

Program evaluation was also used to support sustainability. Annually in years 1 to 5, UAMS staff provided school district staff with evaluation findings identifying the prior year's highest sodium items. School district staff then worked with UAMS staff to select high-sodium items to focus on during the next year of intervention. School district staff had limited time to devote to sodium reduction activities, so this approach focused on modifying menus, recipes, and food preparation strategies that were likely to significantly affect sodium intake.

Our study had limitations. Cafeteria service data were not easily sorted into grade-level categories to facilitate direct comparisons with grade-level USDA National School Lunch Program sodium targets, which are increasingly salient as school districts prepare for lower sodium limits to take effect in July 2023. A second limitation is that, because of limits on staff resources, we focused on sodium served and sodium offered rather than sodium consumed. The study did not incorporate consideration of food waste. However, our study's findings add to a growing body of evidence pointing toward SRCP effectiveness in reducing sodium across venues and sustaining sodium reductions over time (13,25,26).

Our study provides evidence for the sustainability of sodium reduction strategies in a large, diverse school district, pointing to potential benefits of implementing similar strategies in other school districts and related settings. The study contributes new evidence showing reductions in sodium were sustained over 5 years. Future evaluations will determine the extent to which reductions are sustained after active implementation support has ended

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Tables

**Table 1. Sodium Reduction Intervention Activities Implemented by Springdale Public Schools During the Sodium Reduction in Communities Program, Springdale, Arkansas, 2016–2021<sup>a</sup>**

Intervention strategy	Activities to address each strategy
Food service guidelines/standards that include sodium	Implemented comprehensive food service guidelines that include sodium reduction standards and practices. Example: SPS added language to specify preference for “low sodium” and “lower sodium” foods to procurement contracts and bids.
Procurement practices to reduce sodium content in purchased items	<ul style="list-style-type: none"> <li>• Implemented standardized purchasing lists with reduced-sodium items. Example: SPS began purchasing no-salt-added tortilla chips and no-salt-added lunch meat.</li> <li>• Conducted taste tests of newly available or newly procured reduced-sodium ingredients/foods for students and staff. Example: SPS students participated in taste tests at Brightwater: Center for the Study of Food to try healthier alternatives to popular items such as macaroni and cheese. SPS child nutrition staff taste tested a grain bar concept that highlighted fresh vegetables, reduced sodium sauces, and whole grains.</li> </ul>
Food preparation practices to reduce sodium content of meals and/or menu items	<ul style="list-style-type: none"> <li>• Implemented policy to eliminate “free salting.” Example: SPS child nutrition staff eliminated practice of salting foods at the end of meal preparation.</li> <li>• Implemented rinsing of canned vegetables to reduce sodium content. Example: SPS emphasized through staff training the importance of rinsing all canned vegetables.</li> </ul>
Environmental strategies/behavioral economics approaches to reduce sodium intake	<ul style="list-style-type: none"> <li>• Placed posters featuring sodium reduction messages in food preparation areas. Example: UAMS designed and supplied posters with spice blends and tips on seasoning without salt to all school kitchens for the staff to refer to when preparing meals.</li> <li>• Moved saltshakers from dining tables and implemented flavor stations. Example: SPS offered flavor stations that featured no-salt-added spice blends for students to use on their meals.</li> </ul>

Abbreviations: SPS, Springdale Public Schools; UAMS, University of Arkansas for Medical Sciences.

<sup>a</sup> All strategies were implemented by 2017, year 1.

**Table 2. Mean Diners, Energy, and Sodium from Baseline through Year 5 at a School District Participating in the Sodium Reduction in Communities Program, Arkansas, 2016–2021<sup>a</sup>**

Variables	Baseline	Year 1	Year 2	Year 3	Year 4	Year 5
Diners per lunch service, n (SD)	16,103 (984)	17,309 (342)	17,249 (617)	17,510 (543)	12,420 <sup>b</sup> (345)	15,793 (515)
Sodium served per diner, mg	1,140 <sup>c</sup>	978 <sup>c</sup>	1,018 <sup>c</sup>	1,062 <sup>c</sup>	1,050 <sup>c</sup>	1,053 <sup>c</sup>
Energy served per diner, kcal	655 <sup>c</sup>	657 <sup>c</sup>	681 <sup>c</sup>	659 <sup>c</sup>	673 <sup>c</sup>	687 <sup>c</sup>
Sodium per 1,000 kcal served per diner, mg	1,740 <sup>c</sup>	1,488 <sup>c</sup>	1,495 <sup>c</sup>	1,612 <sup>c</sup>	1,560 <sup>c</sup>	1,532 <sup>c</sup>
Sodium per entrée offered, mg (SD)	709 (426)	614 (286)	620 (299)	633 (312)	631 (299)	630 (307)
Energy per entrée offered, kcal (SD)	314 (105)	326 (118)	333 (119)	340 (131)	350 (129)	356 (132)
Sodium per 1,000 kcal per entrée offered, mg	2,262 <sup>c</sup>	1,881 <sup>c</sup>	1,863 <sup>c</sup>	1,863 <sup>c</sup>	1,802 <sup>c</sup>	1,767 <sup>c</sup>
Sodium per entrée served, mg (SD)	668 (330)	587 (215)	573 (267)	609 (233)	535 (209)	580 (240)
Energy per entrée served, kcal (SD)	314 (93)	343 (100)	325 (99)	336 (84)	313 (126)	345 (134)
Sodium per 1,000 kcal per entrée served, mg	2,126 <sup>c</sup>	1,711 <sup>c</sup>	1,764 <sup>c</sup>	1,815 <sup>c</sup>	1,707 <sup>c</sup>	1,681 <sup>c</sup>

<sup>a</sup> Data were collected immediately before intervention implementation in December 2016 (baseline) and again each October from 2017 through 2021 (years 1–5). Baseline and follow-up data were collected for 2 consecutive weeks of meal service each year for 29 schools (baseline and year 1) or 30 schools (years 2–5) in the Springdale, Arkansas, school district. At baseline, none of the intervention activities had been implemented.

<sup>b</sup> Year 4 diners per lunch service decreased because of state and local education policy changes resulting from the COVID-19 pandemic (eg, increased options to attend classes online).

<sup>c</sup> Values without SDs are those for which the means were calculated directly by dividing the total sodium or energy content by the relevant denominator. For example, mean sodium served per diner was calculated by dividing the total sodium content of all food items served by the total number of diners served during the observation period for each year. Quantities of sodium mg per 1,000 kcal presented in this table are based on calculations using unrounded values and will differ from quantities derived from calculations using the rounded values presented in this table.

### IMPLEMENTATION EVALUATION

# Implementing and Evaluating a Stakeholder-Driven Community Diffusion–Informed Early Childhood Intervention to Prevent Obesity, Cuyahoga County, Ohio, 2018–2020

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#### PEER REVIEWED

#### Summary

##### What is already known on this topic?

Obesity is a complex problem with many interconnected drivers and impacts. Combining systems science thinking and policy, systems, and environmental-level change, as implicated in the Stakeholder-Driven Community Diffusion (SDCD) theory, has been successful in addressing obesity.

##### What is added by this report?

This report describes how an SDCD-informed intervention was used to engage a small group of multisector stakeholders drawn from an existing coalition to collectively prioritize obesity prevention action steps and work together to implement those steps. The report also describes use of a systems map to evaluate where action was taking place after the intensive intervention phase concluded.

##### What are the implications for public health practice?

The findings from this report offer an approach for community coalitions interested in using a theory-informed approach for facilitating policy, systems, and environmental-level changes to promote healthy weights among children in their communities.

## Abstract

### Purpose and Objectives

The purpose of this article is to demonstrate and evaluate aspects of a Stakeholder-Driven Community Diffusion (SDCD)–informed intervention with a group of stakeholders drawn from a large coalition seeking a novel approach for promoting policy, systems, and environmental-level change. The objectives were to implement an SDCD intervention, assess changes in participants' perspectives, and evaluate where the group's actions fit within the context of a systems map that the group created during the intervention.

### Intervention Approach

An SDCD-informed intervention convened 12 multisector stakeholders from the Early Ages Healthy Stages coalition in Cuyahoga County, Ohio. They participated in group model building activities to promote systems thinking related to childhood obesity prevention, reviewed evidence about topics of interest to the group, and were provided with technical assistance and seed funding to guide the selection and implementation of actions prioritized by the group.

### Evaluation Methods

Data were collected via meeting notes and group model building outputs to demonstrate implementation and action prioritization; online surveys and qualitative interviews to measure perspective change among stakeholders; and a follow-up survey to the broader coalition assessing actions coalition members were taking.



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## Results

An SDCCD-informed intervention guided the development of a systems map and the selection of 4 actions: 1) develop a better understanding of the local early childcare environment; 2) assess the effectiveness and impact of Ohio Healthy Programs (OHP); 3) advocate for OHP and improved early childhood education quality; and 4) hold OHP designees accountable to high-quality programming. Data collected from surveys and interviews showed increased awareness of programs, resources, and collaboration opportunities among stakeholders. Follow-up survey results showed ongoing coalition action throughout the systems map.

## Implications for Public Health

Using an SDCCD-informed intervention among a coalition of community stakeholders provided a unique approach for implementing, assessing, and analyzing collaborative efforts to prevent childhood obesity in Cuyahoga County. Our approach can be applied to help researchers and stakeholders improve efforts to address childhood obesity in their communities.

## Introduction

Many public health challenges, including obesity, are complex in that they are driven by multiple factors that interact over time (1,2). Applying a socioecological perspective, obesity is influenced by individual-level factors (eg, genetics, taste preferences, food preparation skills), social factors (eg, cultural traditions, socioeconomic status), and environmental factors (eg, access to healthy food and safe places to be active) (3). Preventing excess weight gain during childhood is important for reducing obesity rates across the life course (4), and many childhood obesity prevention interventions have targeted single and multiple levels of the socioecological model with varying success (5). Successful obesity prevention interventions often include multiple strategies that target the social and physical environments to influence individual-level behaviors (6). Targeting the policies, systems, and environments (PSEs) that shape healthy eating and physical activity can influence population-level health at a lower cost than individual-level interventions and may address drivers of obesity-related health disparities (7–9). Therefore, federal agencies including the US Department of Agriculture and the Centers for Disease Control and Prevention recommend PSE change for childhood obesity prevention (10–12).

PSE change adoption, implementation, and maintenance requires buy-in from various stakeholders and collaboration across settings and sectors (13). Cross-sector collaborations, including community coalitions, can facilitate PSE change by creating opportunities for individuals and organizations to build trusting relationships, share information, pool resources, and align efforts toward a

common goal that is difficult for a single entity to achieve (14). The mechanisms through which cross-sector collaborations create the conditions for PSE change are not well understood, and interventions designed to influence such mechanisms are needed.

Stakeholder-Driven Community Diffusion (SDCCD) is a theory that aims to address that gap by proposing a mechanism of how cross-sector collaborations such as community coalitions influence stakeholder members, and in turn, how these members influence the PSEs that shape child health (15,16). SDCCD builds on the Community Coalition Action Theory and community-based participatory research by identifying key individual-level factors — stakeholder knowledge and engagement — that may be influenced by coalition participation (14,17,18). SDCCD integrates concepts from Diffusion of Innovations Theory and Social Network Theory to explain how changes in knowledge and engagement permeate professional networks (19,20).

Our research team used the SDCCD theory to inform an intervention that targets specific constructs and processes. The intervention was pilot tested (21) and was then implemented in Cuyahoga County, Ohio; that implementation is the focus of this study.

## Purpose and Objectives

The purpose of this study was to evaluate aspects of an SDCCD-informed intervention with a group of stakeholders drawn from a large, existing community coalition seeking a novel approach for promoting PSE change in their community. The objectives of the study were to assess changes in participants' perspectives after taking part in the intervention and evaluate where the group's actions fit within the context of a systems map that the group of convened stakeholders created during the intervention.

## Coalition description

Early Ages Healthy Stages (EAHS) is a coalition led by the Cuyahoga County Board of Health focused on early childhood health and wellness in Cuyahoga County, Ohio. The EAHS coalition grew out of a 2014 task force that was assembled by a group of funders, political leaders, and decision makers to reduce early childhood obesity in Cuyahoga County. EAHS now includes 85 agencies representing sectors influencing early childhood health (eg, health care, home-based and center-based childcare, education providers, social service agencies, community organizations, businesses). The coalition supports programs and initiatives by providing technical assistance and promotes resource and information sharing between member organizations. One initiative is the Ohio Healthy Programs (OHP), a free training and technical assistance program for early childcare and education professionals in Ohio, focused on promoting policies and practices that encourage

healthy eating, physical activity, and family engagement strategies to prevent and reduce early childhood obesity (22). OHP includes PSE strategies that support these healthy behaviors and aligns with the Centers for Disease Control and Prevention's (CDC's) Spectrum of Opportunities Framework for State-level Obesity Prevention Efforts (23). Research has shown the effectiveness of training programs like OHP on increasing childcare providers' knowledge and practices (24,25). Given this, EAHS plays a key role in supporting the expansion of OHP through community collaboration and resource sharing, and the expansion of OHP in Cuyahoga County is specified in the EAHS strategic plan.

Despite widespread community support for early childhood health and EAHS's strategic goal of expanding OHP in Cuyahoga County, the coalition's work remained siloed within sectors while nontraditional partners such as mental health care providers struggled to see the role that they and their organizations played in early childhood obesity prevention in Cuyahoga County. These barriers inspired EAHS leadership to investigate how a systems approach could unite community efforts, leading to the development of a partnership with ChildObesity180 at Tufts University (<https://childobesity180.org/>) to implement and evaluate an SDCD-informed intervention in their community.

## Intervention Approach

### Intervention overview

An SDCD-informed intervention was implemented by a team composed of Tufts University researchers, a community-based system dynamics expert at Boston College School of Social Work, a Cuyahoga County Board of Health staff member and EAHS leader, and an external consultant (this group will henceforth be referred to as the "research team"). The group of multisector stakeholders that was convened for the intervention was called the Action Building Committee (henceforth referred to as the "Committee") and included 12 key stakeholders selected from the EAHS Coalition. EAHS leaders identified 10 Committee members, with input from the research team on sector representation. The 2 remaining positions were chosen by coalition-wide nomination. The Committee represented 8 sectors: nutrition assistance programs, early education, center-based childcare, home-based childcare, public health department, community-based organization, private business, and philanthropy. The Committee received a stipend for participating in approximately 50 hours of intervention and evaluation activities over 10 months.

The SDCD-informed intervention was implemented in 2 phases in Cuyahoga County: 1) an intensive phase in which the research team facilitated Committee meetings and 2) a technical assistance phase in which the research team, which included EAHS leader-

ship, continued to work to advance priorities identified by the Committee. The first step of the intervention was to convene the Committee (Table 1). Next, the Committee engaged in group model building to better understand the systems influencing childhood obesity and facilitate shifts in perspective through exposure to new ideas. Group model building is a participatory approach for engaging stakeholders in building system dynamics models that depict how elements within a system interact to produce patterns of behavior over time (26). Group model building is designed to promote comprehensive understanding of a problem and shared insights among stakeholders, often resulting in increased motivation to implement action steps identified by the group (27). Group model building has been used with community stakeholders globally to create systems models related to childhood obesity and to identify opportunities to reshape those systems through PSE changes that promote healthy child weights (28–31). The SDCD-informed intervention extends existing literature conceptualizing group model building as an intervention that influences participants' thinking, decision making, and group cohesion (32). During the SDCD-informed intervention, the research team shared evidence (eg, recommendations from consensus reports, findings from peer-reviewed literature) related to the topics that the group prioritized through group model building activities. By using the system insights developed during group model building and the evidence shared by the research team, the group decided what PSE actions they wanted to take to promote healthy weight. The research team provided technical assistance and \$20,000 in seed funding to support the group's actions and to pursue additional funding opportunities to support their work. The research team worked with the group to create a large systems map that has since been used to communicate the complexity and interconnectedness of systems that influence childhood obesity. According to SDCD theory, the intervention activities should spur collaboration and diffusion of knowledge, engagement, and systems insights and facilitate PSE changes aiming to improve child health outcomes (16).

### Group model building and meeting facilitation

In Cuyahoga County, the intervention included monthly meetings with the Committee that were facilitated by the research team. The first 7 meetings used group model building to gain a deeper understanding of factors driving and impacted by early childhood health in Cuyahoga County. The research team used free group modeling building scripts from Scriptapedia to plan and facilitate group model building activities (33). Scripts provide detailed explanation of inputs needed to conduct group model building activities, how to facilitate the activities, and what outputs the activities should yield (27). The following group model building activities were selected and tailored to the community by the research team: hopes and fears, graphs over time, variable elicitation and connec-

tion circles, creating causal loop diagrams from connection circles, initiating and elaborating a causal loop diagram, and action ideas (Table 2). After completing the group model building activities, the Committee developed an action plan and designated existing organizations to operationalize the action items during the final 3 Committee meetings. Insights from the SDCD-informed intervention helped the EAHS coalition develop action strategies to implement the current EAHS strategic plan and to inform future coalition goals and objectives.

The research team planned the monthly meetings. Each meeting followed a general structure: introduction, brief evidence shares, group model building activity, group discussion, and reflection (Table 2). However, the process was flexible in that meeting plans could be adapted on the basis of Committee feedback. The research team facilitated monthly make-up meetings (conducted in person or over the telephone, depending on participant availability), as close to the scheduled meeting date as possible, to ensure that all individuals had a chance to share their ideas and perspectives. Make-up meeting participants also received a summary of the discussions and takeaways from the scheduled meeting.

Starting with the second meeting, the research team shared evidence from peer-reviewed and gray literature related to each meeting theme to increase Committee members' understanding of topics related to early childhood health. In response to Committee members' expressed interests, evidence share topics included the connection between early childhood education and health, promoting community health through equitable food systems, assessment of child health and health care in Ohio, and a roundtable discussion on obesity solutions with local leaders.

## Evaluation Methods

Data collection included meeting notes and group model building outputs to demonstrate implementation, online surveys and interviews to assess Committee member perspective shifts, and a follow-up survey to identify actions taken by the EAHS following the SDCD-informed intervention with the Committee (Table 1).

### Implementing an SDCD-informed intervention

The research team recorded meeting notes at each Committee meeting to document meeting facilitation, activities, and actions that the group prioritized. Additionally, Committee members developed tangible outputs during group model building activities, including graphs and system maps that depict key concepts and relationships discussed by the group (34). The research team photographed group model building outputs at the conclusion of meetings. Throughout the study period, Committee members revisited

group model building outputs to reinforce their understanding of the underlying relationships impacting early childhood obesity and to discuss ways in which to intervene (34).

### Perspective shifts

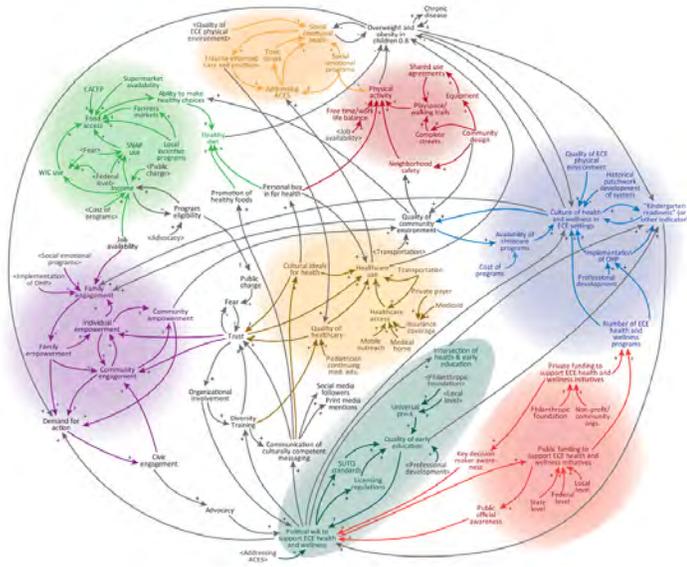
Committee members were surveyed about shifts in their perspective related to early childhood obesity prevention in Cuyahoga County. Participants were asked via multiple-choice questions whether they had experienced a perspective change related to early childhood obesity prevention and whether a person in the Committee, participation in the Committee, or both influenced the change. Questions about perspective shifts were embedded in a longer survey that took approximately 20 minutes to complete. The survey was written in English and disseminated using Qualtrics, an online survey platform, and was administered during months 5 and 9 of Committee meetings. Only data from month 9 were used in this study to assess perspective shifts at the final stage of Committee meetings. Survey questions about perspectives shifts were tallied and frequencies were reported.

One member of the research team (J.A.) conducted interviews with Committee members at baseline and at the conclusion of the study. That member of the research team also assisted with Committee meeting facilitation. The same interview questions were asked at both points. An SDCD-informed interview guide was designed to capture perspective changes related to early childhood health and early childhood obesity prevention between baseline and the end of Committee meetings (15). Questions also asked about Committee members' thoughts on the SDCD process and how their participation in the Committee influenced their perception of early childhood health and obesity prevention. Interviews were transcribed and responses were summarized into themes related to perspective shifts and reflections on the SDCD-informed intervention by one of the co-authors (D.N.) who was not involved in Committee meetings.

### Follow-up action survey

Fourteen months after the conclusion of Committee meetings, the research team distributed another online survey to all members of the EAHS coalition (n = 387) to understand the actions that had been taken related to early childhood health in Cuyahoga County. This survey was different than the one used to assess shifts in perspectives. The survey was sent 14 months after the Committee meetings ended to capture actions that may have been inspired by the intervention but that take time to initiate. Using the systems map developed by the Committee (Figure), participants selected up to 5 variables on the map to indicate where participants had taken action related to early childhood obesity prevention. The results of the survey allowed the research team and EAHS coalition

leaders to assess where within the system there was the most and least activity. The design of this systems map-based action survey was informed by a similar evaluation activity developed for the WHO STOPS project (35).



**Figure.** Systems map developed and refined by the Early Ages Healthy Stages Action Building Committee, 2019. Arrows indicate a connection between variables; plus signs indicate a connection in which change in one direction (eg, an increase or decrease) in the first variable results in a change in the same direction in the connected variable; minus signs indicate a connection in which a change in one direction in the first variable results in a change in the opposite direction in the connected variable. Abbreviations: ACEs, adverse childhood experiences; CACFP, Child and Adult Care Food Program; ECE, early childhood education; OHP, Ohio Healthy Programs; SNAP, Supplemental Nutrition Assistance Program; WIC, Special Supplemental Nutrition Program for Women, Infants, and Children.

## Results

### Implementing an SDCD-informed intervention

#### Meetings and group model building activity outputs

Throughout the study, an average of 90.7% of the 12 Committee members attended either originally scheduled (range, 7–12 attendees) or make-up meetings (range, 1–4 attendees), except for the final meeting. Only 3 Committee members attended the final meeting due to poor weather and the meeting being scheduled on a holiday. Committee members who did not attend received an email that provided information from the meeting. Committee members produced outputs throughout the series of group model building activities, including graphs depicting obesity-related variables changing over time and multiple versions of a causal loop diagram (Table 2). Over several sessions, the diagrams maintained their connection to participants’ understanding of the sys-

tem and relationships between variables but lost some connection to the principles of system dynamics (34). The diagrams evolved into systems maps, rather than a causal loop diagram representing a specific dynamic hypothesis. Therefore, the diagrams were merged into 1 systems map and styled to highlight different thematic areas in the system (Figure).

The final systems map developed by the Committee included 81 variables, organized into 8 main themes: healthy diet, engagement, political will, health care, physical activity, social emotional health, funding, and health and wellness in early childhood education settings (Figure). The systems map was primarily used to inform conversations around action prioritization and implementation. EAHS leadership continues to use this map as a tool for developing partnerships, unifying cross-sector efforts, and communicating to stakeholders how specific actions can influence the broader goal of increasing early childhood wellness in Cuyahoga County.

An impact feasibility grid was the last group model building output from the Committee. Committee members brainstormed intervention ideas or actions they could take to improve the system depicted in their systems map and ranked each idea based on its potential impact and feasibility. Next, the group voted on the items, reviewed relevant scientific evidence provided by the research team, and ultimately identified 4 actions.

#### Prioritized actions

After participating in group model building activities and reviewing evidence, the Committee prioritized the following actions to promote PSE change in early childcare settings: 1) develop a better understanding of the early childhood education system in Cuyahoga County, 2) assess the effectiveness and impact of OHP, 3) advocate for OHP and improved early childhood education quality, and 4) hold OHP designees accountable to meeting their objectives. Each of these actions reinforced an overarching goal of strengthening OHP, a goal chosen for its broad impact potential as seen in the systems map and impact feasibility grid, as well as its alignment with the EAHS strategic plan.

#### Taking action

The Committee and research team worked together to advance the 4 prioritized actions (Table 3). To develop a better understanding of the early childhood education system in Cuyahoga County, the research team member from the Cuyahoga County Board of Health (the EAHS Coalition leader) conducted a scan of existing efforts and initiatives in Cuyahoga County. The goal of the scan was to understand where opportunities existed to work with ongoing initiatives and where there was a need to advance advocacy efforts and expand OHP into more early childhood education programs. To assess the effectiveness and impact of OHP, the Com-

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mittee worked with an expert at Kent State University College of Public Health to design and conduct an evaluation of the impact of OHP on early childhood environments by using secondary data collected at OHP sites. This evaluation led to the development of a white paper targeting local and state funders and key decision makers, with the aim of advocating for funding and for the integration of OHP into the Ohio early childhood education quality rating system and/or licensing requirements (36). To develop the positions of EAHS members as child health champions and prepare them to advocate for OHP, one of the research team members hosted an advocacy training for EAHS members before an early childhood advocacy day in May 2019 at the state capitol. Twelve coalition members attended the training, and 4 EAHS representatives attended the statewide advocacy day. Finally, to hold OHP designees accountable, a monitoring tool to assess fidelity to the OHP designation requirements was developed in collaboration with an OHP coordination and program manager. OHP grant coordinators at the Cuyahoga County Board of Health will use the observation tool to make recommendations to sites.

### Perspective shifts

Survey responses by Committee members showed perspective changes after engaging in group model building activities. After 9 months, 9 Committee members (75%) noted a change in their perspective on early childhood obesity prevention, specifically, an increase in awareness of programs, resources, and collaboration opportunities in the early childhood education setting. Five members indicated that another member of the Committee influenced the change. The 9 members who reported a perspective change all reported that their involvement in the Committee influenced the change, referring to the following specific aspects of their participation: exposure to diverse perspectives, participating in committee meeting activities, working with committee members, exposure to diverse roles, and scientific evidence presented to the Committee.

Similar perspective shifts were reported in qualitative interviews of Committee members that were conducted at baseline and at the conclusion of Committee meetings, with all 12 members of the Committee completing both interviews. The interviews highlighted an appreciation for the Committee experience and new collaboration opportunities within the group (“I enjoyed strengthening the relationships with the other persons that were participating . . . I definitely have a newfound appreciation and feel like I know more now than I did a year ago”). These interviews also demonstrated increased knowledge of resources and of county-wide childhood obesity prevention efforts that are under way (“It’s been enlightening, like I’ve learned a lot about what’s going on in Cuyahoga County and all of the players”), as well as a recognition

of systems influencing childhood health in the county (“I really valued . . . understanding at a deeper level what some of the work looks like from the systems perspective, the systems that were represented in the room”).

### Follow-up survey and future coalition work

Sixty-three (16%) of 387 EAHS coalition members completed the follow-up survey 14 months after the conclusion of Committee meetings. Of respondents, 30% identified their primary sector as center-based childcare; 19%, early education; 15%, community-based organization; 11%, home-based childcare; and the remaining 25% of respondents representing health care, Cuyahoga County Board of Health, philanthropic organizations, parents, university, and other sectors. The survey asked participants to select variables they were working on within the systems map generated during group model building activities. Of the 81 variables, the most frequently selected were physical activity (n = 19 selections), family engagement (n = 18), food access (n = 15), social emotional health (n = 15), Child and Adult Care Food Program (n = 12), community engagement (n = 8), Step Up To Quality standards (n = 8), and trauma-informed care (n = 8). Although not conclusive given the low response rate, these variables show ongoing work in the engagement, healthy diet, social-emotional health, and physical activity subsystems of the systems map, while also indicating a potential lack of activity in the political will, funding, health care, and health and wellness in early childhood education settings subsystems. The results of this follow-up survey suggest that sustained efforts are needed in early childhood health, building on the actions prioritized by the Committee. Results of this survey provide EAHS with a rough estimate of where work is ongoing within the system and where the coalition could focus their efforts to reinforce existing efforts or to fill in gaps.

### Implications for Public Health

This study demonstrates how the SDCD theory can inform PSE-level initiatives and sustained community-led action. The study engaged 12 stakeholders from the EAHS coalition in Cuyahoga County to develop a holistic view of the system influencing early childhood obesity in their county and use those insights to generate and implement action in their community. The research team shared information throughout the intervention to encourage the group to select evidence-based actions. The actions focused on the early childcare system in Cuyahoga County and strategies for expanding OHP, which includes PSE approaches to support healthy eating and physical activity among young children. Stakeholders reported that the SDCD theory-informed intervention influenced their knowledge of the problem of early childhood obesity and their awareness of resources and collaboration opportunities to ad-

dress the problem. Additionally, the follow-up action survey provides a unique approach for assessing ongoing work in a community. The systems map developed by the Committee allows EAHS leadership to better understand what is driving and what is affected by the work of the coalition and create or adapt coalition priorities as necessary.

Our approach in Cuyahoga County responds to the call for researchers and practitioners to use systems thinking and community engagement to promote public health (13,37). Improving complex, adaptive systems (eg, health and social systems) requires collaboration across disciplines, sectors, and organizations (38). Systems science provides approaches and methods for examining interactions between variables over time that shape population health outcomes (39). Systems thinking tools can help groups with different expertise and perspectives build shared understanding and support learning as groups work to address complex public health issues (38). Systems thinking is highlighted as a critical capability to equip public health practitioners to effectively respond to forces rapidly reshaping the field, including climate change, demographic shifts, and social media and informatics (37). Developing effective interventions for population change requires collaboration between sector leaders as well as broad community buy-in. Integrating community-engaged research and systems science by taking a community-based system dynamics approach to build community capabilities in system dynamics offers new methods to study the systems that generate and perpetuate serious public health challenges and strengthens the translation of “knowledge to action” (40).

Our approach is generalizable in many ways. Community coalitions exist across the US, and decades of research indicate that coalitions may be amenable to working with scientists to try new strategies and engage in data collection activities. Conducting group model building activities that yield meaningful systems insights that can be shared within a group takes skill and training, which can be a limiting factor when using group model building to implement an SDCD-informed intervention as described here. Increasing training opportunities for group model building and community-based system dynamics could increase the pool of graduates and professionals who could implement interventions that use those methods. The main costs of implementing this intervention are salaries for those implementing and evaluating the intervention, stipends for intervention participants, and seed funding to initiate community-based actions. Grant funding was secured from a foundation to cover the costs of implementing the intervention described in this study. Finally, the SDCD theory and SDCD-informed intervention could be applied to a variety of public health concerns beyond childhood health, because the theory

describes processes and mechanisms not specific to a single public health concern.

This study also has limitations. We cannot isolate the effect of our SDCD process from the effects of general facilitation with a group because we had no control group. Future studies should include a comparison group. Building on systems thinking and modeling capabilities developed within this group, future work using group model building as a process for engaging stakeholders in Cuyahoga County could work toward more rigorous causal loop diagrams or formal system dynamics models with simulation to enable deeper system insights (40). Further, this should include taking a community-based system dynamics approach to engaging stakeholders to enable an explicit emphasis on developing community capabilities to ensure community ownership over system insights (40). The follow-up survey asked participants to click on variables in the systems map where they took or are taking action. There is an opportunity to test the reliability and validity of a similar survey with a more parsimonious causal loop diagram, and to program it such that participants can also select connections between variables and feedback loops to indicate they are working on the relationships between variables that drive system behavior. According to the Meadows Leverage Points framework, influencing connections and feedback mechanisms within a system is likely to create more change in system behavior over time than focusing on individual variables (41). An opportunity exists to administer pre–post surveys to assess change in systems actions. However, doing so would require a baseline systems map, which was not available in this study because the systems map was created as part of the intervention. Additionally, the low response rate of the follow-up survey limits our ability to draw conclusions about actions underway within the systems map after the Committee finished meeting. The low response rate may have been due to the survey timing (ie, COVID-19 was surging in the US), who sent the survey (a member of the research team whose name may have been unfamiliar to survey recipients), and time that the survey was open (3 weeks). Although survey results indicate a lack of activity in political will, funding, health care, and health and wellness in early childhood education settings subsystems, this may reflect who responded to the survey (ie, mostly early childcare professionals). Increasing response rate and sector representation would provide a more accurate assessment of coalition actions.

To conclude, an SDCD-informed intervention offered the EAHS coalition a new approach for member engagement, leading to a large systems map of factors driving childhood obesity and health in Cuyahoga County. This galvanized community-level action intended to improve the system influencing early childhood health in the community. The coalition continues to use the systems map to

communicate the interconnectedness of childhood obesity-related factors across sectors. The coalition also uses the systems map to plan and evaluate their work toward their vision.

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Tables

**Table 1. Timeline of the Implementation and Evaluation of a Stakeholder-Driven Community Diffusion–Informed Intervention to Prevent Early Childhood Obesity, Cuyahoga County, Ohio, 2018–2020**

Intervention activities	2018									2019					2020
	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Apr
Committee identification	X														
Committee meetings		X	X	X	X	X	X	X	X	X	X				
Group model building activities		X	X	X	X	X	X	X							
Evidence shares			X	X	X	X	X	X	X	X	X				
Technical assistance and grant-funded action															
Early childhood education scan												X			
Ohio Healthy Programs evaluation													X		
Early Childhood Advocacy Day														X	
Designed Ohio Healthy Programs monitoring tool														X	
Evaluation															
Survey with perspective items						X				X					
Interviews		X								X					
Meeting notes		X	X	X	X	X	X	X	X	X	X				
Group model building outputs		X	X	X	X	X	X	X							
Follow-up survey with entire EAHS coalition <sup>a</sup>															X

Abbreviation: EAHS, Early Ages Healthy Stages.

<sup>a</sup> EAHS is a coalition of 85 agencies that represent various sectors that influence early childhood health in Cuyahoga County, Ohio.

**Table 2. Meeting Themes, Meeting Summaries, and Description of Facilitated Group Model Building<sup>a</sup> Activities, Early Ages Healthy Stages Action Building Committee,<sup>b</sup> Cuyahoga County, Ohio, May 2018–February 2019**

Meeting theme	Meeting summary and attendance	Description of group model building activity
Project overview and creating a shared vision	<ul style="list-style-type: none"> <li>• Committee and research team introductions</li> <li>• Project overview (introduction to group model building and systems dynamics)</li> <li>• Hopes and fears (group model building)</li> <li>• Shared vision group discussion</li> <li>• Attendance: 11 of 12</li> </ul>	<p><b>Hopes and fears:</b> Prompted with the question, “What are your hopes and fears for our work together over the next 10 months?” Early Ages Healthy Stages Committee members shared their personal hopes and fears for the project and, with the help of the facilitators, organized responses into themes.</p>
Identifying trends and systems	<ul style="list-style-type: none"> <li>• Evidence share by research team: Connecting early childhood education and health</li> <li>• Hopes and fears recap</li> <li>• Graphs over time (group model building)</li> <li>• Group discussion</li> <li>• Attendance: 9 of 12</li> </ul>	<p><b>Graphs over time:</b> Given the prompt, “What impacts, or is impacted by, the work of the Early Ages Healthy Stages Coalition?” members identified factors that fit the description then created and shared line graphs showing how they perceived these factors to have changed in recent decades and the potential future trajectories that they hoped and feared might unfold.</p>
Identifying and connecting system variables	<ul style="list-style-type: none"> <li>• Graphs over time recap</li> <li>• Variable elicitation (group model building)</li> <li>• Connection circles (group model building)</li> <li>• Group share and discussion</li> <li>• Attendance: 9 of 12</li> </ul>	<p><b>Variable elicitation:</b> Guided by the questions, “What are key things that affect the functioning of the Early Ages Healthy Stages Coalition, or the impact that the Coalition has in the community?” members wrote variables that came to mind.</p> <p><b>Connection circles:</b> Members worked in groups to draw connections between variables around a circle, using arrows to begin seeing how variables can be connected.</p>
Reflecting on the past and sketching a roadmap	<ul style="list-style-type: none"> <li>• Evidence share by research team: The importance of early learning</li> <li>• Reflection on prior activities (hopes and fears, graphs over time, variable elicitation, connection circles)</li> <li>• Connection circles (focused on connection between coalition’s functioning and impact)</li> <li>• Group share and discussion about defining success moving forward</li> <li>• Attendance: 9 of 12</li> </ul>	<p>[See description of Hopes and fears, Graphs over time, Variable elicitation, and Connection circles]</p>
Visualizing systems connections and structures	<ul style="list-style-type: none"> <li>• Evidence share by research team: Promoting community health improvement through more equitable food systems</li> <li>• Introduction to causal loop diagrams: Purpose and use in Committee</li> <li>• Introduction to causal loop diagrams: Technical aspects and mechanics of drawing (group model building)</li> <li>• Small group drawing of causal loop diagrams</li> <li>• Group share</li> <li>• Causal loop diagram combination by facilitation team (during group lunch break)</li> <li>• Reaction and refinement of combined causal loop diagram as whole group</li> <li>• Attendance: 11 of 12</li> </ul>	<p><b>Causal loop diagrams:</b> Committee members learned how to read and create causal loop diagrams. A causal loop diagram was then developed by the entire group to visualize connections between factors identified in previous group model building activities and identify system structures, such as feedback loops, that drive trends over time. Creating a causal loop diagram helps groups develop shared language and begin to understand the dynamics of a complex problem.</p>
Causal Loop Diagram elaboration and use for action planning as systems map	<ul style="list-style-type: none"> <li>• Evidence share by research team: Assessment of child health and health care in Ohio</li> <li>• Research team presented integrated causal loop diagram, review of causal loop diagram, progression, summary of key feedback loops (group model building)</li> <li>• Small group discussion: Is there anything missing or that should be changed?</li> <li>• Group share and discussion</li> <li>• Attendance: 10 of 12</li> </ul>	<p><b>Causal loop diagram elaboration:</b> The causal loop diagram was updated between meetings by the research team and then presented back to the group. When presented back, the facilitator explained each loop and reflected on key insights before asking the group for feedback on what is missing. Refining and elaborating the causal loop diagram as a group ensures that all connections are included and that all members feel represented. This causal loop diagram was styled into a systems map to be used primarily as a communication tool moving forward.</p>

Abbreviation: NA, not applicable.

<sup>a</sup> Group Model Building is a participatory approach for engaging stakeholders in building system dynamics models that depict how elements within a system interact to produce patterns of behavior over time.

<sup>b</sup> Early Ages Healthy Stages is a coalition of 85 agencies that represent various sectors that influence early childhood health in Cuyahoga County, Ohio. Attendance numbers reflect people who attended the regularly scheduled meetings, not those who attended the make-up meetings.

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(continued)

**Table 2. Meeting Themes, Meeting Summaries, and Description of Facilitated Group Model Building<sup>a</sup> Activities, Early Ages Healthy Stages Action Building Committee,<sup>b</sup> Cuyahoga County, Ohio, May 2018–February 2019**

Meeting theme	Meeting summary and attendance	Description of group model building activity
Identifying opportunities for systems change	<ul style="list-style-type: none"> <li>Evidence share by research team: Overweight/obesity and blood pressure in Cuyahoga County</li> <li>Review of refined systems map and feedback loop connections</li> <li>Reflection on the importance of systems change</li> <li>Individual work to generate action ideas (group model building)</li> <li>Group share and impact-feasibility grid</li> <li>Group discussion</li> <li>Attendance: 7 of 12</li> </ul>	<b>Action ideas:</b> Action ideas that targeted specific areas of the systems map were then conceptualized using an impact-feasibility grid, a tool to guide members in formulating actionable solutions, and creating a shared understanding of potential interventions within the system.
Prioritizing activities for action ideas	<ul style="list-style-type: none"> <li>Evidence share by research team: Early Ages Healthy Stages engagement in the community</li> <li>Presentation of top 11 survey results (Committee members voted on top ideas to prioritize from impact-feasibility grid)</li> <li>Presentation of evidence around top strategies, developed by research team</li> <li>Group discussion of each idea and what needs to happen to move forward</li> <li>Attendance: 7 of 12</li> </ul>	NA
Action planning and catalyzing future work	<ul style="list-style-type: none"> <li>Evidence share by research team: The intersection between health and education in very young children</li> <li>Action planning continued: more structured discussion around top 4 action items</li> <li>Introductory discussion to sustainability</li> <li>Attendance: 9 of 12</li> </ul>	NA
Preparing for sustainability of work going forward	<ul style="list-style-type: none"> <li>Evidence share by research team: Roundtable discussion on obesity solutions with local early childhood education leaders</li> <li>Discussion of action strategies moving forward using the systems map</li> <li>Committee Culmination/Kickoff event with community leaders to showcase work: panel discussion on creating healthier early childhood environments through community</li> <li>Group discussion on sustainability of work moving forward</li> <li>Hopes and fears (for future)</li> <li>Attendance: 3 of 12</li> </ul>	NA

Abbreviation: NA, not applicable.

<sup>a</sup> Group Model Building is a participatory approach for engaging stakeholders in building system dynamics models that depict how elements within a system interact to produce patterns of behavior over time.

<sup>b</sup> Early Ages Healthy Stages is a coalition of 85 agencies that represent various sectors that influence early childhood health in Cuyahoga County, Ohio. Attendance numbers reflect people who attended the regularly scheduled meetings, not those who attended the make-up meetings.

**Table 3. Prioritized Actions and Outcomes to Reduce Prevalence of Childhood Obesity, Developed Through the Group Model Building Process, Action Building Committee of the Early Ages Healthy Stages Coalition, Cuyahoga County, Ohio, 2019–2020**

Prioritized actions	Implementation activities	Implementation outcomes
Understand early childhood care system in Cuyahoga County	Conducted a scan of existing efforts and initiatives in Cuyahoga County	<ul style="list-style-type: none"> <li>• Scan survey developed and fielded in spring 2019</li> <li>• Results of scan presented to Early Ages Healthy Stages coalition subgroup to assist with development of strategic plan in December 2019</li> </ul>
Assess the effectiveness and impact of OHP in Cuyahoga County	Designed and conducted an evaluation of OHP	<ul style="list-style-type: none"> <li>• Evaluation conducted and results presented to Cuyahoga County Board of Health in February 2020</li> <li>• Manuscript submitted for publication July 2020</li> <li>• White paper developed to advocate for funding for OHP, and for the integration of OHP into the Ohio early childhood care quality rating system and/or licensing requirements in June 2020</li> </ul>
Advocate for OHP and improved early childhood care quality in Cuyahoga County	Developed communication materials and hosted a training to advocate for enhanced integration of early childhood health and education at a state level	<ul style="list-style-type: none"> <li>• 12 Coalition members attended the training held in March 2019</li> <li>• 4 Coalition members attended a statewide advocacy day held in May 2019</li> </ul>
Maintain accountability of OHP designees in Cuyahoga County	Worked with OHP coordinator and program manager to develop monitoring tool for OHP-designated sites	<ul style="list-style-type: none"> <li>• Monitoring tool designed summer and fall 2019, with planned implementation of tool in early 2020; implementation delayed due to COVID-19</li> </ul>

Abbreviation: OHP, Ohio Healthy Programs.

## IMPLEMENTATION EVALUATION

# A Pilot Study of Integration of Medical and Dental Care in 6 States

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Accessible Version: [www.cdc.gov/pcd/issues/2021/21\\_0027.htm](http://www.cdc.gov/pcd/issues/2021/21_0027.htm)

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## PEER REVIEWED

**Summary****What is already known on this topic?**

Poor oral health is linked to chronic diseases such as diabetes, cardiovascular disease, and obesity.

**What is added by this report?**

Six state health departments conducted 2-year pilot projects to promote collaboration between their oral health and chronic disease programs. States were able to increase collaboration, train oral health and medical professionals, deliver clinical preventive education to patients, implement referral systems, and deliver education via media campaigns.

**What are the implications for public health practice?**

Collaborations between oral health and chronic disease programs can result in promising projects that address common risk factors for oral health and chronic disease.

## Abstract

**Introduction**

Poor oral health affects overall health. Chronic diseases and related risk factors such as tobacco use or consuming sugar-sweetened beverages can also increase a person's risk of periodontitis. Given the linkages between oral health and certain chronic diseases, we conducted a pilot study to facilitate intradepartmental collaborations between state chronic disease and oral health programs.

**Methods**

State health departments in 6 states (Alaska, Colorado, Georgia, Maryland, Minnesota, and New York) collaborated to develop and implement projects that addressed oral health and the following

chronic diseases or risk factors: obesity, diabetes, heart disease, stroke, and tobacco use. States developed various projects, including media campaigns, clinical education, and screening and referrals. We used a mixed-methods approach to understand barriers to and facilitators of states' increasing collaboration and implementation of pilot projects. In-depth interviews were conducted with 12 staff (1 from oral health and 1 from chronic disease for each state). We also reviewed state-submitted documents and performance measures.

**Results**

All 6 states increased collaboration between their oral health and chronic disease programs and successfully implemented pilot projects. Collaboration was facilitated by investing in relationships, championing medical–dental integration, and meeting and communicating frequently. Barriers to collaboration included the perception of oral health in chronic disease programs as separate and distinct from other chronic diseases and the structure of funding. The pilot projects were facilitated by partner support, providing technical assistance to clinics, and working early on referral networks. Barriers to implementing the pilot projects included gaining clinician buy-in and establishing referral networks.

**Conclusion**

This pilot study demonstrated that by fostering collaboration, state health departments are able to train dental and medical clinicians, deliver clinical preventive education to patients, implement referral systems, and deliver impressions via media campaigns.

## Introduction

Poor oral health, which includes dental caries (tooth decay), periodontal disease (gum disease), and oral cancer, affects quality of life for millions of Americans (1,2). Tooth decay is one of the most common chronic diseases in the United States. About 1 in 4 US children aged 2 to 5 years, 52% of children aged 6 to 8 years, 90% of adults aged 20 to 64 years, and 96% of adults aged 65 or older experience dental caries (3). Approximately 42% of adults aged 30 or older had periodontal disease in 2009–2014 (4). In 2016, nearly 45,000 new cases of cancer of the oral cavity and



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pharynx were diagnosed in the United States, and more than 10,000 people died from those diseases (5).

Studies show that poor oral health is linked to chronic diseases such as diabetes, cardiovascular disease, and obesity (6,7). Emerging research indicates a possible 2-way relationship between diabetes and periodontitis. Research suggests that diabetes, especially when poorly controlled, is a risk factor for periodontitis, and conversely, people with diabetes may be at increased risk of periodontitis (7). Although causality has not been established, studies suggest associations between periodontitis and cardiovascular disease (8) and between periodontitis and obesity (9). Research suggests that obesity could be a potential risk factor for periodontal disease, especially among younger people (10). The linkage between poor oral health and overall health also includes risk behaviors such as tobacco use (11) and consuming foods and beverages with high levels of added sugar (12).

Few public health programs in the United States integrate oral health and chronic disease programs. Although oral disease and chronic disease are linked, dental and medical health care systems are not. The Institute of Medicine and others have proposed integrating oral health into the medical health care system to promote better health and improve access to both dental and medical preventive services (13–15). Some agencies have also called to examine the role of medical–dental integration in reducing oral health disparities (16) and to increase oral health equity (17).

Given that research shows links between oral health and certain chronic diseases (6–12) and a lack of integration of oral health and chronic disease programs within state health departments, the Centers for Disease Control and Prevention (CDC) initiated a pilot project, Models of Collaboration, in 2016 in which it funded 6 state health departments to promote collaboration between programs addressing oral health and chronic disease (eg, diabetes, heart disease) or risk behaviors (eg, smoking, high-sugar diet).

## Purpose and Objectives

The purpose of Models of Collaboration was for the chronic disease and oral health programs of state health departments to collaboratively develop and implement 2-year chronic disease prevention pilot projects that integrated activities from both chronic disease and oral health programs. The aim of the state pilot projects was to facilitate, strengthen, and increase collaboration between oral health and chronic disease programs at the state health department around common risk factors for oral health and chronic disease; build synergy; and maximize resources to improve oral health and decrease associated comorbid chronic diseases. We provided guidance to states to select strategies that focused on the prevention of selected chronic diseases or risk beha-

viors of mutual importance to both the states' oral health and chronic disease programs, such as obesity prevention; diabetes, heart disease and stroke prevention; or tobacco control. As described earlier, these are risk factors known to increase the risk of periodontitis and poor oral health.

## Intervention Approach

We provided a general framework to states as they developed their pilot projects. This framework included 1) convening an advisory panel of key chronic disease and oral health personnel to oversee the 2-year project; 2) creating and refining a project work plan that used oral health program activities to have an impact on 1 chronic disease; 3) using oral health program staff, partners, and activities to implement the project work plan; 4) assessing the project through process and outcome evaluation measures; 5) building communication among state chronic disease and oral health program staff to strengthen collaboration between the programs; and 6) reporting project outcomes to state and national chronic disease and oral health partners.

The rationale for providing a framework was to identify commonly used program components that states would implement as part of the project to maintain structure and a level of consistency in the development of pilots across the 6 states, given that each state would be selecting its own prevention program for oral health and chronic disease. For example, the development and participation of advisory panels would reflect an intent by the leadership of both the chronic disease and oral health programs to jointly commit time and resources to the pilot projects. A work plan is a useful project implementation tool in that it defines strategies, activities, evaluation and performance measures, and project timelines and assigns tasks to staff of both the oral health and chronic disease programs. Building communication activities included sharing project work plans and progress with chronic disease and oral health partners and oral health staff participating in development of the state's chronic disease prevention plan. Finally, we recommended that states disseminate project outcomes and evaluation findings to state and national chronic disease and oral health partners to monitor program outcomes, build an evidence base for program interventions, and drive continuous program improvement.

States developed interventions on the basis of a combination of contextual factors including existing relationship between state oral health and chronic disease programs, state priorities, and recommendations from an advisory panel of key chronic disease and oral health personnel. All state interventions selected were evidence-based: consumption of foods and beverages with high levels of

sugar in relation to dental caries (12), screening for periodontitis among people with diabetes (7), poor oral health among people who use tobacco (11), and associations between periodontitis and cardiovascular disease (8).

Six state health departments (Alaska, Colorado, Georgia, Maryland, Minnesota, New York) developed state-specific pilot projects, which were conducted from August 2016 through August 2018, 5 of which were clinical interventions (eg, diabetes risk assessments and testing in federally qualified health centers [FQHCs], administering periodontal self-assessments in community health clinics). In addition to key project outcomes listed, all pilot states had success stories, including some life-saving referrals (Table 1).

**Sugar-sweetened beverages.** Alaska developed a clinical intervention in community dental practices and tribal health organizations to reduce the consumption of sugary drinks and encourage drinking (preferably fluoridated) water through a pilot in which dental clinicians incorporated a counseling intervention to address sugary drink consumption among parents and children. Key project outcomes included training 125 participants and developing and distributing more than 600 communication guides to be used by oral health professionals as structured training materials to discuss sugar-sweetened beverages with patients.

New York developed and implemented a multimedia marketing campaign among African American and Hispanic adolescent males in western New York to decrease sugar-sweetened beverage consumption and encourage drinking (preferably fluoridated) water. Key project outcomes included a media campaign that delivered more than 25 million impressions (ie, the number of times a piece of media content such as a billboard or social media message is consumed).

**Tobacco cessation.** Georgia piloted a tobacco cessation project for dental clinicians working with pregnant women aged 18 to 24 who were eligible for Medicaid and WIC (Special Supplemental Nutrition Program for Women, Infants, and Children), provided tobacco cessation and quitline referral training for dental clinicians serving this population, developed a tobacco prevention tool kit for oral health clinicians, and created a media campaign. Key project outcomes included training 62 oral health clinicians, and 14,780 tobacco quitline caller referrals made by dental professionals.

**Hypertension and tobacco cessation.** Maryland developed and implemented hypertension and tobacco use screening and referral in dental practices and created a social marketing campaign to promote hypertension screenings in the dental setting among African

American women aged 35 to 65 at risk for hypertension. Key project outcomes included screening 36,996 patients and referring 2,689 to primary care. The pilot also implemented a media campaign that delivered more than 3 million impressions.

**Hypertension and periodontal disease.** Minnesota developed and implemented a program with bi-directional referrals in community health clinics for periodontitis and hypertension. Key project outcomes included dental offices referring 3,646 patients to clinicians and medical offices administering 844 periodontal self-assessments.

**Diabetes and periodontal disease.** Colorado collaborated with an FQHC to facilitate training, screening, and bi-directional referral for periodontitis and diabetes/prediabetes. Key project outcomes included delivering 461 diabetes risk assessments and 100 prediabetes (hemoglobin A1c) tests.

## Evaluation Methods

At the end of the 2 years, we evaluated Models of Collaboration with 2 objectives: 1) to determine facilitators and barriers for collaboration between state oral health and chronic disease health programs, and 2) to determine barriers and facilitators in the development and implementation of pilot projects. We used a mixed-methods evaluation study design, collecting both qualitative and quantitative data. The primary data collection tools were in-depth interviews, a review of state-submitted documents, and performance measures.

### Data sources

**In-depth interviews.** We conducted in-depth interviews to better understand project implementation, facilitators, barriers, and lessons learned. Two in-depth interviews (1 interview with staff from the oral health program and a second interview with staff from the collaborating chronic disease program) were conducted with state health department staff from each of the 6 project states for a total of 12 in-depth interviews. Staff were purposively selected for their experience with the pilot project. Interviews were conducted via Skype or telephone from January 11 through April 19, 2019, by M.L., a trained and experienced qualitative interviewer. Verbal consent was obtained from all interview participants. Interviews ranged from 47 minutes to 1 hour 45 minutes (average = 1 hr 17 min) and were recorded on Skype for Business recording software and a digital recorder. CDC reviewed this study for human subjects protection and deemed it to be nonresearch.

**State-submitted documents.** As part of Models of Collaboration, states were required to submit yearly performance measure and narrative progress updates and a final evaluation report. Two

yearly reports were submitted, 1 for each year of the project, which included quantitative data collected by the states to measure progress on their self-established performance measures and a narrative with the following elements:

- Dissemination of evaluation results
- Enhancements made based on evaluation findings
- Successes
- Challenges
- CDC program support to awardees

We reviewed these state-submitted documents to identify project facilitators and barriers and to create project-specific probes for in-depth interviews. Twenty-eight documents in total were analyzed.

**Performance measures.** States developed performance measures based on key outputs or outcomes (Table 2). Each state was required to set targets and to collect and submit data for these performance measures each year. For performance measures, the 6 states developed a numeric indicator value and identified whether they had met the target, were in progress to meet the target or the work was ongoing, or had not met the target.

### Data analysis

We transcribed interviews verbatim, developed a codebook based on the interview guide, and iteratively updated the codebook throughout the coding process. Themes based on the identified barriers and facilitators were developed by comparing responses across and between states. For state-submitted documents, we coded narrative portions of these documents and analyzed in the same manner as in-depth interviews. In-depth interviews and narrative portions of state-submitted documents were analyzed by using ATLAS.ti (ATLAS.ti Scientific Software Development).

We reviewed state-submitted performance measure updates. Because states developed their own performance measures for different pilot projects, performance measures varied by state. For example, for the outcome “increased incorporation of oral disease systems and concepts into the state’s chronic disease work plans,” 1 state defined this performance measure as the number of instances of incorporation of oral disease systems and concepts into the state’s chronic disease work plans, whereas another state defined it as the number of strategic plans developed where oral health program staff and their partners were engaged. Additionally, not all states conducted pilot projects on the same chronic disease prevention program or risk factor (ie, some states worked on diabetes prevention and others worked on smoking cessation). States developed indicators and target values solely on the chronic disease or risk factor they selected, creating wide variability in

target values for indicators among the 6 pilot states. Because of these differences, performance measure data were used to determine key successes for each state and whether state-determined targets were met, but these data were not compared across the pilot projects.

## Results

All 6 states successfully implemented the general framework provided (ie, advisory panel, work plan, implementing work plan, assessing project, building communication, and reporting project outcomes) as they collaborated with their respective oral health and chronic disease health programs. We report key facilitators and barriers to state health department collaboration and pilot project implementation synthesized across all 6 states.

### Collaboration

#### Facilitators

Collaboration between state chronic disease program staff, oral health program staff, and their partners increased in all 6 states. All were successful in convening and collaborating with an advisory panel made up of internal and external oral health and chronic disease personnel. States increased integration of oral health and chronic disease by adding elements of oral health to state chronic disease work plans and vice versa, creating communication materials that addressed both oral health and chronic disease and increasing the frequency of communication between programs. Key facilitators to improving collaboration at the state health department included 1) investing in relationships, 2) championing medical–dental integration, and 3) meeting and communicating frequently.

State representatives identified building and maintaining relationships between members of the oral health and chronic disease programs as a facilitator of several different aspects of collaboration. Relationships helped in the identification and recruitment of advisory panel members. As a result of the relationships built, oral health representatives were invited to participate in other aspects of chronic disease programming. Building strong relationships was also key to helping states continue to collaborate despite frequent staff transitions, an issue faced by several states.

Championing medical–dental integration was another facilitator of collaboration at the state health department. Interest in medical–dental integration helped program staff actively look for opportunities to collaborate. Because funding was provided to only 1 program in each of the state health departments (to the chronic disease program or the oral health program), staff of the other program were not always funded to work on the project. Be-

lieving in the idea of the project and seeing the benefit for both programs helped facilitate collaboration, even in cases where funding was not provided by Models of Collaboration.

Meeting and communicating frequently helped facilitate collaboration. Frequent meetings helped ensure that staff continued to collaborate despite staff transition. In addition, meetings helped build and maintain relationships, facilitate information sharing, and solidify the collaboration between the programs. Overall, states reported that meeting frequency varied between weekly and monthly and was either in person or by telephone.

### **Barriers**

The most common barrier to improving collaboration between programs was that oral health was viewed as separate and distinct from other chronic diseases, which affected the states' ability to collaborate on work plans and communication materials. One oral health staff member found it difficult to integrate work plans because they perceived oral health as being interactive earlier in life than other chronic diseases and at more points throughout the lifespan (ie, oral health programming can target young children, pregnant women, adults, and the elderly, whereas programming for other chronic diseases mostly targets adults). In response to developing shared communication materials, a chronic disease staff member from another state said, "It comes across as dental oral health is kind of a standalone, whereas other chronic diseases like cardiovascular and diabetes are more connected at the hip." Respondents reported that this disconnect between oral health and other chronic diseases had less of an impact for those working with chronic diseases and associated risk factors that had stronger, more widely accepted evidence of a causal relationship with oral health (ie, consumption of sugar-sweetened beverages, smoking) than for those with less evidence of a causal relationship (ie, hypertension, diabetes).

Funding for Models of Collaboration was provided to 1 program in the state health department. Other program staff were not always funded or fully funded. Even among staff who were interested in medical–dental integration, a lack of direct funding made it difficult for them to dedicate time to the project. Staff reported feeling overwhelmed by their workload and found it difficult to spend much time on projects they were not funded to develop or implement.

### **Pilot projects**

Overall, all 6 states, regardless of the type of chronic disease or risk factor they worked with, were able to develop and implement pilot projects. Key outcomes of these pilot projects included training of oral health and medical clinicians, delivering clinical pre-

ventive education to patients, implementing referral systems, and delivering impressions through media campaigns (Table 1).

### **Facilitators**

Key facilitators to developing and implementing the pilot projects were partner support, providing technical assistance to clinics, and working on referral networks early. As part of the project guidelines, states were asked to convene an advisory panel to support the development and implementation of their pilot project. The advisory panel provided key clinical expertise to state health department staff. This clinical expertise included developing clinical workflows, providing guidance on referral systems, clinical guidelines, billing, and reviewing communication materials for clinical accuracy.

Several states found that providing technical assistance to the clinics implementing the medical–dental collaboration program improved implementation. As expected in a pilot project, clinics faced issues when incorporating screening and referral processes into their established workflows. By communicating with the implementing clinics, state health departments were able to learn about problems that the clinics were facing and collaborate with their advisory panels to develop solutions to these problems. In addition, maintaining strong relationships with the clinics allowed state health departments to share information and lessons learned across different clinics. This support to the clinics amounted to clinical quality improvement practices.

When patients were screened and identified as being at high risk for a chronic disease, referral protocols needed to be in place. Several states that struggled to create referral networks between clinics provided a few strategies to facilitate this process. For example, states recommended working on building referral networks early in the process, even before the official start of a project. Building strong relationships early on with potential referring clinics through consistent communication can facilitate the establishment of referral networks.

### **Barriers**

Key barriers to developing and implementing the pilot projects were gaining clinician buy-in and developing and implementing referral networks. Several states said that getting clinician buy-in to the project at the clinic level was difficult. State health department staff faced resistance when they asked clinicians to change their workflow to incorporate screening, referrals, or education. Clinicians told state health department staff that because their time with patients was already limited, adding an additional task such as screening, referrals, or education was difficult. States responded by working with clinics to establish workflows that accommodated these additional tasks.

Some clinics experienced difficulties in creating referral networks. State health department staff found that establishing these networks took longer than anticipated. One dental clinic was able to establish a referral procedure only after multiple attempts at contacting the medical clinic, highlighting the importance of persistence. Some barriers to establishing referral networks were a lack of medical practices near the dental clinic and an inability of potential medical and dental referral sites to take on new patients, especially those without health or dental insurance. Clinics also struggled to track and measure referral completion, partially because medical and dental clinic health records were not interoperable.

## Implications for Public Health

Although the mouth is part of the body, oral health has historically been treated as separate from medical health. This distinction dates back to the origins of dentistry as a profession (18) and the lack of inclusion of dentistry during the establishment of medical schools in the United States, still evident in the mostly separate care system that we have today (19). The long-standing perception that oral health is separate and distinct from overall medical health was cited as a barrier to collaboration by the 6 state health departments that manifested in challenges in implementing pilot projects, especially in integrating work plans and developing communication materials. Low prioritization of oral health on the political agenda is another barrier to integrating oral health into primary care (20).

Several reviews of medical–dental integration found that having strong leadership champion the integration facilitates the process, in part through educating public health professionals and clinicians about the importance of oral health (20,21). Relationship-building was key to increasing collaboration. For some states, educating the collaborating program at the state health department was an important aspect of building relationships as was creating and engaging champions for medical–dental integration from their partner program. Models of Collaboration allowed for the growth of relationships among pre-existing champions who previously had not been able to collaborate on medical–dental integration because they lacked explicit funding. Partnerships and common vision were a facilitator in other medical–dental integration projects (20).

States that implemented pilots in clinical settings faced a unique set of challenges. The biggest of these challenges was developing referral networks between clinics where none previously existed. This included getting clinician buy-in at the clinic level, changing workflow to incorporate screenings, referrals, and education. Studies have shown that although clinician opinions of using dental

settings to screen for chronic diseases were generally positive, some barriers — including workload, time, cost, and patient willingness — remained (22). Our 6 states found that gaining clinician buy-in was difficult in some cases, requiring that clinics work on their own or in collaboration with the state health department to overcome issues related to workload and time (developing workflows that work for each clinic) and patient willingness (developing a standard explanation of the purpose of screening). Establishing and implementing these processes took time and persistence.

After screening patients, clinicians referred those at risk to appropriate clinicians for care. As with other projects (21), just as medical clinicians had difficulty finding dentists to accept patients, dental clinicians had difficulty finding nearby medical clinicians who would accept patients, especially patients without insurance. Health record incompatibility was also identified as a barrier to integration (20,21). The inability of dental records to “talk to” electronic health records makes the referral process difficult. All 5 states implementing clinical interventions reported difficulties related to health record incompatibility.

Quality improvement is important in implementing medical–dental integration projects (21). Providing support to clinics and sharing lessons learned across clinics was an important way the states improved integration. The Models of Collaboration pilot projects addressed some of the issues identified by an environmental scan of public health medical–dental integration efforts (23). One issue was a lack of established protocols for implementing integrated activities. Five of 6 projects turned to local experts through an advisory panel to develop guidance for clinics. The environmental scan also recommended that projects prioritize local community needs through formative research, which several states, including New York, did (Table 1).

Sustainability of medical–dental integration remains an issue (19,20) and has been identified by several reviews (20,21,23). Sustainability of funding at the clinic level, specifically sustainability of integrated practices after grant funding was completed, was a concern among health department staff. State health departments funded only 1 of the 2 programs (oral health or chronic disease), so members of the partner program found it difficult to collaborate in a sustainable manner. CDC funded this pilot project for 2 years but has since expanded funding for future medical–dental integration projects for longer periods. Lessons learned from this pilot project were used to improve the new long-term CDC project (24).

Because of our study’s small sample size, our findings are not generalizable; however, they can provide lessons for future medical–dental integration projects. Our 6 states were funded for a short time — 2 years. A few states reported that more than half of that

time was spent developing relationships between oral health programs and chronic disease programs, leaving little time to implement the pilot projects themselves, especially those in clinic settings. This short time frame limited the ability of states to collect clinical outcome data, corroborated by an environmental scan, which found very limited outcome data (23). Finally, a few states faced frequent staff turnover. This affected continuity of project planning and implementation and affected the ability of some interviewees to respond to select interview questions.

Evidence is slowly emerging on the effectiveness of integration models (25), with some evidence pointing to the need for reform of the oral health care system (26) and a recognition of all social determinants of health connecting oral health and overall medical health, especially during the COVID-19 pandemic (27). State health departments are uniquely positioned to support medical–dental integration. Our pilot study showed that through collaboration, state oral and chronic disease programs can leverage funding to provide training and increase screenings and referrals for oral diseases that share risk factors with chronic diseases. Additional studies are needed to further understand some of the logistical challenges in implementing integration projects, including building effective and sustainable referral networks.

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Tables

**Table 1. Project Success Stories, Pilot Study of Medical–Dental Collaboration in 6 US States, 2016**

State	Success Story
Alaska	<p><b>Desire for materials.</b> One of the key successes of Alaska’s project was the interest generated for the project-created communication materials. After the communications guide was published, several groups, including the Special Supplemental Nutrition Program for Women, Infants, and Children (WIC), Supplemental Nutrition Assistance Program (SNAP), and 2 tribal organizations, invited staff to present and train on the guide. Having a variety of state agencies ask that their staff have access to and be trained on the communication materials showed how successful the project had become.</p> <p><b>Perception of practitioners.</b> Another key success of Alaska’s project was the positive perception of project-created communication materials among practitioners. After presenting at the Alaska Native Tribal Health Consortium, project staff learned that some clinicians were already familiar with and using the materials in their practices. The program received a great deal of positive feedback, including the impact these resources were having in their communities. Clinicians indicated their desire to have the project implemented in Head Start programs and schools. The passion that the training and materials evoked from clinicians was inspiring. The development and publication of the guide started conversation among different agencies and clinicians on difficult issues.</p>
Colorado	<p><b>Self-esteem.</b> A patient came to the Colorado Coalition for the Homeless, an FQHC that provides various services to homeless people, including medical and dental care, to receive dental care to improve his chances at getting a job. He had not seen a medical doctor in years, and while there, he agreed to take the verbal risk assessment for diabetes. When his score came up high, the clinician did a point-of-care hemoglobin A1c (HbA1c) screening. The test showed that the patient probably had diabetes. Through the Diabetes Oral Health Integration project, the patient was referred to primary care for diagnosis, education, medications, and other needs for care. Because of the screening and subsequent care, this patient was able to improve the appearance of his teeth, felt ready to get a job, and was connected with medical clinicians to help control his diabetes.</p> <p><b>Access to integrated care.</b> A patient visited the Colorado Coalition for the Homeless dental clinic for a problem-focused visit. They had previously been told by clinicians to monitor their HbA1c levels because of a family history of diabetes; however, because of limited access to care, the patient had not been screened in many years. Before the Diabetes Oral Health Integration project, testing a patient’s HbA1c levels would not be included in dental care. Luckily for this patient, under the project protocols, the dental clinician referred the patient to a medical clinician on site for more testing that same day. The client was grateful to be able to receive both dental and medical care at the same visit. Another patient who came in for dental care received a point-of-care HbA1c screening and was surprised to learn that they had elevated glucose levels. The patient was referred to the medical clinic for a same-day appointment where they were diagnosed, given diabetes education, and prescribed appropriate medications. Without the Diabetes Oral Health Integration project, this patient would not have been screened, diagnosed, or treated for their diabetes, and their oral and overall health would have continued to suffer.</p>
Georgia	<p><b>Impact on clinicians.</b> One key success from Georgia’s Models of Collaboration project was its impact on dental clinicians. During clinician training, staff were able to use interactive presentation software to gain real-time insights from participants. They conducted pre- and post-training session surveys to understand how the presentation affected clinicians. After the training session, clinicians were more likely to report interest in seeing pregnant clients, accepting Medicaid for pregnant clients, and educating patients on tobacco cessation. This confidential expression of increased interest showed program staff that clinicians were excited about what the staff had to say. Having real-time survey data where all participants could see the results also served as a motivating factor to the other clinicians in the room who saw that their peers were interested in changing their practices toward serving pregnant women and providing smoking cessation counseling.</p>
Maryland	<p><b>Life-saving care.</b> A patient served by Maryland’s Models of Collaboration project credited the program with saving his life. That patient came to a dental clinic for a comprehensive oral exam and full mouth x-rays. He was not exhibiting any symptoms and did not report pain or feeling ill. Still, as part of the new intake protocol, the chairside assistant took the patient’s blood pressure and found it to be high (147/101). After taking the blood pressure a second time to confirm, the patient was referred to his primary care clinician and urged to seek care as soon as possible because he had no previous history of hypertension. The patient was so concerned upon learning this that he instead went directly to a nearby emergency department (ER). At the ER, he passed out and his heart stopped several times. Thanks to the screening provided by Maryland’s Models of Collaboration project, this patient was quickly diagnosed with heart failure and received the necessary care. The importance of hypertension screening from a dental clinician was underlined by Maryland’s statewide media campaign, “2 minutes with your dentist can save your life.”</p>
Minnesota	<p><b>Establishment of referral network.</b> A key success of Minnesota’s pilot programs was the establishment of a referral network among private practices. One dental clinic, in particular, was extremely dedicated to creating a reliable medical referral pathway for patients who were identified as needing medical attention. The lead dentist at this clinic identified the ideal urgent care walk-in clinic to receive patients on the basis of its proximity to the dental clinic. Establishing communication with the clinic proved challenging, but the lead dentist persisted.</p>

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(continued)

**Table 1. Project Success Stories, Pilot Study of Medical–Dental Collaboration in 6 US States, 2016**

State	Success Story
	<p>Ultimately, he succeeded in making contact, outlined the project, and demonstrated to senior leaders of the urgent care center the need for a formalized relationship between these 2 facilities. Soon a workflow between the 2 clinics was established. Reflecting back, staff from the dental clinic credit the “pressure” of receiving funding to establish a project for pushing them to be persistent enough to establish a relationship.</p>
New York	<p><b>Formative research.</b> As part of the Models of Collaboration pilot project, the New York State Oral Health Program worked with their partners in the Adolescent Health Program, who already had established partnerships with adolescent health and after school programs, to conduct formative research on attitudes toward sugar-sweetened beverages. This partnership gave the oral health program access to their target audience — young people — to conduct focus groups to improve their messages, and some of the results were surprising. For example, one strategy they thought would be effective in communicating with young people, using celebrities or athletes, was identified by focus group participants as not appealing. Without this vital feedback, the program may have developed products and disseminated them in ways that did not connect with their target audience. As a result, by avoiding traditional strategies such using celebrities, they hope their materials will also stay relevant longer. The relationship with the Adolescent Health Program allowed project staff to quickly reach their target audience and learn valuable insights that they believe resulted in a stronger, more sustainable media campaign.</p> <p><b>Variety of dissemination methods.</b> Although they had originally planned to do only a social media campaign, New York State was able to disseminate their message on a much larger scale. As they were working on the social media campaign, they collaborated with their contracted advertising agency to reallocate funds to add out-of-home advertising to the media campaign. This redistribution of funds allowed them to develop a variety of out-of-home advertisings, including posters, billboards, interior bus signs, exteriors of bus shelters, and cooler clings and “one sheets” in convenience stores. In some cases, the Drink Water messages were placed alongside the competing soft drink advertisements on coolers in convenience stores. A close partnership with schools and chronic disease prevention partner organizations facilitated the dissemination of their posters, allowing messages to be displayed to students in classrooms, cafeterias, clinic waiting rooms, gyms, and more. By closely collaborating with their advertising agency, redistributing their funds, and disseminating products through partners, New York State was able to greatly increase the number of people who saw their important messages.</p>

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**Table 2. Performance Measures, Pilot Study of Medical–Dental Collaboration in 6 US States, 2016**

Short-Term Outcomes	Intermediate Outcomes
<ul style="list-style-type: none"> <li>• Established a pilot project that integrated oral health and chronic disease program staff and resources.</li> <li>• Increased awareness of importance of oral health in chronic disease conditions among state health department staff</li> <li>• Increased communication and information sharing between chronic disease and oral health programs</li> <li>• Incorporated oral disease control systems and concepts into the state’s chronic disease work plans</li> <li>• Improved messaging about the importance of oral health in chronic disease programs</li> </ul>	<ul style="list-style-type: none"> <li>• Developed public health programs that used oral health infrastructure to affect chronic disease performance measures.</li> <li>• State chronic disease program staff collaborated with oral health program staff and partners.</li> <li>• Used oral health professionals in chronic disease prevention programs.</li> </ul>

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### IMPLEMENTATION EVALUATION

# Assess, Plan, Do, Evaluate, and Report: Iterative Cycle to Remove Academic Control of a Community-Based Physical Activity Program

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#### PEER REVIEWED

#### Summary

##### What is already known on this topic?

Multicomponent physical activity interventions are needed to increase the proportion of older adults meeting the Physical Activity Guidelines for Americans.

##### What is added by this report?

Because a one-size-fits-all approach has shown to thwart the translation of evidence-based programs into practice, a focus on intervention core elements and adaptability has emerged.

##### What are the implications for public health practice?

Based on the needs of different audiences, researchers are called to train and support delivery staff in their ability to adapt, implement, and evaluate community-based efforts.

## Abstract

### Purpose and Objectives

Responsive methods and measures are needed to bridge research to practice and address public health issues, such as older adults' need for multicomponent physical activity. The objective of this study was to detail the longitudinal, quasi-experimental work that spans 5 years to describe outcomes across RE-AIM (reach, effectiveness, adoption, implementation, and maintenance) dimensions of integrating a physical activity intervention for older adults into the Cooperative Extension System through the assess, plan, do, evaluate, report (APDER) cycle.

### Intervention Approach

The participant-level intervention is Lifelong Improvements through Fitness Together (LIFT), an 8-week, group dynamics-based, strength-training program with 16 in-person sessions. The implementation intervention applies the iterative APDER cycle based on feedback for each dimension of RE-AIM. Each year, the APDER cycle was used to embed data collection procedures at the instructor and participant level to reveal the next evolution of the program.

### Evaluation Methods

Each evolution of LIFT was measured through a pretest and post-test quasi-experimental design. Data were collected on each RE-AIM dimension through participant surveys and functional fitness assessments, number and representativeness of trainees, and process evaluation.

### Results

Overall, LIFT was expanded to 4 states with 275 instructors, reaching 816 older adults; consistently improved functional fitness outcome measures; demonstrated strong program adherence; and was seen as feasible and enjoyable by instructors and participants. LIFT is now undergoing adaptations for virtual delivery as well as updating the exercise protocol to introduce yoga postures that target flexibility and balance.

### Implications for Public Health

Overall, ongoing adaptations were necessary to ensure the program continued to fit the mission, values, and resources of the delivery system. Public health implications to support the need for ongoing adaptation include embedding pragmatic measures of adaptations and RE-AIM into standard evaluation pathways and using iterative APDER cycles.



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## Introduction

The lofty goal of integrating evidence-based interventions into community settings—and all the models, measures, and methods available for this task—leaves one wondering if this effort is a service for improving the lives of participants. A disconnect exists between the outcomes valued by the systems that house researchers and those of community stakeholders. Academics are pushed within a publish-or-perish cycle (1), whereas community partners need trust, autonomy, incentives, and effects (2,3). Despite these different system-level measures of time and effort, research recommends that academic and community partners work together to understand infrastructures (resources, staff, values), core elements of an intervention, and ways to increase the likelihood of health equity and program sustainability (4). Taken together, participatory approaches that identify, adapt, and deliver programming that meet the needs of the community ensure a balance between academia and community to ultimately reduce translational delays and improve public health. Traditional implementation science methods, however, have not resulted in a sustained delivery of evidence-based programs in the real world (5). New approaches are needed to speed translation from research to practice and integrate priorities of both systems (5).

To address this need for pragmatism, generalizability, comprehensive planning, and evaluation (6), the RE-AIM framework has been used in several settings and populations for the last 20 years (7). RE-AIM stands for reach (who), effectiveness (what impacts), adoption (who and where is it delivered), implementation (how well it is delivered and at what cost), and maintenance (behavior change maintenance and institutionalization of the intervention) (8). These are key variables that delivery staff and stakeholders use in choosing an intervention, particularly considering needs for tailoring or adaptation and evaluation (9–11). In many cases (12), RE-AIM has been applied in pragmatic, real-world contexts to guide decision making with limited extramural funding, indicating the framework's ability to be useful whether the program is a service or a study. Furthermore, to account for the dynamic nature of delivering interventions in the real world, RE-AIM can be applied before, during, and after intervention initiation, through an assess, plan, do, evaluate, report (APDER) cycle (11).

These responsive methods and measures can be used to address one of the most prominent public health issues affecting the health of the aging population: the need for social engagement and multicomponent physical activity. Low physical activity compliance indicates that efficacious exercise programs for older adults are not readily translated into sustained practice (13). Although extensive literature is available to support community-delivered physical activity programs for older adults in settings such as the

YMCA, less is known about targeting the federally funded Cooperative Extension System (14). The Cooperative Extension System is ideal structure for dissemination, as it is available in all states and territories and has county-based agents who are trained in evidence-based interventions by university-based specialists (14,15). Embedding robust outcome evaluation, however, has been challenging for Extension professionals, especially because the system values a variety of data sources and types (16). Finally, rather than adapt existing Extension interventions, programs are duplicated (rebranded) and not collated (matched) for national effect (17).

## Purpose and Objectives

Few studies have detailed the long-term process of delivering interventions in the real world, including using an iterative process to document and respond to adaptations through a research practice–partnership (18). The purpose of this study, therefore, was to document program adaptations that occurred as a result of our implementation strategy: iterative APDER cycles used to improve an older adult physical activity program, the Lifelong Improvements through Fitness Together (LIFT) program, from an efficacy trial to an ongoing, community-based program. Although information on the effectiveness and maintenance of LIFT itself is used to provide a holistic picture of the implementation evaluation, it is not the focus of our work here. As articulated by earlier research (19), this implementation study was primarily focused on the “stuff we do to help people do the thing” (ie, the APDER cycle) rather than “the thing” (ie, the LIFT program). The primary outcomes were adaptations made to 1) LIFT data collection protocols based on the RE-AIM framework and 2) LIFT components (setting, target audience, mode of delivery, cultural adaptations, core components) based the Adaptome (19).

The APDER (assess, plan, do, evaluate, report) process was collaboratively conducted by a university-based exercise specialist, graduate research assistants, and the Physical Activity Leadership Team (PALT; county-based agents housed within Virginia Tech serving Virginia Cooperative Extension) (18). To support the iterative process of understanding programming needs, adaptations, and evaluation (competency and capacity), all members of PALT met annually to develop program evaluation reports based on the APDER cycle. For example, when reach data showed low representativeness of non-White participants or when implementation process evaluation data were not being returned, the integrated research-practice team was able to adjust as needed and capture why, what, and how adaptations were made. One response to low racial/ethnic diversity among participants was PALT members serving as program champions and cohosting training to encourage their district colleagues to deliver the program (2,20–22).

More racial diversity among LIFT instructors led to greater diversity in LIFT participants. In alignment with the integrated research-practice approach, research and practice needs were equally valued (18), and decisions were made by consensus.

LIFT is an 8-week, group dynamics-based strength-training program that has 16 in-person sessions (23). During the 16 sessions, participants follow a similar guide for group dynamics strategies that have worked with a number of populations (24). In weeks 7 and 8 (the final sessions) group strategies focus on relapse prevention by preparing for program termination and long-term behavior change. The sequence for LIFT's 8 recommended full-body exercises (25) is wide-leg squat, standing leg curl, seated knee extension, side-hip raise, biceps curl, overhead press, seated bent-over rows, and toe stand. The focus of this sequence is on the entire body and provides an opportunity for participants to stand and sit, improving functional fitness in the interim of exercise. The exercises take approximately 50 minutes to complete, allowing time for the agents to facilitate a group dynamics-based warm-up as well as cool-down stretching within the 60-minute class.

Repetition of LIFT exercises in each class (ie, 3 sets of about 10 repetitions) and across the 8 weeks allows participants to become familiar with the routine over time. Participants are asked to engage in aerobic activity to reach a minimum of 150 minutes of moderate-to-vigorous aerobic activity per week outside LIFT class time. Participants who were previously inactive, however, are encouraged to move more as they progress to meet recommendations. Instructors facilitate goal setting, feedback, and self-monitoring to increase aerobic activity levels. Ultimately, core elements of LIFT provide opportunities for group engagement (friendly competition, interaction, problem solving), experiential learning for strength training exercises (repetition), and promotion of behavior change strategies (goal setting, self-monitoring).

LIFT was tested in 1 state system before its national launch. Based on the success of the program to retain participants, objectively measured functional fitness improvements, and ease and enjoyment of program delivery, PALT adopted LIFT as a statewide program (23,26). Only the few agents who delivered the program in the first year, however, had these successes with the program (Figure).



**Figure.** Timeline from 2014 to 2021 and beyond showing progressive milestones for Physical Activity Leadership Team (PALT) adopting Lifelong Improvements through Fitness Together (LIFT) as a statewide program.

In a complementary investigation, a survey was distributed and semistructured interviews were conducted to determine why educators who attended LIFT training chose to deliver the program or not. Intent to deliver LIFT was based on the Stages of Change (27) and a 5-point Likert scale. We found no significant difference between deliverers and nondeliverers in intent to deliver (mean [SD], 3.8 [1.1]). Training satisfaction was based on a 60-point adapted training satisfaction scale (28). Both deliverers and nondeliverers reported high training satisfaction in objectives and content, methods and training context, and the usefulness and overall rating (51.8 of 60) immediately posttraining. Posttraining, nondeliverers were significantly more likely to want more training on delivering physical activity interventions ( $P = .045$ ), to feel that the physical activity interventions are not part of their job ( $P = .04$ ), and to report that they are not physically active, so do not feel comfortable delivering a physical activity intervention ( $P = .001$ ). Deliverers were significantly more likely ( $P = .02$ ) to be preparing to deliver a physical activity intervention than their nondeliverer counterparts.

Overall, deliverers and nondeliverers reported high training satisfaction, the need for structured peer support, and a desire for ongoing training. Frequently reported barriers to implementation included the complexity of the intervention, cost of equipment, and low self-efficacy in physical activity and physical activity delivery. Frequently reported facilitators to adoption included assistance from the research team and other Cooperative Extension staff to reduce delivery burden, positive perceptions of pragmatic fit of the intervention, and positive perceptions of the effectiveness of the intervention. Nondeliverers were more likely to report barriers than facilitators, although deliverers reported both barriers and facilitators.

Based on older adult efficacy and agent feedback and enthusiasm, a standardized training protocol was developed and vetted through PALT. The training program involves detailed explanation of underlying program principles (eg, group dynamics-based activities) and experiential learning to practice the exercises and fitness assessments in small groups. After the 8-hour, in-person training, ongoing assistance and support was provided by use of web conferencing. This assistance aligned with Cooperative Extension's standards of ongoing implementation for peer education, program support, and specialists' availability.

Older adults (aged  $\geq 65$  y) with a working comprehension of English (for consent, safety cues, and program evaluation) and residents of participating counties were eligible to join the program. Cooperative Extension provides open-access programming to all Americans as part of its civil rights mandate, including, for example, programs designed for Hispanic audiences (17,29). More work is needed, however, to translate LIFT and other Cooperative Extension programs for non-English speaking audiences (28). As this was a real-world effectiveness trial based on a community program, no further inclusion or exclusion criteria were used, and all LIFT program participants were invited to be research participants.

Participants completed the Physical Activity Readiness Questionnaire for Everyone, which was developed for inclusion of older adults who might benefit from participating in physical activity, but who have a managed chronic condition. Agents recruited cohorts of older adults from within the counties they serve. Each agent used a variety of methods for recruitment including targeted mailings, newsletters and newspapers, word of mouth, flyers, and presentations at existing programs. Agents also leveraged existing community ties to recruit from local retirement and assisted living facilities. The Virginia Tech Institutional Review Board approved the entirety of this work.

## Evaluation Methods

Reach, Effectiveness, Adoption, Implementation, and Maintenance (RE-AIM) data collection methods and adaptations to LIFT core components were determined through annual reviews of LIFT program evaluation data, captured in Cooperative Extension annual reports. These reports were based on data acquired through a pragmatic, quasi-experimental, mixed-methods evaluation protocol implemented from 2016 through 2020. Each year, research team members collated individual-level outcome data (ie, reach, effectiveness) as well as number and representativeness of trainees and process evaluation (ie, adoption, implementation data). RE-AIM annual reports were developed based on national requirements of Cooperative Extension impact statements, which discuss

relevance, response, and results. Impact statements are a combination of quantitative and qualitative data. More specific data analysis, based on measurement, are reported in primary outcome articles elsewhere (23,26,30).

## Results

We present adaptations based on RE-AIM dimensions (Table 1) and a rapid deductive analysis of Adaptome categories, based on the survey and email correspondence with state administrators and adaptations to core components by state (Table 2). PALT meeting notes with key outcomes and decision pathways are presented longitudinally to document the APDER process and adaptations made over time (Figure).

### 2016–2018

From 2016 through 2018, LIFT was evaluated in its original state, reaching 258 participants using 21 trained educators. In 2016, 139 older adults participated; in 2017, 63 participated; and 56 participated in 2018. Participants were predominantly White (70%) and aged 73, with a body mass index of 31. Overall, participants provided positive feedback about LIFT. Data were used in annual impact statements required by the state system that include program relevance, response, and results. Reach, effect (functional fitness), and illustrative quotes were the data used to drive decision making.

### 2018-2019

Program results (2016–2018) were considered strong for a Cooperative Extension program and from 2018 through 2019, 3 additional states were trained for LIFT: Wyoming, Pennsylvania, and North Carolina. Through these partnerships, an additional 269 LIFT instructors (agents and community partners) were trained: 24 in North Carolina, 13 in Wyoming, 114 in Pennsylvania, and 83 additional instructors in Virginia (Table 2).

### 2020 and beyond

Although functional fitness assessment (31) remained the primary outcome measure, participant survey items were adapted over time. For example, the original surveys were double-sided, multiple-paged, and time-consuming. Members of PALT and other instructors suggested condensing the text of the surveys to 1 page, front and back. Font size, but not content, changed on the survey. The length of the Physical Activity Group Environment Questionnaire (32) had been perceived as a participant burden; therefore, PALT opted for a shorter social network scale instead. In addition, and to aid in open-access, a program repository became available at [www.parcilab.org/lift](http://www.parcilab.org/lift). The repository is updated

as needed and contains all paper and electronic versions of data collection tools, training slide decks, and all program materials.

To produce an annual national impact statement, all state LIFT coordinators were asked to complete a 5-minute report — based on Adaptome (20) and RE-AIM (7) — in October of each year. This includes 17 items on a 5-point Likert scale within RE-AIM dimensions. Open-ended questions in the report are based on Adaptome categories (19) and inquire whether adaptations were made, such as “Have you made any adaptations for who can deliver the program?” Pennsylvania and North Carolina administrators had positive perceptions across each dimension of RE-AIM in their annual report; however, North Carolina administrators shared that they did not collect outcome data at 6 months. North Carolina staff were trained just before the COVID-19 pandemic and were delivering the intervention online. Wyoming did not complete the survey because LIFT was discontinued (Table 3).

As with many other public health interventions, LIFT was adapted to virtual delivery in response to COVID-19. In summer 2020, a pilot project to examine the feasibility and effects of delivering LIFT by web conference was conducted through the Virginia Cooperative Extension. The project resulted in 11 participants with a weekly attendance average of (mean [SD], 4.7, [1.4]) participants. Through process evaluation, autoethnographic field notes, and participant tracking during the program, we detected that group dynamics strategies needed adaptation and that participants facilitated discussion by using audio and video. We anticipate that when in-person rapport is challenging, online LIFT delivery will encourage use of audio and video for additional contact with the instructor outside-of-class through social media posts, emails, and optional telephone calls. (Table 3).

## Implications for Public Health

Testing the adapted and newly packaged LIFT program took 5 years, a substantial decrease from the 17- to 24-year lag time for translation of research to practice (33). Overall, we found that ongoing adaptations at the educator and state levels were necessary to ensure the program continues to fit the mission, values, and resources of the system (34). This implementation evaluation has 4 primary public health implications.

First, we propose pragmatic measures of adaptations and RE-AIM that can be embedded within the standard evaluation pathway (6,8,12). Although, like many inner- and outer-setting construct measurements (35), the RE-AIM scale here was not validated but it did capture the information needed to determine if additional training or support was needed to integrate LIFT in new state systems. In addition to administrator perceptions of LIFT, LIFT has 2

key individual-level measurements: the self-report questionnaire and the functional fitness assessment. Administrators and instructors can choose which data are important to their partners and assess accordingly (10,11,36).

Second, we acknowledge the importance of the iterative cycle of assess, plan, do, evaluate, report and the nonlinear timeline (37); a full-scale efficacy trial for each adaptation is not feasible. Explicitly, efficacy trials for each adaptation are not necessary if the adaptation does not threaten program outcomes (eg, reach, effectiveness, fidelity). In fact, intervention developers should assume adaptations will occur and provide guidance for making appropriate adaptations (4,19,34,38). For example, materials for recruitment might require translation into other languages or literacy levels to better reach audiences across various ethnic groups and educational backgrounds. Additionally, if delivery agents prefer to deliver the program with music to increase the enjoyment of the activities, that would not negatively affect the functional fitness outcomes and might improve agent and participant enjoyment and therefore improve retention. Yet, researchers largely continue to retest intervention effects, leading to over-duplication of interventions and the loss of resources (39). For example, more than 20 different exercise programs exist for older adults in the Cooperative Extension System that are primarily based on Strong Women, Strong Bones (Strong Women) (17). With those programs, however, adaptations have occurred, data collection has halted, and Cooperative Extensions’ collective influence on physical activity of older adults is largely unknown (17). Cooperative Extension represents an implementation laboratory where we can study relatively stable inner and outer contexts and intervention updates (40). Our work, therefore, focuses on the importance of modifying interventions and disseminating information, so that all audiences have access to relevant information that informs decision-making processes for training, delivery, and participation at the administrator, instructor, and participant levels.

Third, we aim to remove academic control of a community-based physical activity program. We do this, in part, by providing an open-access program repository that includes materials on how to be a state administrator, how to provide training, and how to deliver and evaluate LIFT. This access is unique because 1) many evidence-based program repositories exist, but practitioners cannot always readily download materials to deliver the intervention (41); 2) many exercise programs for older adults require participants to pay a fee, which is a system-level barrier (42); and 3) Cooperative Extension professionals want relevant program information on-demand (43).

Finally, intervention costs are often a barrier to increasing the scale of a program (44). The open-access repository, therefore, aims to put the control into the hands of instructors and state ad-

ministrators to ensure more people, particularly those representing socioeconomically disadvantaged communities, can offer the program. Costs considered instructor delivery time, participant travel, time for recruitment, equipment (whether individually purchased or provided by the county), and evaluation. In other older adult physical activity programs, training costs \$250 per instructor (45). In some states, costs prohibited training new staff, therefore, state systems either 1) were unable to train new agents and maintain the program in the system or 2) developed their own programs that could be delivered at no additional cost. For example, in Wyoming, Cooperative Extension adopted Strong Women but did not maintain it. Two retired agents and a senior center, however, continued to deliver Strong Women in their communities and continued the program without Cooperative Extension involvement. Although delivery resulted in continued opportunities for older adults to engage in physical activity over the years, drift from the core components of the original program occurred (eg, inclusion of strength training exercises that did not appropriately target major muscle groups). When a new agent learned of LIFT and offered training to those delivering Strong Women, there was initial interest from other agents and community partners. After integrating and testing LIFT within the system, however, the agent left the system and the community partners went back to delivering Strong Women (ie, not sustaining the group dynamics, aerobic activity, or nutrition education components of the LIFT program). Additionally, although other agents expressed interest in delivering LIFT in Wyoming, only 2 agents attended training and only 1 agent delivered LIFT (30). Work is needed to better support community partners who have the time and ability to deliver physical activity programs. When agent positions become vacant, state-level specialists could continue to support community partners through training and curriculum updates to promote high-fidelity delivery of evidence-based programs.

As another example, agents in another state were trained in and delivered Strong Women, but the cost was prohibitive and a similar program, Extension Get Fit, was developed. Extension Get Fit was originally based on the same core exercises as Strong Women. However, program drift occurred over the years until agents and state-level staff were unclear as to the purpose of the program, the primary audience to focus on (ie, older adults vs adults of any age), or intended outcomes (eg, weight loss vs functional fitness). As the primary outcome of the program, functional fitness test results were reported as indicators in required national-level reports. Fewer participants improved in the aerobic endurance and agility portions of the functional fitness test than in the strength training components, likely because an aerobic warm-up was not consistently included as part of the Extension Get Fit program. Rather than incorporate aerobic activity as part of Extension Get Fit, as was incorporated into LIFT, staff created an additional circuit-

training program that included aerobic activity. Participants also expressed interest in yoga and flexibility, and similarly, instead of incorporating a flexibility component into Extension Get Fit, another program focusing on chair yoga was added. The state system was ultimately supporting 3 separate programming efforts. County residents chose among the programs and did not receive an evidence-based program that included the comprehensive functional fitness components of strength training, aerobic activity, and flexibility. Multicomponent programs align with the national physical activity recommendations for older adults (ages  $\geq 65$  y) and have been shown to be more effective at improving physical activity outcomes (46).

Our study has limitations. First, all of the studies (ie, evolutions) discussed and designed were quasi-experimental, meaning that no randomization or causation could be explored. Second, as with any community work, representativeness and recruitment are limitations, as efforts to recruit undergo continuous improvement to reach intended audiences (7). The studies mentioned in this work attempted to nullify the lack of reach and effectiveness data by monitoring community needs assessments and demographic data to reach those that would benefit most from these interventions. Finally, the pragmatic nature of this study led to missing data across several levels. Intervention delivery staff and research staff made every effort to complete follow-up time points, as indicated by the approving institutional review board protocols. Empirically established reasons for missing data are unknown; however, anecdotally, agents shared that because LIFT is an open-access, community-based program, it is not seen as a research initiative. Therefore, participants do not feel obligated (or compensated) to provide data.

Communities desire interventions that are easy to deliver and have strong evaluation protocols, but they need assistance in the selection, adaptation, delivery, and evaluation of these interventions. Although it is an implementation laboratory, even the Cooperative Extension is not able to adopt and adapt interventions with fidelity without effective dissemination and intervention testing. More work should be directed to the continued testing, adapting, reporting, and accessibility of evidence-based interventions. This evaluation helps demonstrate ways in which intervention information and adaptations can be conducted, presented, and made available. Generally, we suggest that other organization and integration efforts use RE-AIM and APDER cycles to track changes. Specifically, we demonstrate that the core elements of a behavioral intervention for physical activity promotion among older adults can adapt over time while continuously supporting functional fitness.

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Tables

**Table 1. Fundamental Evaluation Protocol for RE-AIM Dimensions and Measures**

Dimension	Outcome Measures	APDER Feature and Notes
<b>Reach</b>		
Number, proportion, and representativeness of participants	Number, proportion, and representativeness of LIFT participants assessed via survey	<ul style="list-style-type: none"> <li>Individual-level sociodemographic data are required for reporting Cooperative Extension efforts. These survey items were initiated in 2015, continuing since then in each state</li> <li>State administrators determine representative data; LIFT participant sociodemographic information can be compared to the full state census data or compared to the counties from which the participants were recruited</li> </ul>
<b>Effectiveness</b>		
Effect on primary outcomes, quality of life, and unintended consequences	Objectively measured functional fitness assessment and survey for self-report items of interest (social connection, physical activity behaviors)	<ul style="list-style-type: none"> <li>Educators and volunteers found it cumbersome to administer the Rikli and Jones functional fitness assessment (31) plus other assessments. For virtual adaptations, educators can allow participants to self-report functional fitness outcomes</li> <li>Self-reported survey items changed over time to align with research questions, survey duration, or outcomes of interest; therefore, summary and comparisons across years is not possible, nor perceived as relevant by PALT</li> </ul>
<b>Adoption</b>		
Number, proportion, and representativeness of settings and staff who deliver the intervention	<ul style="list-style-type: none"> <li>Number, proportion, and representativeness were measured for Cooperative Extension health educators and community partners who implement LIFT</li> <li>What steps were taken in delivering LIFT</li> </ul>	LIFT training included pretraining and posttraining surveys to assess instructor sociodemographic characteristics with intent to deliver LIFT, and program content (ie, teach-back).
<b>Implementation</b>		
Degree that intervention was delivered as intended	Process evaluation checklists for every LIFT session	<ul style="list-style-type: none"> <li>Process evaluation was available in paper and pencil or online</li> <li>Low instructor compliance limited interpretation</li> <li>State administrators surveyed to assess state adherence to LIFT principles and delivery</li> </ul>
<b>Maintenance (system level)</b>		
Extent to which delivery and implementation are sustained over time	Number of years LIFT is delivered in the county or state	Monitored via LIFT program records by the LIFT program manager. In 2021, a protocol to follow up with all trained staff will be launched.

Abbreviations: APDER, assess, plan, do, evaluate, report; LIFT, Lifelong Improvements through Fitness Together; PALT, Physical Activity Leadership Team; RE-AIM, reach, effectiveness, adoption, implementation, and maintenance.

**Table 2. Summary of State Adaptations to LIFT Program State**

Virginia	Wyoming	Pennsylvania	North Carolina
<b>Setting</b>			
Delivered in a variety of facilities including YMCA, schools, libraries, churches, and through Parks and Recreation	Discontinued. In 2017, there were 6 nutrition educators; by 2020, only 2 across the state. Educators and administrators did not have resources to support delivery	Delivered by trained instructors across the county through Cooperative Extension, with a standardized fee	Delivered predominantly online due to COVID-19
<b>Selected audience</b>			
Adults ages ≥65 y who are inactive or insufficiently active	NA	Adults ages ≥65 y, fee-based program (with tuition options for lower incomes); predominantly female; many participants continue program participation throughout the year (ie, not new participants every session)	Expanded to those aged <65 y; “During our initial discussions our target audience was defined as limited-resource individuals of any age”
<b>Mode of delivery</b>			
Virtual delivery allows more modes available for in 2020	NA	Predominantly in person; exploring virtual and in person with masks during COVID-19 public health restrictions	Added a Facebook Live session delivery option during COVID-19
<b>Cultural adaptations</b> —Agents expressed concern for LIFT imagery, including White-only and lean-bodied older adult models. More representation in LIFT materials is needed for all states.			
<b>Core components</b>			
Added yoga asanas in 2020 to improve flexibility and balance outcomes	NA	Added some advanced Strong Women/ Strong Bones exercises (indicated on the process evaluation form); added state’s nutrition education handouts (ie, beyond LIFT’s embedded nutrition messaging)	NA

Abbreviation: LIFT, Lifelong Improvements through Fitness Together; NA, not available.

**Table 3. Administrator Perceptions of RE-AIM, 2020**

RE-AIM Dimensions	Quantifiable Scale (1–5 Points)	Pennsylvania	North Carolina
Reach	Overall, participants were representative of older adults in our catchment area.	Agree	Agree
	Our recruitment strategies ensured that all eligible people felt supported to attend.	Agree	Strongly agree
	Costs of recruitment were embedded within usual practice.	Agree	Neither agree nor disagree
Effectiveness	Our participants had measurable functional fitness improvements.	Agree	Agree
	Our participants were more socially connected.	Agree	Strongly agree
Adoption	A large proportion of eligible instructors were trained on LIFT (agents, volunteers, educators).	Agree	Strongly agree
	Trained LIFT instructors were representative of our staff (years working with Cooperative Extension, age, race, etc.).	Agree	Strongly agree
	Training costs fit within our resources.	Agree	Strongly agree
Implementation	Our LIFT instructors felt confident delivering the core elements of LIFT.	Agree	Strongly agree
	Our instructors knew what an appropriate adaptation would be.	Agree	Strongly agree
	Our instructors reported adaptations.	Agree	Agree
	Delivery time for LIFT met my expectations.	Agree	Strongly agree
Maintenance/individual level	Participants will continue with an exercise routine.	Agree	Agree
	Participants have sustainable fitness.	Agree	Agree
	We measured long-term outcomes (at 6 months).	Agree	Disagree
Maintenance/organizational level	We intend to deliver LIFT in the future.	Agree	Strongly agree
	We have financial support to keep LIFT running.	Agree	Strongly agree

Abbreviation: LIFT, Lifelong Improvements through Fitness Together; RE-AIM, reach, effectiveness, adoption, implementation, and maintenance.

## IMPLEMENTATION EVALUATION

# A Dissemination Strategy to Identify Communities Ready to Implement a Pediatric Weight Management Intervention in Medically Underserved Areas

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## PEER REVIEWED

**Summary****What is already known on this topic?**

Geographical disparities exist in the prevalence and treatment of childhood obesity. Expanding the availability of effective programming and expertise is imperative to translate research to practice in medically underserved areas.

**What is added by this report?**

This study describes a dissemination strategy and a systematic approach to identify communities that are ready and have demonstrated the capacity to disseminate a pediatric weight management intervention.

**What are the implications for public health practice?**

Findings provide guidance for translating pediatric weight management programs in medically underserved geographic areas by maximizing the probability of successful adoption and implementation through a community application process.

## Abstract

**Purpose and Objectives**

We developed a competitive application process to test the feasibility of a fund and contract dissemination strategy to identify and engage communities that demonstrated the necessary resources and motivation to adopt, implement, and sustain a pediatric weight

management intervention, Building Healthy Families, in rural and micropolitan (<50,000 residents) communities in Nebraska.

**Intervention Approach**

From April through December 2019, a community advisory board with representation from rural and micropolitan clinical, public health, education, and recreational organizations collaboratively developed a request for applications, as a fund and contract dissemination strategy, to encourage community adoption of Building Healthy Families.

**Evaluation Methods**

Quantitative assessments included determining the distribution of requests for applications, evaluating organizational readiness to change assessment (ORCA) ratings (on a scale of 1 to 5, from strongly disagree to strongly agree that the organization is ready to change), and reviewing community advisory board member ratings of applications. We gathered qualitative data from community narratives provided in response to the request for applications and community advisory board reviews of the applications.

**Results**

The request for applications was distributed to all 93 counties in Nebraska. Of the 8 communities that submitted a letter of intent, 7 submitted a community narrative. Across the 8 communities, 31 ORCAs were completed by the organizational decision makers (n = 15) and staff members (n = 16) who would be responsible for screening, recruiting, or implementing the intervention. Overall mean ORCA scores varied by ratings of evidence (4.1–4.6), context (4.2–4.9), and facilitation (4.3–4.8), indicating a high degree of readiness. Community advisory board ratings of applications ranged from 2.3 to 3.4 of 4 points. Qualitative data indicated that lower community narrative scores were primarily caused by weak implementation and sustainability plans.



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## Implications for Public Health

Findings provide guidance for translating pediatric weight management programs in medically underserved geographic areas by maximizing the probability of successful adoption and implementation through a fund and contract dissemination strategy.

## Introduction

Childhood obesity prevalence is elevated across the United States and continues to be a pressing public health concern despite substantial prevention and treatment efforts (1). Disparities persist in obesity prevalence among children who have lower socioeconomic status and are in racial and ethnic minority groups (2–4). Furthermore, children residing in rural areas have 26% greater odds of obesity than their urban counterparts (3), and the most recent childhood obesity treatment recommendations do not address barriers for those living in medically underserved geographic areas (5).

Pediatric weight management interventions (PWMIs) are shown to reduce child weight (5–7). Efficacious PWMIs are family-based; they engage both the parent and child together and separately (8) through improved dietary intake, increased physical activity, and delivery of behavioral strategies through a multidisciplinary team (9,10). Most efficacious PWMIs were developed and implemented in large cities and urban areas and delivered through multidisciplinary teams in a hospital or medical center. For families living in micropolitan (ie, cities with populations <50,000) and rural areas, community resources and the teams needed to implement PWMIs are often not available (2).

The few PWMIs tested in efficacy trials in rural communities resulted in significant reductions of BMI z scores or percentile rankings (11). However, evidence is limited on the degree to which these or other efficacious PWMIs can be translated to, and are feasible in, other medically underserved geographic areas without adapting the interventions to the level of resources available and accessibility of multidisciplinary teams to deliver them (2,5,12). Currently, options are limited for childhood obesity treatment programs in Nebraska. These programs and other nearby programs outside the state are in hospital-associated metropolitan settings and require families to travel great distances. For example, a family living in the center of Nebraska, a rural area, who searches for a childhood obesity treatment program would find one in Omaha (a distance of 165 miles), Kansas City, Missouri (a distance of 265 miles), and Denver, Colorado (a distance of 310 miles). Building Healthy Families (BHF), an adapted evidence-based, family-based PWMI (10), was developed and implemented in a midwestern micropolitan city to provide a treatment option in medically underserved geographic areas for families with children who are obese.

The magnitude of change in weight status of children participating in BHF was similar to the magnitude seen in efficacy trials (BMI z score reduction of  $\geq 0.25$ ) (10). Expanding the availability of effective programming and expertise and identifying the demand for PWMIs is imperative to translate research to practice in rural and micropolitan areas.

Numerous strategies have been developed to support dissemination and implementation of evidence-based interventions (EBIs) (13,14). Dissemination strategies that focus on organizational and community adoption and that include system-level and provider-level incentives have been used to help facilitate initial uptake (15). One dissemination strategy that holds promise is the use of organizational incentives to increase adoption of EBIs (16). Organizational incentives can take numerous forms (eg, payment schemes, ability to bill for the innovation or provide as a fee for service) (13). However, few have been applied to PWMIs or outside metropolitan clinical or health care settings (14,17).

A method for organizational incentives that may be practical in underresourced areas is a fund and contract dissemination strategy (13). This method includes a competitive funding announcement and a modest budget to identify and engage communities that have demonstrated the necessary resources and motivation to adopt, implement, and sustain evidence-based practices (13). This strategy allows limited resources to be allocated to communities or organizations most ready to act successfully on those resources to increase the likelihood of PWMI adoption, implementation, and sustainability. A fund and contract strategy is predicated on a pull, rather than a push, approach to increase community uptake of an evidence-based PWMI. Pull approaches aim to identify delivery systems that prioritize a given issue and are motivated and ready to implement an EBI (18). Push approaches bring EBIs to systems that have a need for a program but may not prioritize the issue addressed by the EBI. Push approaches may require substantial system changes in communities that are not ready for change and can inhibit successful adoption, implementation, and sustainability of EBIs (18).

In addition to needing to determine the utility of dissemination strategies to successfully engage organizations and communities in adopting an evidence-based approach, the underlying mechanisms that facilitate an adoption decision need to be explored (19). Organizational readiness for change has been theorized as an important precursor that influences successful adoption of evidence-based approaches in the Promoting Action on Research in Health Services (PARIHS) model (20,21). Studies using the organizational readiness to change assessment (ORCA) in clinical settings demonstrated that evidence, context, and facilitation predict use of

EBIs (21). Organizations with high scores across these 3 constructs are more likely to be successful in adopting, implementing, and sustaining an EBI (22).

## Purpose and Objectives

The purpose of this study was to test the feasibility of a fund and contract dissemination strategy for a PWMI in identifying and engaging communities to adopt BHF in rural and micropolitan areas of Nebraska. Feasibility was operationalized as the ability of the strategy to engage 4 to 8 geographically dispersed communities to commit to delivering BHF. A secondary purpose was to describe the organizational readiness for change of communities — based on ORCA scores and BHF community advisory board (CAB) assessments of communities that responded to the request for applications (RFA). We hypothesized that 1) the dissemination strategy would lead to the identification of a broad cross-section of communities and community organizations interested in PWMI delivery, 2) the inclusion of requirements for formal implementation commitments and engagement across community organizations would reduce the number of communities that would transition from a letter of intent to a full application call for proposals, and 3) communities that submit a full application for proposals would report high scores.

## Intervention approach

This study was part of a larger hybrid type III effectiveness–implementation pilot study to test the adoption, implementation, and sustainability of BHF. A secondary aim of the larger trial is to determine the effectiveness of BHF in reducing child weight. Approval for the study was provided by the University of Nebraska at Kearney Institutional Review Board. The larger trial focuses on a collaborative approach to package all BHF program implementation and training resources necessary to support adoption and implementation of the program in new micropolitan and surrounding rural communities. Additionally, the larger trial includes implementing the packaged program in communities with and without participation in a learning collaborative. The phase of the project described in this study examined the utility of a dissemination strategy intended to identify communities that were motivated and ready to adopt a new PWMI. Specifically, we tested a fund and contract strategy that included a competitive process for organizations that serve low-income families in medically underserved communities to apply for access to the BHF program and resources.

To increase the likelihood of successful adoption of BHF, we used a systems-based approach to incorporate multiple sectors and vertical structures (ie, within organizations) within each community and community-based organization (23). This approach allows for

engagement of community partners to increase referrals among children and families, identify the available community resources to implement BHF, and determine the likelihood of BHF aligning with community values and long-term sustainability (24,25).

## Evaluation Methods

We used ORCA scores to quantitatively assess community readiness. BHF-CAB members also provided a quantitative rating of community narratives. Finally, qualitative data were gathered from community narratives and BHF-CAB member reviews of the narratives. This phase of the project was initiated in April 2019, and community award announcements were made in December 2019.

## Setting and participants

Communities were eligible to participate in this study if they were located in micropolitan (population of at least 10,000 but fewer than 50,000) and surrounding rural communities (population of at least 50,000) outside the 2 largest metropolitan areas in Nebraska (Lincoln, population ~334,590; Omaha, population ~942,198). Ninety of 93 counties in Nebraska were eligible to submit a letter of intent and apply for funding; 3 counties were not eligible because they were metropolitan. Any community organization in an eligible county that could demonstrate local need and potential infrastructure to recruit families and implement BHF was eligible to apply.

## Procedures

Community members invited to serve on the BHF-CAB included representatives from regional public health networks, community and health care organizations, people with experience implementing or participating in BHF, and representatives from an interdisciplinary research team. The overarching goal was to develop a CAB with strong cross-system representation for rural Nebraska. This 19-member CAB was developed as part of the larger trial, with the goal to contribute to all aspects of this research. A 3-phase approach was used to determine regional demand, motivation, and commitment to adopt, implement, and sustain BHF. Phase 1 emphasized a horizontal systems (ie, between organizations) approach to identify and build on partnerships with strong working relationships across community organizations.

The BHF-CAB members collaboratively developed an RFA that included the submission of a letter of intent and a full community narrative. A list of first contacts was strategically developed for RFA distribution through email across the BHF-CAB member networks throughout Nebraska. Recipients of the email were asked to forward the information to their contacts who expressed interest in providing a PWMI in their community. Those who forwarded the

RFA were asked to report back to the BHF-CAB the number of contacts and organizations that received the RFA information. We tracked the number of organizations that received the RFA directly from BHF-CAB members. However, dissemination was likely broader than reported by BHF-CAB members, because organizations that received the RFA were also encouraged to send it to other groups. As a result, we used the total number of eligible counties ( $n = 90$ ) as our denominator for dissemination and the number of counties with organizations that received the RFA as the numerator. In addition to email distribution, we created a website to promote the pilot study and provide information on the 2-step RFA process, a timeline, and frequently asked questions for organizations interested in applying for funding.

Phase 2 was designed to assess local demand for the packaged PWMI and to identify the potential determinants of adoption of BHF. In this phase, we used a letter of intent procedure to gather information on the demand for BHF followed by a full application procedure with more rigorous requirements for participation. Descriptions of BHF and the potential relative advantage of a packaged approach were shared with communities through the RFA materials. The overall goal of this phase was to promote a systems-based approach by requiring communities to document multisectoral partnerships and vertical representation from partners that would be involved in screening and recruiting families and implementing and sustaining BHF. Each participating organization submitted a letter of intent and was required to have a minimum of 2 members from each organization complete a modified ORCA: 1 person with organizational decision-making authority and 1 person who would be responsible for implementing BHF.

The ORCA is an instrument designed to measure the evidence, context, and facilitation constructs of the PARIHS framework, which are theorized to predict implementation outcomes (21). We used a modified 50-item version of the ORCA to assess community readiness to implement BHF (Table 1). The evidence scale assessed respondent ratings of the strength and extent of evidence for PWMI across 3 subscales: research evidence, clinical experience, and patient preferences (26). Modifications to the scale included framing clinical experience and patient preferences as community experience and community member preferences. The context scale consisted of 6 subscales assessing organizational culture, leadership, measurement, resources, and readiness to change among opinion leaders (27). Lastly, the facilitation scale addressed the capacity for internal facilitation and consisted of 4 subscales assessing leadership characteristics and roles, project champion characteristics, and implementation team roles (28). All items were assessed on a 5-point Likert scale, from strongly disagree to strongly agree.

Participants responded to questions about their perceptions of the strength of evidence for BHF and the community context and facilitation that would support implementing the PWMI. We calculated baseline means for overall ORCA scales and subscale scores for evidence, context, and facilitation for each community. Community-perceived readiness from the ORCA was operationalized as “ready” if the mean scale and subscale scores were greater than 4.0, “somewhat ready” if the mean scores were greater than 3.0 but less than 4.0, and “not ready” if the mean scores were 3.0 or less. The ORCA responses were used to characterize readiness, but to reduce the likelihood of social desirability biases, the communities were informed that the responses would not be considered as part of the evaluation of the letters of intent. All respondents completed the survey in a de-identified, online format so information was not shared among applicants.

One week after the letters of intent and ORCAs were submitted, an informational webinar further detailing BHF and the community requirements for participating in the implementation pilot study was provided for communities that submitted a letter of intent. If communities were unable to attend the webinar, they were encouraged to reach out to the program coordinator or refer to the frequently asked questions section of the website. After the webinar, communities that submitted a letter of intent were given a month to complete and submit a full application and community narrative.

Phase 3 aimed to identify, by using the community narratives, communities that were ready to pilot test BHF. Communities that submitted narratives were asked to demonstrate 1) the local priority or need for a PWMI, 2) their ability to develop recruitment methods, 3) their ability to implement BHF, and 4) their plan for sustainability in their community. Each community was also required to 1) provide documentation of their service to low-income families, 2) identify their multisectoral partnerships, 3) agree to implement 2 or 3 cohorts of BHF, 4) use pragmatic evaluation strategies throughout the implementation pilot study, and, if selected 5) participate in a learning collaborative. Formal commitment (a written memorandum of understanding) from each community was also required from those that submitted the community narrative and were selected to participate.

The BHF-CAB members evaluated the community narrative submissions and scored the community applications. The average scores were calculated for each community application; ORCA responses were not provided or used as part of evaluation. Each reviewer was provided an evaluation form with scoring criteria for each section of the application. Ratings were made on a scale of 0 to 4, with 0 indicating a very weak section and 4 indicating a very strong section. Additionally, qualitative feedback was requested from each reviewer for key factors that informed the ratings. The

community members of the BHF-CAB were each assigned a minimum of 2 and up to 4 narratives to review and score, to reduce community burden or conflicts of interest. BHF-CAB research team members evaluated all of the narrative submissions. An average was calculated from the BHF-CAB community member evaluations and the research team member evaluations for an overall score and application rank. Community readiness from the narrative applications were operationalized as “ready” if the mean scores were 3.0 or greater, “somewhat ready” if the mean scores were 2.0 to less than 3.0, and “not ready” (ie, the application had weaknesses that could negatively affect implementation) if the community did not submit a narrative or the mean scores were less than 2.0.

## Results

### Phase 1: CAB development and RFA distribution

The average number of organizations or people that received notification about the RFA from each BHF-CAB member was 6, with a range of 2 to 9. Organizations and people that received notification of the RFA included cooperative extension personnel (n = 39), departments of public health (n = 15), regional hospitals (n = 11), community recreation organizations (n = 10), federally qualified health centers (n = 8), nonprofit organizations (n = 8), and public school districts (n = 5). Based on the locations of organizations or people that received notification, the BHF-CAB members distributed the RFA statewide (n = 93 counties) (Figure 1).

ies, 31 ORCAs were completed, 15 by organizational decision makers and 16 by staff members who would be responsible for screening, recruiting, or implementing the PWMI. The communities that submitted letters of intent represented 28 (31%) of 90 eligible counties. No 2 communities had the same mix of organizational partnerships.

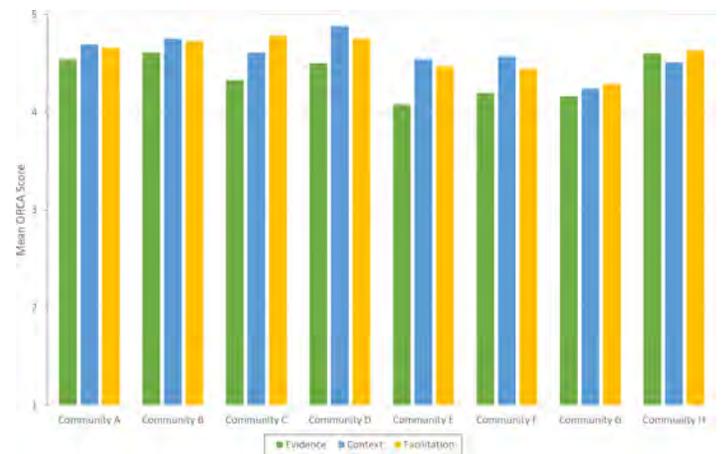
We found variability in community ratings of readiness based on the ORCA completion. However, the overall perceptions of community team members indicated that they were ready to implement BHF (Figure 2). Overall readiness mean (SD) scores for communities, by construct (of a possible 5 points) were highest for context (4.6 [0.5]) and facilitation (4.6 [0.5]) followed by evidence (4.4 [0.4]). The largest variability in perceived readiness for communities was the subscale general resources (4.3 [0.6]). This subscale assessed a community’s perceived availability of resources to implement BHF (staff incentives, equipment and materials, participant awareness/need, instructor buy-in, intervention team, and evaluation protocols).



**Figure 1.** Counties deemed eligible (n = 90) and response to the request for application among counties interested in adopting and implementing Building Healthy Families, a pediatric weight management intervention, Nebraska, 2019.

### Phase 2: Determining local demand for a packaged PWMI program and training resources

In the first step of our 2-step request for applications process, 8 letters of intent were received from communities interested in adopting and implementing BHF (Table 2). Across those communit-



**Figure 2.** Organizational readiness to change assessment (ORCA) scores in the 8 communities that submitted a letter of intent expressing interest in adopting and implementing Building Healthy Families, a pediatric weight management intervention, Nebraska, 2019. Readiness was operationalized as “ready” if the mean scale and subscale scores were greater than 4.0, “somewhat ready” if the mean scores were greater than 3.0 but less than 4.0, and “not ready” if the mean scores were 3.0 or less.

Based on the ORCA subscale scores, 6 communities (all but Community E and Community G) were rated as ready for implementation. One community that submitted a letter of intent, community E, decided to discontinue its application process after the community webinar. It was rated as “somewhat ready” for evidence subscales for research evidence and community experience as well as for general resources. Similarly, Community G was rated as “somewhat ready” for context subscales of general resources and measurement (Figure 3).

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Community A	Community B	Community C	Community D	Community E	Community F	Community G	Community H
Evidence							
Research							
Community experience							
Community member preference							
Context							
Leader culture							
Staff culture							
Leadership behavior							
Measurement							
Opinion leader readiness							
General resources							
Facilitation							
Leader characteristics							
Project champion characteristics							
Leadership implementation roles							
Implementation team roles							
Community narrative rank 4	Community narrative rank 5	Community narrative rank 6	Community narrative rank 7	Community narrative rank 8	Community narrative rank 9	Community narrative rank 10	Community narrative rank 11
BHF-CAB research team member narrative score 3.0	BHF-CAB research team member narrative score 4.0	BHF-CAB research team member narrative score 4.0	BHF-CAB research team member narrative score 4.0	BHF-CAB research team member narrative score 3.0	BHF-CAB research team member narrative score 3.0	BHF-CAB research team member narrative score 4.0	BHF-CAB research team member narrative score 4.0
BHF-CAB community team member narrative score 3.0	BHF-CAB community team member narrative score 4.0	BHF-CAB community team member narrative score 4.0	BHF-CAB community team member narrative score 4.0	BHF-CAB community team member narrative score 3.0	BHF-CAB community team member narrative score 3.0	BHF-CAB community team member narrative score 4.0	BHF-CAB community team member narrative score 4.0

**Figure 3.** Community readiness to implement Building Healthy Families (BHF), a pediatric weight management intervention, Nebraska, 2019. Readiness was operationalized as “ready” (in green) if the mean scale and subscale scores were greater than 4.0, “somewhat ready” (in yellow) if the mean scores were greater than 3.0 but less than 4.0, and “not ready” (in red) if the mean scores were 3.0 or less. Abbreviations: CAB, community advisory board; NA, not applicable.

### Phase 3: Identify communities ready to pilot test the utility of a packaged PWMI and training materials through a community narrative application

In the second step of our 2-step process, 7 communities that provide service across 17 counties submitted complete applications. Average overall BHF-CAB scores for communities ranged from 2.3 to 3.4 of a possible 4 points. We rank ordered communities by their overall score for demonstrating the need in their community and plans for recruitment, implementation, and sustainability (Figure 3). On average, readiness scores given by BHF-CAB community team members were higher than scores given by BHF-CAB research team members, although rank orderings of communities were nearly identical. Communities G and H scored the highest and were considered to be ready to implement BHF by both BHF-CAB research team members and BHF-CAB community members. BHF-CAB research team members and BHF-CAB community members differed in their scoring for communities A, B, and D. BHF-CAB community members gave community A lower scores than did BHF-CAB research team members and perceived them to be somewhat ready, whereas BHF-CAB research team members perceived them to be ready to implement BHF. Additionally, BHF-CAB community members gave higher scores to communities B and D than did BHF-CAB research team members and perceived them as ready, whereas BHF-CAB research team members perceived them as somewhat ready to implement BHF. Although the ORCA responses for com-

munity E indicated they were somewhat ready to implement BHF, they did not complete the application process by submitting a community narrative and were therefore considered not ready.

The qualitative data indicated that lower scores were primarily based on weak implementation and sustainability plans for BHF. Communities that had lower scores lacked details on recruitment and screening efforts and partnership development for implementation and sustainability. Communities that were ranked higher by BHF-CAB members demonstrated strong plans for implementation and established multisectoral partnerships for recruitment, screening, and delivery of BHF. Across all communities, applicants demonstrated areas of weaknesses in generating plans for sustainability. Those with positive sustainability ideas, such as integrating some components of BHF implementation into job descriptions, did not provide details beyond a simple description. Others simply stated they would pursue additional funding for sustainability. Future use of this dissemination strategy would be improved by providing more detailed questions on system strategies that would heighten the likelihood of sustainability.

### Implications for Public Health

The state of Nebraska has identified pediatric and adult obesity prevalence as a priority public health concern and aims to develop a statewide coordinated approach to reduce obesity in children, adults, and members of racial and ethnic minority groups (29). Expanding the availability of effective programming and expertise is imperative to translate research to practice in medically underserved geographic areas. Effective dissemination and implementation strategies are needed to identify and engage communities with the potential capacity to adopt, implement, and sustain BHF. The objective of this study was to test the feasibility of a fund and contract dissemination strategy for a PWMI in identifying and engaging communities to adopt BHF in rural and micropolitan areas of Nebraska. Based on the approach we used, we can make 3 primary generalizations from these data. First, a fund and contract strategy successfully generated a broad cross-section of communities and community organizations interested in delivering BHF and some potential capacity for implementation. Second, based on ORCA responses, community organizations appeared to have strong perceptions on the quality of the evidence on BHF, positive local contexts for implementation, and the likelihood of supportive facilitation infrastructure. Third, the community narrative phase of the application provided critical insights on the potential barriers and facilitators in communities that could affect implementation efforts.

Initial interest from communities coupled with funding for implementation activities, formal commitments, and implementation

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support has been shown to increase capacity for evidence-based approaches (30). Our observational approach extends these findings to demonstrate that this type of strategy can also be used to identify organizations ready to adopt a new EBI (31). We also found that a simple fund and contract strategy identified communities with good geographic representation across a broad rural region and set the stage to investigate whether this representation translates into PWMI that reach families across the state.

If each identified community implements BHF, overall travel time to the new programs, even from the most distant areas, would require less time than is necessary to travel to the closest metropolitan areas with PWMI opportunities — Denver, Omaha, or Kansas City. In addition to addressing geographic barriers, a local PWMI would provide resources that might otherwise be limited in communities for families to receive obesity treatment and opportunities to engage in community-tailored physical activity and nutrition education together. Thus, a fund and contract strategy may be an effective tool for eliminating initial barriers to adopting a PWMI and can identify communities ready for implementation.

The positive ratings of evidence, context, and facilitation across communities is promising (32–34). Although we do not yet know if the identified communities will adopt and implement BHF with high quality, organizational readiness — defined as the interplay between ratings of evidence, context, and facilitation — has been identified as one of the strongest predictors of successful adoption and implementation of EBI using the PARIHS framework (20,35,36). Whether the fund and contract dissemination strategy facilitated organizational readiness and communities' capacity to implement BHF is unclear. The strategy may have simply uncovered communities that potentially would have adopted a PWMI without this process or encouraged a more positive view of readiness with the excitement of engaging new partners in the respondent communities. As the project moves forward, additional assessment of organizational readiness and qualitative interviews with communities during the pre/post-adoption and pre/post-implementation stages is expected to provide information to determine whether a relationship exists between initial assessments and the likelihood of successful implementation (36,37).

The qualitative narrative process required each applicant to describe their readiness and capacity and to initiate and sustain partnership development with the purpose of addressing childhood obesity. Relative to the initial quantitative information provided by the candidates, the qualitative information provided correspondence for communities with high readiness ratings and gave potential causes for communities with low readiness ratings. Common areas of weakness for communities were due to limited data to identify low-income families with children who have obesity, insufficient plans for recruitment and partners for recruitment ef-

orts, no established or pre-identified partners and defined personnel roles, and insufficient sustainability plans. This information provided a better understanding of community context and target areas for implementation strategies to further engage communities in their dissemination and implementation planning process to increase the likelihood of long-term sustainability (38).

Our descriptive study explored hypotheses of whether a fund and contract dissemination strategy can be used to identify a geographically dispersed set of communities with the potential to adopt, implement, and sustain an evidence-based PWMI. However, one limitation of a descriptive study is that it is intended to provide information to generate rather than test hypotheses. As such, although our findings aligned with the exploratory hypotheses, more rigorous experimental designs will be needed to test these hypotheses. The outcome of our study was the completion of the memorandum of understanding committing each community to implement BHF — and not actual adoption. Still, the value of our project lies in the novel use of a fund and contract strategy outside health care settings, the demonstration that this process can attract a geographically dispersed set of communities to commit to the implementation of BHF, and the provision of evidence that the fund and contract approach can facilitate cross-organizational and within-organization efforts to respond to a regional health priority.

Our study provides a systematic approach to identifying and engaging communities that are ready and able to disseminate BHF in their community to increase the likelihood of program adoption and implementation. The 3-phase process allowed community partnerships interested in disseminating BHF to identify communities with initial interest and, through a fund and contract dissemination strategy, narrow down the number of communities to those that are ready and have the apparent capacity to implement a PWMI in their community. Our novel approach to integrating a “pull strategy” through a competitive application process, including a letter of intent procedure followed by a full application narrative, allowed for the identification of 7 new communities that were ready to adopt and pilot the utility of a packaged PWMI and training resources.

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Tables

**Table 1. Organizational Readiness to Change Assessment (ORCA)<sup>a</sup> Items Used to Assess Communities in Nebraska Interested in Adopting and Implementing Building Healthy Families, a Pediatric Weight Management Intervention, 2019**

Scale and Subscale	Item
<b>Evidence</b>	
Research	Implementing Building Healthy Families in my community:
	• Is supported by strong scientific evidence in communities like mine.
	• Is supported by strong scientific evidence from other communities that may not be like mine.
	• Should be effective, based on strong scientific evidence from my community, or other communities like mine.
Community experience	The decision to implement Building Healthy Families:
	• Is supported by my experience with my community and its residents.
	• Is supported by similar experience with residents in other communities.
	• Matches the opinions of experts in my community.
Community preference	The decision to implement Building Healthy Families:
	• Would be/has been well-received by community members in a pilot study.
	• Is consistent with programs that have been accepted by community residents.
	• Takes into consideration the needs and preferences of my community.
	• Appears to have more advantages than disadvantages for my community.
<b>Context</b>	
Leadership culture	Senior leadership/clinical management in your organization:
	• Reward innovation and creativity to improve community health.
	• Solicit opinions of staff regarding decisions about contributing to community health.
	• Seek ways to improve community health and increase community resident participation in programs.
Staff culture	Staff members in your organization:
	• Have a sense of personal responsibility for improving community health.
	• Cooperate to maintain and improve effectiveness of community health programs.
	• Are willing to innovate and/or experiment to improve how things are done.
	• Are receptive to change in community offerings and processes.
Leadership	Senior leadership/management in your organization:
	• Provide effective management to improve community health.
	• Clearly define areas of responsibility and authority for managers and staff.
	• Promote team building to solve community program problems.
	• Promote communication among organizational services and units.
Measurement	Senior leadership and management in your organization:
	• Provide staff with information on their performance measures and guidelines.
	• Establish clear goals for processes and outcomes.
	• Provide staff members with feedback/data on effects of their decisions.
	• Hold staff members accountable for achieving results.
Readiness for change	Opinion leaders (people who influence the opinions, attitudes, beliefs, motivations, and behaviors of others) in your

<sup>a</sup> The ORCA is an instrument designed to measure the evidence, context, and facilitation constructs of the Promoting Action on Research in Health Services (PARIHS) model (20,21), which are theorized to predict implementation outcomes. We used a modified 50-item version of the ORCA to assess community readiness to implement Building Healthy Families, a pediatric weight management intervention.

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(continued)

**Table 1. Organizational Readiness to Change Assessment (ORCA)<sup>a</sup> Items Used to Assess Communities in Nebraska Interested in Adopting and Implementing Building Healthy Families, a Pediatric Weight Management Intervention, 2019**

Scale and Subscale	Item
	organization:
	<ul style="list-style-type: none"> <li>• Believe that how you currently address childhood obesity can be improved.</li> <li>• Encourage and support changes in your approach to childhood obesity.</li> <li>• Are willing to try new community programs.</li> <li>• Work cooperatively with senior leadership/management to make appropriate changes.</li> </ul>
Resources	In general, in my organization, when there is agreement that change needs to happen:
	<ul style="list-style-type: none"> <li>• We have the necessary support in terms of budget or financial resources.</li> <li>• We have the necessary training support.</li> <li>• We have the necessary facilities support.</li> <li>• We have the necessary staffing support.</li> </ul>
<b>Facilitation</b>	
Leader characteristics	Senior leadership/management will:
	<ul style="list-style-type: none"> <li>• Propose a project that is appropriate and feasible.</li> <li>• Provide clear goals for improving community health.</li> <li>• Establish a project schedule and deliverables.</li> <li>• Designate an organizational champion(s) for the project.</li> </ul>
Project champion characteristics	The childhood obesity treatment project champion (your community lead):
	<ul style="list-style-type: none"> <li>• Accepts responsibility for the success of this project.</li> <li>• Has the authority to carry out the implementation.</li> <li>• Is considered an organizational opinion leader.</li> <li>• Works well with the intervention team and partners.</li> </ul>
Leadership implementation roles	Senior Leadership/management/staff opinion leaders:
	<ul style="list-style-type: none"> <li>• Agree on the goals for this program.</li> <li>• Will be informed and involved in the program planning and implementation.</li> <li>• Agree on adequate resources to implement the program.</li> <li>• Set a high priority on the success of the program.</li> </ul>
Implementation team roles	The potential implementation team members:
	<ul style="list-style-type: none"> <li>• Share responsibility for the success of this project.</li> <li>• Have clearly defined roles and responsibilities.</li> <li>• Have release time or can accomplish intervention tasks within their regular workload.</li> <li>• Have staff support and other resources required for the project.</li> </ul>

<sup>a</sup> The ORCA is an instrument designed to measure the evidence, context, and facilitation constructs of the Promoting Action on Research in Health Services (PARIHS) model (20,21), which are theorized to predict implementation outcomes. We used a modified 50-item version of the ORCA to assess community readiness to implement Building Healthy Families, a pediatric weight management intervention.

**Table 2. Characteristics of the 8 Communities in Nebraska That Submitted a Letter of Intent Expressing Interest in Adopting and Implementing Building Healthy Families, a Pediatric Weight Management Intervention, 2019**

Characteristic	Community							
	A	B	C	D	E	F	G	H
<b>Population</b>	35,185	35,989	45,453	35,989	84,801	30,906	78,620	53,105
<b>No. of counties</b>	1	1	4	1	12	4	3	4
<b>Race/ethnicity, %</b>								
White (non-Hispanic)	87.2	71.6	86.9	71.6	79.2	77.2	71.2	73.9
Hispanic	9.1	24.2	9.5	24.2	15.4	6.8	23.7	22.6
Black or African American	1.3	1.0	1.0	1.0	1.0	0.9	3.1	2.1
American Indian/Alaska Native	1.1	3.5	1.2	3.5	3.5	14.5	1.8	1.7
≥2 Races	1.6	1.6	1.3	1.6	2.0	1.6	1.5	1.2
Other	1.0	1.0	1.2	1.0	1.0	0.5	1.7	1.2
<b>Median community income, \$</b>	55,875	50,157	46,888	50,157	45,761	57,122	54,742	55,191
<b>Institutional role of person who completed the ORCA</b>								
Decision maker	1	1	1	1	1	2	1	1
Program implementer	3	3	4	2	1	3	5	1
<b>Type of organization submitting letter of intent</b>	Hospital, recreation	Hospital	Education, health department, hospital, recreation	Community health center	Health department	Health department, hospital	Education, health center, health department	Health department
<b>Team member position</b>	Nurse coordinator, recreation director and employee, wellness educator	Chief operating officer, medical director, physician, recruitment coordinator	Chief executive officer, executive director, extension educator, program coordinator, wellness manager	Advanced practice registered nurse, clinic director, registered dietitian	Community health director, deputy director	Chief executive officer, chief nursing officer, health director, program coordinator	Accreditation coordinator, associate superintendent, chief executive officer, health director, medical director, outreach liaison	Chief public health officer, WIC nutritionist

Abbreviation: WIC, Special Supplemental Nutrition Program for Women, Infants, and Children.

## IMPLEMENTATION EVALUATION

# Evaluating the Implementation of a Before-School Physical Activity Program: A Mixed-Methods Approach in Massachusetts, 2018

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## PEER REVIEWED

**Summary****What is already known on this topic?**

Despite strong evidence supporting school-based physical activity interventions, a knowledge gap exists that relates to intervention delivery in real-world settings.

**What is added by this report?**

We evaluated the implementation of a before-school physical activity program in 3 schools by using a structured evaluation framework. Each school had different approaches to program delivery, with potential implications for program results and sustainability.

**What are the implications for public health practice?**

Use of a structured implementation evaluation framework provides key insights into program implementation and delivery that can be used to guide future dissemination efforts across different settings.

## Abstract

**Purpose and Objectives**

Our aim was to evaluate the implementation of a widely available, before-school, physical activity program in a low-resource, racially/ethnically and socioeconomically diverse, urban school setting to identify adaptations needed for successful implementation.

**Intervention Approach**

We used a collaborative effort with stakeholders to implement the Build Our Kids' Success (BOKS) program in 3 schools in Revere,

Massachusetts. Program structure followed a preexisting curriculum, including 60-minute sessions, 3 mornings per week, over 2 sessions (spring and fall 2018). Programs had a capacity of 40 students per school per session and the ability to adapt as needed.

**Evaluation Methods**

We used a mixed-methods approach, guided by the Reach, Effectiveness, Adoption, Implementation, and Maintenance (RE-AIM) framework. RE-AIM domains were assessed by use of baseline and follow-up student measures, parent interviews, and program administrative records.

**Results**

From a district of 11 schools, 3 schools (2 elementary, 1 middle) implemented the BOKS program. Program enrollment reached 82% capacity (188 of 230 potential participants). Of the 188 enrolled students, 128 (68%) had parental consent for study participation. Among the 128 study participants, 61 (48%) were male, 52 (41%) identified as Hispanic/Latino, and mean age was 9.3 years (SD, 2.2). Program duration varied by school (25–60 minutes), with a mean of 33% (SD, 16%) of the session spent in actigraphy-measured moderate-to-vigorous physical activity (MVPA), or mean 16.3 (SD, 9.3) minutes of MVPA. Participants attended a median 90% (interquartile range [IQR], 56%–97%) of sessions. We observed no change in body mass index (BMI) z score or self-reported quality of life from baseline to follow-up assessment. Parents reported positive program effects. Enrollment was sustained in elementary schools and decreased in the middle school during the study period, expanding to 3 additional schools for spring 2019.

**Implications for Public Health**

Implementation and evaluation of an evidence-based physical activity program, in a low-resource setting, are feasible and yield relevant information about program adaptations and future dissemination of similar programs.



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## Introduction

Physical activity is an important lifestyle behavior that is associated with a reduced risk of chronic diseases (1) and is known to have other benefits, ranging from improved cognition (2) to social and emotional wellness (3,4). Data from 2018 indicate that most children do not meet recommendations for 60 minutes of physical activity daily (5); therefore, increasing physical activity levels is an important population health target for interventions. The school setting has been proposed as an effective place to reach children across socioeconomic levels without barriers that might exist in other community-based settings (6).

Despite strong evidence supporting a role for school-based physical activity interventions (7), a significant knowledge gap exists related to intervention delivery in real-world settings (8). Most studies focus on intervention effectiveness, with limited reporting on program implementation (9). Public health results depend on successfully disseminating and diffusing effective interventions (10). To adequately address dissemination and diffusion, we must understand how interventions are adopted, implemented, and sustained in less controlled settings, especially relative to the need for adaptations (11).

Use of the Reach, Effectiveness, Adoption, Implementation, and Maintenance (RE-AIM) framework allows investigators to systematically address the gap between research and practice, recognizing that optimal research conditions often do not reflect the complexity of real-world settings (12). By understanding initial intervention adoption and reach, followed by implementation, effectiveness, and maintenance (Table 1), the RE-AIM framework seeks to capture both internal and external validity and facilitate the translation of research findings into real-world settings (12).

Our study used a mixed-methods design, guided by the RE-AIM framework, to evaluate an evidence-based, before-school physical activity program, Build Our Kids' Success, or the BOKS program, in 3 public schools in a low-income community in Revere, Massachusetts. Previous studies showed the effectiveness of BOKS in improving child weight status, social-emotional wellness, and overall physical activity levels (13,14); however, less is known about program delivery and outcomes in low-resource settings. We hypothesized that a detailed implementation evaluation would identify adaptations to program structure, with potential implications for program outcomes.

## Purpose and Objectives

The primary goal of this study was to perform a structured implementation evaluation of a widely available and preexisting before-school physical activity program, Build Our Kids' Success

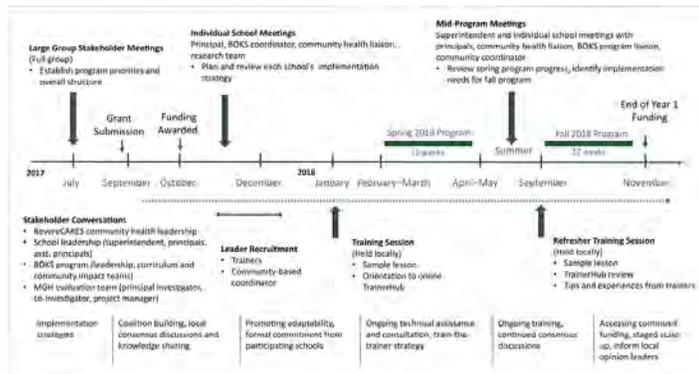
(BOKS), in a low-resource setting and to identify adaptation needs and targets for optimizing future interventions in similar settings. The BOKS program includes a freely available curriculum, designed for delivery by trained volunteers, with sessions occurring 2 to 3 times weekly during a 12-week period. For our study, the BOKS program was implemented and evaluated for 2 sessions of 12 weeks each (March–May 2018, October–December 2018) in collaboration with stakeholders, including community health infrastructure, and school district administration.

The BOKS program aligns with a systems-level framework of obesity, which highlights the importance of considering both the interpersonal and community levels in effective obesity prevention initiatives (15). The RE-AIM evaluation framework (Table 1) is consistent with this approach by facilitating understanding of intervention contexts (8,12).

## Intervention Approach

Implementation of BOKS was supported by a Massachusetts General Hospital community health improvement grant awarded to target health disparities in Revere, Massachusetts. In this community, 65% of students speak a first language other than English, 47% are from economically disadvantaged families, defined as participation in  $\geq 1$  state-administered program, including public health insurance, food assistance, or child protective services (16), and 66% identify as a racial/ethnic minority, primarily Hispanic/Latino (17). The city has a high burden of chronic disease, with 47% of children meeting the criteria for overweight/obesity (18); rates of diabetes, stroke, and cardiovascular disease among adults are higher than the state average (19).

Before the initiative was funded, our research team participated in collaborative community engagement meetings, forming a coalition with local community health leaders, school principals, and BOKS program staff to align program and evaluation priorities. This group met throughout the project to discuss program implementation and delivery (Figure 1).



**Figure 1.** Evaluation timeline with overview of stakeholder engagement process and implementation strategies, 2018–2019.

For our study, 3 schools committed to implementing the BOKS program for 1 year, beginning in the spring of 2018. School leadership identified candidate schools in the target community and selected 1 middle school (grades 6–8) and 2 elementary schools (grades K–5) from 11 schools in the district. Each participating school recruited 2 trainers to lead the program, enrolled students, and completed 2 sessions of the BOKS program for 12 weeks, 1 session in spring 2018 (February–June) and 1 session in fall 2018 (September–December).

Because BOKS is widely available, the primary intention was to deliver the program within the standardized BOKS curriculum; however, we prioritized each school’s ability to adapt the program as needed to suit their delivery capabilities. A grant-funded, school-based coordinator assisted each school, working in consultation with a coordinator from the BOKS program. We chose this train-the-trainer approach to build capacity in the community.

Before the start dates of the spring and fall programs, program leaders from each school attended a 2-hour BOKS training session held in the community. Training consisted of an introduction to the online TrainerHub at <https://www.bokskids.org/>, which provided resources and access to the standardized curriculum as well as participation in a sample lesson. Each school had the capacity for 40 students per 12-week session, based on the BOKS standard of 1 trainer for every 20 students. Total program capacity was originally 120 maximum students enrolled per session (240 students, over 2 sessions of 12 weeks, across 3 schools). Maximum capacity decreased to 230 students following one school’s decision to limit capacity to 30 students for their fall program.

## Evaluation Methods

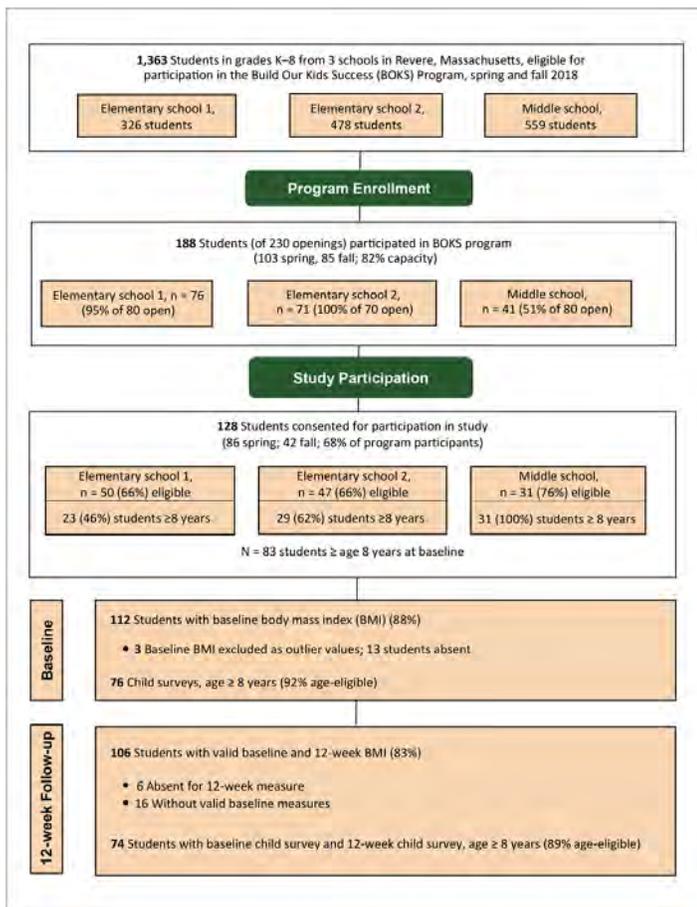
We performed an exploratory concurrent-nested mixed-methods evaluation, guided by the RE-AIM framework. We chose this approach to embed supportive qualitative data within the larger quantitative evaluation (20). We collected evaluation data at the individual level (student, parent) and at program and school levels (Table 1).

The study was conducted from February 2018 through December 2018 and included 2 BOKS program sessions with program maintenance observed through spring 2019. The study was recorded in [clinicaltrials.gov](https://clinicaltrials.gov) (NCT#2017P002770) and approved by the Partners HealthCare Institutional Review Board of Boston, Massachusetts.

All children enrolled in the 3 participating schools (K–8) were eligible to enroll in the BOKS program, although 1 school excluded kindergarten because of scheduling conflicts. Each school directed program enrollment at the start of the spring and fall sessions. To increase program access for the fall session, schools gave enrollment preference to children who had not previously participated.

To facilitate enrollment, study staff provided schools with information and recruitment materials to send home with children at the start of each session. Materials were available in English, Spanish, Arabic, and Portuguese. Parents returned signed consent forms in a sealed envelope to the school, where study staff picked them up. A telephone number was included for parents to call and ask questions. For collection of child measures, children provided verbal assent to trained research staff at the start of study visits.

Students were eligible to participate in the study with enrollment in the BOKS program, valid written parental consent, and verbal child assent. Of 188 total children enrolled in the BOKS program during the study period, 128 (68%) had both parental consent and child assent for study participation (Figure 2). Although children whose parents did not consent to study enrollment could continue their participation within the BOKS program, we did not collect any study measures from them other than anonymized attendance.



**Figure 2.** Flow diagram of physical activity participants in the Build our Kids Success (BOKS) evaluation from 3 schools in Revere, Massachusetts, spring and fall 2018.

Parents from 1 participating elementary school formed a convenience sample for a 20-minute semistructured, qualitative telephone interview. Parents received a letter describing the interview and returned a form providing permission to be contacted. Eligibility criteria included being an English-speaking parent and having a child enrolled in the BOKS program. Parents provided verbal consent at the start of the interview. We randomly selected participants from interested parents until the target sample size was reached (n = 20). Ultimately, 25 of 40 parents (62.5%) expressed interest, 23 were contacted for participation, 20 completed the interview, and 2 were not contacted because the target sample size was already reached. Parents received a \$10 gift certificate when they completed the interview. Interviews were conducted by trained research assistants and were recorded and transcribed for qualitative analysis.

For evaluating program adoption, school records provided information on district and school demographics (17). We compared demographics of participating schools to overall district demographics. Program administrative records provided information on trainer recruitment. District records detailed the number of students eligible for participation in each school. We obtained program enrollment data from registration forms and attendance records to evaluate program reach. Baseline participant characteristics included race/ethnicity, sex, and age (obtained from registration forms) as well as anthropometrics (obtained through study visits). We compared participant demographics at baseline to overall school demographics. Parents also answered semistructured interview questions addressing reasons for enrolling their child in the BOKS program.

Implementation evaluation occurred at both the program and individual levels. Program administrative records provided information on program costs. We assessed intervention fidelity through review of program structure, administrative records, and session visits. Trained research assistants visited each school at least once (range 1–3 times) per 12-week session to perform a structured physical activity observation and obtain objective measurement of participant physical activity.

Research staff conducted structured observations by using the System for Observing Fitness Instruction Time (SOFIT) (21,22). With this tool, independent observers classified student activity and lesson context in 10-second intervals. Classifications for activity included vigorous activity, walking, standing, sitting, and lying down. Classifications for lesson context included fitness, games, skills, knowledge, and management. Frequencies of each activity and context classification were calculated, and percentage of each classification within total number of observations was reported. Session observations with interobserver reliability of 75% or less were excluded (n = 2). We performed a total of 10 structured observations using SOFIT, with 87% interobserver reliability for activity observations and 84% for context observations.

On session observation days, 10 to 15 study participants wore an ActigraphGT3X+ (Actigraph, LLC) accelerometer on the wrist or an ActigraphGTX on the hip. Upon arrival to the morning program, research staff fitted children with the accelerometer and recorded time for program arrival (monitor on) and program departure (monitor off). We recorded physical activity intensity levels using Evenson cut-point thresholds (23). Children were included for analysis if total wear time was consistent with program duration. We made objective measurements of physical activity during 9 sessions and obtained 84 total observations.

Individual-level data included child attendance and parent feedback through semistructured qualitative interviews on program

feasibility and acceptability, including barriers to program participation and parental input on program content and structure. Stakeholder conversations throughout the intervention planning and implementation periods documented logistical support provided for programming.

Effectiveness evaluation included individual child measures, as well as qualitative interview data from parents on observed program effectiveness among children. Research staff collected anthropometrics and quality-of-life data at baseline and 12-week follow-up during both sessions (spring and fall). Trained research assistants measured child weight and height using a Seca scale and stadiometer (Seca North America East Medical Scales & Measuring Devices). We calculated child body mass index (BMI) and age- and sex-specific BMI z score for each participant (24). Additionally, students aged 8 years or older completed the Pediatric Quality of Life Inventory 4.0 (PedsQL) Child Self Report, a reliable and valid measure of health-related quality of life in a healthy population (25). The PedsQL consists of 23 items addressing physical, emotional, school, and social domains. This measure was self-administered on paper. For program maintenance, study staff reviewed program and administrative records for fall session enrollment, attendance, and trainer retention and for spring 2019 enrollment.

### Data analysis

We tabulated descriptive statistics of participant characteristics by session and school. We assessed differences between sessions and schools by using *t* tests, ANOVA, and Wilcoxon tests as appropriate for continuous variables, and  $\chi^2$  for categorical variables. We assessed all data for outlier values and errors in data entry.

For the analyses of anthropometrics and quality of life, we used linear regression to measure change across assessment points, using each assessment point as a categorical predictor and model coefficients to estimate change in outcome from baseline. We included all available cases for analyses, with only complete cases included in measurement of change from baseline to each assessment point. For objective measurement of physical activity, we calculated means for wear time as well as time spent in MVPA. We performed 1-way ANOVA to evaluate differences between schools and frequencies for participants achieving thresholds of MVPA. We also report a Pearson correlation coefficient to describe correlation between program duration and MVPA minutes. Due to nonnormality of attendance, we report median and interquartile ranges. We performed Wilcoxon tests to assess for difference in attendance by school, spring versus fall program participation, identification as Hispanic/Latino, and study participant versus nonparticipants.

At maximum program capacity ( $n = 230$ ), this study would be powered to detect a 0.38 unit change in BMI z score, with 80% power at significance level  $P = 0.05$ . However, with actual enrollment at 188, we were underpowered to detect statistically significant change in BMI z score so we report the observed difference from baseline to follow up only. We performed quantitative analyses using R 3.5.0 (R Core Team) (26). We collected and managed study data using REDCap electronic data capture tools hosted at Partners Healthcare (27).

All interviews were recorded and transcribed for analyses. We conducted thematic analyses using the Framework Approach (28), establishing an a priori deductive framework within relevant RE-AIM domains (29). Two coders independently reviewed transcripts, developed preliminary themes and codes, and compared initial framework to reach consensus. Coders then indexed themes and relevant quotations into an Excel spreadsheet from line-by-line transcript review, refining by combining and removing codes as needed to generate thematic framework. Coders resolved any discrepancies through discussions.

## Results

### Adoption

Grant funding for implementation of the BOKS program was available for 3 schools in a district with 11 schools. Overall, participating schools were representative of the district in the percentage of economically disadvantaged students (district 47.1%; participating school range 45.4%–51.0%) and students whose first language was not English (district 64.5%; participating schools range 61.7%–65.8%) (17).

A total of 11 program trainers were trained across all sessions and schools. Elementary school 1 had 2 trainers, with the addition of an occasional parent volunteer. Elementary school 2 recruited 6 trainers in total, with 2 present each morning. The middle school recruited 3 trainers; 1 led both sessions and the other 2 led 1 session each. Roles of trainers in the school included gym teacher ( $n = 2$ ), school nurse ( $n = 1$ ), academic teacher ( $n = 7$ ), and counselor ( $n = 1$ ); 9 of 11 trainers were female. One trainer served as the grant-funded community coordinator and was responsible for coordination within schools and primary communication with the BOKS program.

### Reach

At maximum capacity, the program could accommodate 230 students over 2 sessions, or approximately 17% of the total student body across schools. A total of 188 students (82%) of potentially 230 students began the program. Total enrollment for the fall ses-

sion was reduced to 110 students, as 1 school (elementary school 2) decreased target enrollment from 40 to 30 students for a lower student-to-trainer ratio (15 to 1, as opposed to 20 to 1). Of the 128 students in the study, a different number was present at baseline and follow-up measurements. Because this study evaluated participation in the program, we did not count the number of students who completed the program (Figure 2).

At baseline, 60 (55%) participating students met criteria for overweight, with a BMI in the 85th to the 95th percentile for age and sex, or obesity, with a BMI in the 95th percentile or higher for age and sex (28). These percentages were slightly higher than the district-wide prevalence of 45% of students with a BMI in the 85th percentile or higher (18). Parents provided specific responses for reasons to enroll their children in the BOKS program (Table 2).

Demographics of consenting participants were representative of school and district demographics overall. Within the school district, 55.3% of students identify as Hispanic/Latino (participating schools range 43.5%–56.7%) and 34.3% of students identify as non-Hispanic white (participating schools range 33.3%–43.1%) (17). Most study participants identified as Hispanic/Latino ( $n = 52$ , 41%) on program enrollment forms, followed by non-Hispanic White ( $n = 29$ , 23%). (Table 3). Thirty (23%) of study participants returned parental consent forms in a language other than English.

## Implementation

### Institutional support

Logistical support for programming was provided by the district superintendent, school principals, and the BOKS program. Each school managed program location, dates, and times, as well as student program enrollment and trainer recruitment.

### Program costs

Total program cost for each 12-week session per school was \$2,600 and included trainer stipends, gym equipment (\$300 per school), and participant t-shirts (approximately \$300 per school). The program curriculum was free of cost. Assuming full capacity, total cost per participant was \$65/student; at actual capacity, cost was \$83/student. Program costs for the study period were grant funded; therefore, participation was free for students and participating schools.

### Program fidelity

**Structure.** All schools adhered to recommended program frequency (3 times/week) and scheduled program duration (12 weeks total). Schools completed 32 to 36 sessions, or 89%–100% of scheduled sessions. Reasons for missed sessions included inclement weather ( $n = 2$ ) or a school event ( $n = 2$ ). Recommended program time was 60 minutes; as implemented, sessions were 25

minutes at the middle school, 45 minutes at elementary school 1, and 60 minutes at elementary school 2. Both schools that were unable to achieve the prescribed length were limited by early morning access to school facilities and school start time. Overall program capacity was 40 students (1 trainer per 20 students).

**Content.** We performed 10 structured observations using the SOFIT observational measure. Interobserver reliability was 87% for activity observations and 84% for context observations. Across SOFIT-observed sessions, mean 19% (SD, 9) of sessions were spent in vigorous activity, 14% (SD, 7) standing, 37% (SD, 13) walking, 28% (SD, 16) sitting, and 3% (SD, 7) lying down. For lesson context, 54% (SD, 13) of the lesson was spent on fitness, skills, or games, 43% (SD, 12) was spent on management/knowledge, and 3% (SD, 5) was classified as other.

**Attendance.** Overall participant attendance was 77.2% (IQR, 17.5%–95.1%) of sessions, with significantly higher attendance among study participants (median = 90%; IQR, 56%–97%) versus program enrollees who did not participate in the study (median 23%; IQR, 9%–89%;  $P < .001$ ). No significant difference in session attendance occurred from the first to the second program sessions among schools in 2018. Median attendance in spring 2018 was 91% (IQR, 63%–95%) of sessions. Median attendance in fall was 84% (IQR, 48%–97%) of sessions ( $P = .89$ ) (Table 4).

**Physical activity delivery.** Overall, 32% to 35% of the session was spent in MVPA, with no significant differences in percentage of time in MVPA between schools (Table 5). Total MVPA was moderately correlated with program duration ( $r = .36$ ,  $P = .008$ ).

### Feasibility and acceptability

Parent feedback on program implementation relating to feasibility, acceptability, barriers, and suggestions for future programming supported positive program outcomes.

### Effectiveness

Effectiveness evaluation revealed maintenance in BMI (mean change  $-0.1$  kg/m<sup>2</sup>, 95% CI,  $-1.2$  to  $-1.0$ ), BMI z score (mean change  $-0.001$  units, 95% CI,  $-0.3$  to  $0.3$ ) and self-reported quality of life (mean change in PedsQL total score of  $-0.8$  units, 95% CI,  $-5.2$  to  $2.8$ ) from baseline to completion of program at the 12-week follow-up. Parent observations regarding impact of program participation are summarized in Table 2.

### Maintenance

Enrollment decreased between sessions from 103 students (120 capacity) in spring 2018 to 85 (110 capacity) that fall. The decrease was primarily a result of decreased middle school enrollment. Both elementary schools had sustained interest, reaching

100% enrollment capacity in the second session (70 participants, including 67 new participants with 3 continuing siblings whose mother volunteered) with an additional 143 students on wait lists. In elementary school 1, 20 of 36 spring participants were on the fall wait list. Elementary school 2 solicited enrollment paperwork only from new participants. No middle school student participated in both sessions.

No significant difference in session attendance occurred from the first to the second program sessions among schools in 2018. Median attendance in spring 2018 was 91% (IQR, 63%–95%) of sessions. Median attendance in fall was 84% (IQR, 48%–97%) of sessions ( $P = .89$ ) (Table 4).

In spring 2019, the program continued in schools with district-supported funding and expanded to 3 additional schools (2 elementary, 1 middle school) through additional grant funding for a total of 6 schools, representing 61% of the district's K–8 enrollment. Total enrollment was 189 students of 230 for spring 2019 (82% capacity; 115 of 120 in new schools, 72 of 110 in previously participating schools). Overall, 17 trainers led the spring 2019 session (2 recruited within each new school; 8 continuing within previous schools, with 3 additional trained). Trainers who did not continue cited the time and administrative burden; elementary school 1 addressed this by splitting responsibilities among 3 trainers.

## Implications for Public Health

Using the RE-AIM framework to guide our implementation evaluation, we observed that each of the 3 participating schools successfully implemented the BOKS program. Each school had different approaches to program delivery, with potential implications for program results and sustainability. Overall, schools that adopted the program were representative of the school community at large, successfully reaching a diverse target population at risk for obesity-related sequelae. Program implementation varied most between schools in session length and structure of trainer teams. Both elementary schools had sustained interest between the spring and fall sessions, although interest decreased in the middle school. These findings should be considered in dissemination and delivery of school-based physical activity programs, as well as broader population health efforts to increase access to physical activity opportunities in diverse and low-resource settings.

In collaboration with stakeholders, our implementation strategy prioritized program adaptability within each school's capabilities, maximizing fidelity through ongoing support and training from BOKS and school-based coordinators (30). Literature describing successfully disseminated physical activity interventions supports the importance of in-person, hands-on training, as well as build-

ing self-efficacy and ownership in the target community, both of which were priorities in our approach. Although counterintuitive, larger dissemination efforts show that omitting critical intervention components might be necessary for success (31). In low-resource settings, especially such as in this study, successful adaptation necessitates balancing complete fidelity with practical constraints.

Limited space and schedule constraints warranted decreased session time in 2 schools from the prescribed 60 minutes. With one-third of session time spent in MVPA, a further reduction influenced the total time promoting MVPA to participants. Fixed logistical constraints and competing priorities are common barriers to implementing wellness initiatives in schools and are not unique to this study (32). As a result, strategies to maximize MVPA within the available time are crucial. Our program observations suggest targets for improvement, mostly related to minimizing time spent in program management. Potential strategies include simplifying program activities to reduce the time spent explaining rules, directing children to move in place (eg, jogging, jumping jacks) during explanations, and promoting active cheering during activities that require taking turns (eg, relays).

Schools also adapted their approach to trainer recruitment, either concentrating responsibilities between 2 trainers or distributing responsibilities among a larger group. Program sustainability depends on maintaining trained personnel who are willing to deliver the intervention (31). With volunteer trainers who might have competing professional commitments, it is crucial to distribute the burden and build program champions while avoiding burn-out, especially in a low-resource school.

After the first year, stakeholder discussions focused on program sustainability. Additional grant funding supported program expansion; however, our shared priority was to identify existing funding streams in the district budget to support trainers. School wellness personnel and current trainers also proposed strategies requiring minimal funding, including a peer mentorship model with older student volunteers. These strategies rely on fitting the current intervention within existing school programs and policies as well as continuing to build capacity (33).

Ultimately, program results depend on overall reach and efficacy (31). At maximum capacity in the initial schools, the BOKS program could accommodate only 17% of students. As schools considered program continuation, they weighed having a different group of students participate each morning. When time and personnel are limited, increasing reach would have an unavoidable trade-off of decreasing overall MVPA delivery to each participant. The balance depends on individual priorities for program implementation. Although the research setting optimizes dose and pro-

gram adherence, the community setting might prioritize equity in access. Identifying scalable and effective strategies to supplement school-based physical activity interventions is a research priority to extend reach and maintain the optimal intervention dose.

Although this intervention successfully engaged a diverse group of youth at risk for obesity-related sequelae, students not enrolled in the study had lower levels of program attendance. Although those students might have been less interested in the program, other disparities might exist between the study and nonstudy groups. Although we translated our study consent forms to reduce language barriers, both overall literacy and health literacy might have influenced enrollment. As vulnerable populations have lower rates of intervention delivery (34), social determinants of health or other unmeasured barriers to participation must be considered to account for differences in program participation.

Additionally, the middle school had high rates of attrition compared with both elementary schools. Although school leadership changed between sessions, an identified risk factor for poor sustainability (32), other factors unique to adolescents also warrant consideration. Adolescence is a time of increasing independence and physical and emotional changes (35). Lifestyle interventions that target overweight and obesity are often less successful in adolescents than in younger children (36). In our population, fewer middle school participants had BMI higher than the 85th percentile compared with elementary school participants. This lower prevalence of overweight and obesity suggests that middle school students most at risk for obesity-related sequelae were less likely to participate in the program than those with BMI <85th percentile. These factors suggest that the program might need to be tailored to improve uptake among adolescents.

Our study's primary strength is its use of a structured framework, RE-AIM, to evaluate a before-school physical activity program. This approach provides a comprehensive view across each measure with qualitative insights from parents and a focus on identifying program adaptations needed for successful implementation. We identified key objectives for program improvement, which can be explored through more work on processes to maximize physical activity delivery. Furthermore, using the before-school period to deliver a physical activity intervention is an innovative approach, as it takes advantage of a time when children and adolescents are not typically active.

Although we have detailed information on implementation in each school, we were not able to test implementation strategies between schools. Without a greater number of participating schools, differences in each school's capabilities would have confounded differences in implementation strategies. School district stakeholders identified participating schools, which might limit generalizability.

Although schools were representative of the district, other unmeasured characteristics, such as openness to innovation or school leadership qualities, may have made these early adopters likely to succeed (10).

Additional perspectives are missing from this study, including teacher input, detailed trainer feedback, and qualitative interviews with non-English-speaking and middle school parents. For parent interviews, adequate representation would have required translation to Arabic, Portuguese, and Spanish, which was not feasible. Although we focused on parents of elementary students, challenges in the middle school setting highlight the importance of engaging the middle school population and provide a target for future work. This study was performed within a single school district and results may not be generalizable beyond this community; however, the evaluation process used may be applied across different school settings.

This study demonstrates that structured implementation and evaluation of an evidence-based physical activity program in a low-resource setting is feasible and yields relevant information on program delivery. Program adaptations may be crucial to successful implementation; however, they might also have implications for program outcomes. Through structured implementation evaluation following a similar procedure to this study, it may be possible to identify program components that are key to successful implementation, allowing for targeted dissemination and diffusion of the effective intervention components across various settings.

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Tables

**Table 1. Assessment Measures in the RE-AIM Framework<sup>a</sup> of the Build Our Kids' Success Program (BOKS) Evaluation, Massachusetts, 2018**

RE-AIM Dimension	Definition	Source of Data (Level)	Data Collected	Tools
<b>Adoption</b>	Support and uptake for adoption of programming	School	School demographics Trainer recruitment	District records Administrative data
<b>Reach</b>	Proportion of target population participating in intervention	School	Number of students eligible	District records
			Number of students enrolled	Enrollment records
		Child	Participant characteristics	Enrollment records Anthropometrics
		Parent	Parent feedback	Semi-structured interviews
<b>Implementation</b>	Extent to which intervention is implemented as intended in the real world	Program	Program structure	Administrative records
			Program content	SOFIT structured observation
			Physical activity delivery	Accelerometry
			Program costs	Administrative records
			Logistical support	Stakeholder conversations
		Child	Program attendance	Enrollment records
		Parent	Parent feedback	Semi-structured interviews
<b>Effectiveness</b>	Success if implemented as intended	Child	BMI (z score)	Anthropometrics (height, weight)
			Quality of life	Pediatric Quality of Life Inventory
		Parent	Parent feedback	Semi-structured interviews
<b>Maintenance</b>	Extent to which program is sustained over time	School	Number of students enrolled in fall 2018 vs spring 2018	Enrollment records
			Trainer retention	Administrative data
			Program attendance	Enrollment records

Abbreviations: BMI, body mass index; RE-AIM, Reach, Effectiveness, Adoption, Implementation, and Maintenance; SOFIT, System for Observing Fitness Instruction Time.

<sup>a</sup> Based on Glasgow, et al (12).

**Table 2. Summary of Relevant Dimensions and Representative Feedback From Parent Interviews, Build Our Kids' Success (BOKS) Evaluation, Massachusetts, 2018<sup>a,b</sup>**

RE-AIM Dimension	Relevant Interview Question(s)	Key Themes and Subthemes	Representative Quotes
Reach	Your child has been participating in the BOKS program at their school; why did you choose to enroll them in this?	Benefits parent and child	<ul style="list-style-type: none"> <li>• [I]t's good because, for me, I have three kids. They study in two different schools. . . . When [teacher] said, "Now we have the BOKS program," and also, "Sign up for the kids, and then they can come to school early." (Father of daughter, 7 y)</li> <li>• I just said that maybe it's gonna help him and put this energy a little down. (Mother of son, 10, y)</li> </ul>
		Child interest	<ul style="list-style-type: none"> <li>• He loves anything that keeps him bouncing around and moving and jumping. He definitely was very interested in signing up, so, it was all him. (Mother of son, 9 y)</li> </ul>
		Need for physical activity opportunities	<ul style="list-style-type: none"> <li>• Oh, because I knew that at home he's not very active and I will like to see him do more exercise and keep active, just to keep him healthy. (Mother of son, 6 y)</li> </ul>
Implementation	What things have made it hard to participate in BOKS? Is there anything you would change about the program?	Acceptability	<ul style="list-style-type: none"> <li>• From my standpoint, from my children, whatever is going on at BOKS, and you guys are doing, seems to be keeping my kids very interested. From my standpoint, I wouldn't change a thing. (Mother of daughter, 9 y)</li> </ul>
		Barriers: transportation, weather, time	<ul style="list-style-type: none"> <li>• The first time it was hard because I'm not driving anymore. It was his father, and it was really hard for him, but now we did manage that. (Mother of son, 10 y)</li> <li>• [It's hard] especially when it's cold and raining. (Mother of daughter, 6 y)</li> <li>• Getting him ready and up early in the morning. The only downside. (Mother of son, 9 y)</li> </ul>
		Suggestions for future program structure and content	<ul style="list-style-type: none"> <li>• I think maybe a shorter program. I think that the hour was a very long time. (Mother of son, 9 y)</li> <li>• I wish that it's more than 12 weeks, because my child likes that program very much. (Mother of son, 6 y)</li> <li>• It's like, if they can do some dancing too in the morning, some music, some dance, some Zumba, something. (Mother of daughter, 6 y)</li> </ul>
Effectiveness	What good things have you seen about participating in the BOKS program?	Impact on parents	<ul style="list-style-type: none"> <li>• I found that it was helpful for me. . . . It helped me with the day. You know what I mean? (Mother of daughter, 6 y)</li> </ul>
		Child benefits observed: behavior, self-esteem, health	<ul style="list-style-type: none"> <li>• He concentrates better at school. His teacher's not so after him to calm down. He's got ADHD, so, I think it kinda helps him settle his mind a little bit having that activity in the morning so he's not so wound up. (Mother of son, 9 y)</li> <li>• [S]he teach me how to do a new exercise. I don't know how to do it but she teach me how to do it. . . . I like to see her more confident and active. (Mother of daughter, 8 y)</li> <li>• I see she's losing a little weight. (Mother of daughter, 9 y)</li> </ul>
		Physical activity behaviors: skills, enjoyment, sedentary time	<ul style="list-style-type: none"> <li>• Coordination used to be a big deal with him, but he's past that right now, so that's why I think BOKS probably helped him. (Mother of son, 10 y)</li> <li>• They make it fun to be active. They play games. (Mother of son, 9 y)</li> <li>• [E]xercising to take her away from watching TV or to be[ing] inactive. (Mother of daughter, 10 y)</li> </ul>

Abbreviations: RE-AIM, Reach, Effectiveness, Adoption, Implementation, and Maintenance.

<sup>a</sup> Based on Holtrop et al (29).

<sup>b</sup> Adoption not assessed as a setting-level domain; maintenance not assessed because interviews were performed during program (before maintenance period).

**Table 3. Participant Demographics at Baseline by School and by Session in the Build Our Kids' Success (BOKS) Evaluation, Massachusetts, 2018**

Characteristics	Total (N = 128) <sup>a</sup>	By School			P Value <sup>b</sup>	By Session		
		Elementary School 1 (n = 50)	Elementary School 2 (n = 47)	Middle School (n = 31)		Spring (N = 86)	Fall (N = 42)	P Value <sup>b</sup>
Age, mean (SD), y	9.3 (2.2)	8.3 (1.6)	8.4 (1.6)	12.2 (0.7)	<.01	9.3 (2.2)	9.2 (2.2)	.90
Male, no. (%)	61 (48)	26 (52)	20 (43)	15 (48)	.57	45 (52)	16 (38)	.90
Baseline BMI, kg/m <sup>2</sup> , mean (SD) <sup>a</sup>	20.4 (4.4)	19.2 (2.5)	20.0 (4.2)	21.4 (4.4)	.05	20.3 (4.0)	20.5 (5.2)	.06
Baseline BMI z score, median (IQR) <sup>c</sup>	1.16 (0.39, 1.73)	1.24 (0.60, 1.82)	1.39 (0.44, 1.96)	0.64 (.21, 1.39)	.12	1.26 (0.40, 1.87)	1.32 (0.50, 1.55)	.47
<b>Child BMI Category, no. (%)</b>					.17 <sup>d</sup>	—	—	.50 <sup>d</sup>
<85th percentile, no. (%)	50 (45)	18 (43)	14 (35)	18 (64)	—	34 (45)	13 (38)	—
85th–95th percentile	27 (25)	17 (40)	16 (40)	6 (21)	—	17 (22)	10 (29)	—
>95th percentile	33 (30)	7 (17)	10 (25)	4 (14)	—	25 (33)	8 (24)	—
<b>Race/ethnicity, no. (%)</b>					—	—	—	.90
Hispanic/ Latino	52 (41)	26 (52)	15 (32)	11 (35)	—	31 (36)	21 (50)	—
Non-Hispanic White	29 (23)	10 (20)	11 (23)	8 (26)	—	20 (23)	9 (21)	—
Non-Hispanic Black	8 (6)	3 (6)	3 (6)	2 (6)	—	6 (7)	2 (5)	—
Other	13 (10)	6 (12)	6 (13)	1 (3)	—	9 (11)	4 (9)	—
Declined	26 (20)	5 (10)	12 (25)	9 (29)	—	20 (23)	6 (14)	—

Abbreviation: —, not applicable; BMI, body mass index.

<sup>a</sup> N = 112 total participants with complete baseline anthropometrics for BMI calculation, 78 in spring, 34 in fall.

<sup>b</sup> *t* tests, ANOVA, and Wilcoxon tests were used for continuous variables;  $\chi^2$  tests used for categorical variables; race/ethnicity by school not assessed because of insufficient sample size.

<sup>c</sup> For BMI z-score calculation, total N = 110 participants, 2 students are missing data on age.

<sup>d</sup> *P* values represent  $\chi^2$  analysis for BMI category across schools and sessions.

**Table 4. Program Attendance by School, Session, Student Identification as Hispanic/Latino, and Participation Status, Build Our Kids' Success Evaluation, Massachusetts, 2018**

Variable	No. of Sessions Attended, Median (IQR)	P Value <sup>a</sup>	Percentage of Sessions Attended, Median (IQR)	P Value <sup>a</sup>
<b>By school</b>				
Elementary school 1 (n = 50)	30 (24-31)	<.001	94 (75-97)	.04
Elementary school 2 (n = 31)	37 (29-40)		93 (69-95)	
Middle school (n = 47)	16 (8-21)		57 (35-91)	
<b>By session</b>				
Spring (n = 86)	29 (18-35)	.61	91 (63-95)	.89
Fall (n=42)	30 (15-31)		84 (48-97)	
<b>By study participation</b>				
Yes (n = 128)	29 (18-33)	.001	90 (56-97)	.001
No (n = 100)	7 (2-31)		23 (9-89)	
<b>By Hispanic/Latino</b>				
Yes (n = 52)	27 (1-31)	.38	87 (66-97)	.91
No (n = 76)	30 (15-36)		91 (48-97)	

<sup>a</sup> Wilcoxon rank sum used because of non-normality of data.

**Table 5. Overall Time Spent in Moderate-to-Vigorous Physical Activity (MVPA) and Percentage of Participants Achieving Physical Activity Targets, Build Our Kids' Success Evaluation, Massachusetts, 2018**

Measure	Total (N = 84)	Elementary School 1 (N = 30)	Elementary School 2 (N = 39)	Middle School (N = 15)	P Value
Mean wear time, mean (SD), min	48.0 (11.6)	44.7 (0.4)	59.9 (0.28)	29.0 (1.3)	<.001 <sup>a</sup>
MVPA, mean (SD), min	16.3 (9.3)	15.8 (6.0)	19.1 (11.6)	9.7 (2.0)	.003 <sup>a</sup>
Percentage of sessions in MVPA, mean (SD)	33 (16.0)	35 (14.0)	32 (19.0)	33 (7.0)	.68
<b>Students achieving physical activity target, no. (%)</b>					
≥5 min of MVPA	84 (100.0)	30 (100.0)	39 (100.0)	15 (100.0)	— <sup>b</sup>
≥10 min of MVPA	64 (76.2)	23 (76.7)	36 (92.3)	5 (33.3)	— <sup>b</sup>
≥15 min of MVPA	32 (38)	14 (47)	18 (46)	0	— <sup>b</sup>
≥20 min of MVPA	21 (25)	10 (33)	11 (28)	0	— <sup>b</sup>
≥30 min of MVPA	6 (7)	0	6 (15)	0	— <sup>b</sup>

Abbreviation: NA, not applicable.

<sup>a</sup> One-way ANOVA used for continuous variables of minutes and percentage of time spent in MVPA.

<sup>b</sup>  $\chi^2$  tests not performed because of insufficient sample size for categorical variables of student percentage meeting physical activity targets.

## IMPLEMENTATION EVALUATION

# Quality Improvement Coaching for Human Papillomavirus Vaccination Coverage: A Process Evaluation in 3 States, 2018–2019

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## PEER REVIEWED

**Summary****What is already known on this topic?**

Quality improvement (QI) coaching is effective in improving clinic human papillomavirus (HPV) vaccination coverage; however, improvements are generally small, and little is known about factors influencing QI coaching effectiveness.

**What is added by this report?**

We report implementation outcomes for a QI coaching intervention and qualitative findings on factors that might explain when coaches are successful at 1) persuading clinics to adopt the intervention, 2) reaching clinic staff and providers during a coaching visit, and 3) implementing coaching protocols with fidelity.

**What are the implications for public health practice?**

Results of our evaluation advance understanding of factors that might influence the successful implementation of QI coaching and inform the development of future coaching interventions.

## Abstract

**Purpose and Objectives**

Quality improvement (QI) coaching improves human papillomavirus (HPV) vaccination coverage, but effects of coaching have been small, and little is known about how and when QI coaching works. To assess implementation outcomes and explore factors

that might explain variation in outcomes, we conducted a process evaluation of a QI coaching intervention for HPV vaccination.

**Intervention Approach**

QI coaches received tools and training to support 4 core coaching competencies: 1) expertise in using clinic-level adolescent vaccination data to drive change, 2) knowledge of the evidence base to support change in HPV vaccination practice, 3) familiarity with improvement strategies and action planning, and 4) skill in building relationships.

**Evaluation Methods**

Our mixed methods evaluation involved collecting quantitative data through effort-tracking logs and gathering qualitative data through in-depth interviews with QI coaches (N = 11) who worked with 89 clinics in 3 US states. Data were collected on implementation outcomes and on contextual factors that might explain variations in those outcomes. Implementation outcomes included adoption by clinics, reach to providers and staff (ie, participation in the coaching visit), and implementation fidelity.

**Results**

States achieved either high adoption or high reach, but not both. For example, state A had high adoption with 94% of clinics accepting a coaching visit, but low reach with a median of 1 participant per clinic. In contrast, state C had lower adoption (29%,  $P < .01$ ) than state A but higher reach (median of 4 participants per clinic,  $P < .01$ ). Generally, states had high coaching protocol fidelity with the exception of advising on strategies and action planning. QI coaches described factors that might explain these variations, including strength of relationships with clinic staff and whether they recruited clinics directly or through large clinic networks.



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## Implications for Public Health

Our findings have implications for the design of future QI coaching initiatives, including how coaches recruit clinics to ensure full clinic engagement, refinements to coaching visits, and how QI coaches can effectively engage with clinic networks. Findings could inform future QI coaching interventions to strengthen their impact on public health.

## Introduction

Persistent human papillomavirus (HPV) infection leads to over 34,000 new cancer diagnoses per year in the United States (1). HPV vaccination is highly effective at preventing HPV cancers, yet only 51% of US adolescents aged 13–17 have received the recommended number of doses (2). The Centers for Disease Control and Prevention (CDC) provides funding for immunization quality improvement (QI) coaching to 61 state, local, and territorial immunization programs, with the goal of increasing immunization rates for routinely recommended vaccines, including HPV vaccine (3). CDC provided this coaching through the AFIX (Assessment, Feedback, Incentives, and eXchange) program, which was replaced by IQIP (Immunization Quality Improvement for Providers) in July 2019. The AFIX program engaged staff in state and regional health departments to deliver QI coaching to improve clinics' immunization practices (2). QI coaching, also referred to as "practice facilitation," is an evidence-based implementation strategy defined as a process of interactive problem solving and support that occurs in the context of a recognized need for improvement and a supportive interpersonal relationship (4).

Researchers at the University of North Carolina (UNC) developed an intervention that provides tools and training to support the delivery of QI coaching to improve clinics' HPV vaccination rates (5). In a previous study, we found that the intervention demonstrated a small but significant improvement in HPV vaccination rates in clinics that received HPV vaccination QI coaching, as compared with those that did not (6,7). In the evaluation presented here, we explore factors that influenced the implementation of HPV vaccination QI coaching, with the goal of further refining the intervention.

## Purpose and Objectives

The UNC research team sought to compare the effectiveness of HPV vaccination QI coaching to clinical medical education by conducting a randomized controlled trial in primary care clinics in 3 states (clinicaltrials.gov NCT 5108275). The purpose of this process evaluation was to assess the implementation outcomes for the QI coaching aspect of the trial and explore contextual factors that

might explain variations in implementation outcomes across the states.

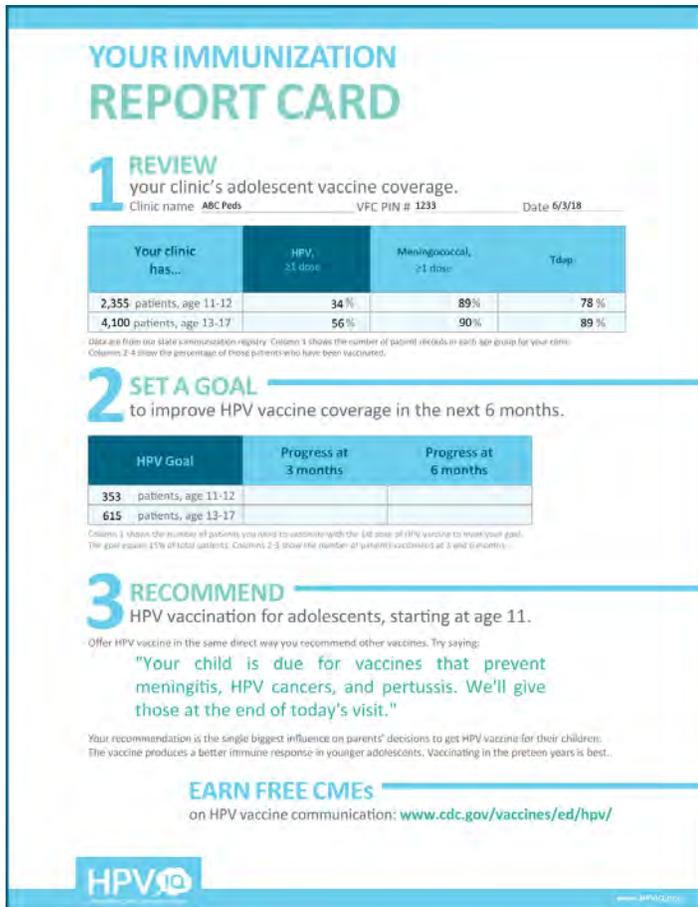
## Intervention Approach

The coaching intervention provided tools and training to support QI coaches who worked in CDC-funded AFIX programs in state or regional departments of public health. AFIX-based QI coaches typically were trained in public health or nursing and made an annual 1–2 hour, in-person coaching visit to a subset of primary care clinics in their geographic regions, following the in-person visit with additional coaching by email or telephone. CDC originally designed the AFIX program to improve vaccination coverage for infants and young children and only later expanded it to improve adolescent vaccination coverage. Given persistently low rates of HPV vaccination, the goal of the HPV QI coaching intervention was to provide coaches with additional training and tools to improve HPV vaccination rates for adolescents.

QI coaching is a widely tested implementation strategy. In a systematic review of 22 studies involving 1,429 clinics, reviewers found that clinics that received QI coaching were more likely to adopt evidence-based guidelines than those that did not (8). The activities involved in QI coaching vary across studies but generally require the 4 core competencies of 1) expertise in using data to drive change, 2) knowledge of the evidence base that drives the change in practice, 3) familiarity with available strategies to implement change, and 4) skills in relationship building (9). UNC's QI coaching tools for HPV are freely available on the project website (<https://www.hpviq.org>). The tools are designed to support the 4 core coaching competencies and include an immunization report card template to increase QI coach competence in using data to drive change, a PowerPoint presentation to support clinic education on the evidence base driving the change in practice, a menu of recommended improvement strategies to implement change, and protocols for guiding clinics in action planning to initiate change.

**Immunization report card template.** The report card template provided QI coaches with a tool that supports their efforts to use data to drive change (Figure). Coaches used the template to translate data from the state's immunization registry into a report card that provides feedback on a clinic's current coverage or percentage of adolescents vaccinated for HPV, as compared with 2 other adolescent vaccines — meningococcal conjugate vaccine and the tetanus toxoid, reduced diphtheria toxoid, and acellular pertussis (Tdap) booster. Assessing and providing feedback on performance is an evidence-based implementation strategy. A Cochrane review found that assessment and feedback generally led to modest (4%–7%) clinically important improvements in pediatric health

outcomes (10). Coaches also used the report card to prompt clinics to set specific goals for improvement.



**Figure.** Template for coaches' immunization report card. Source: <https://www.hpviq.org>.

**Presentation.** Coaches received an HPV PowerPoint slide set to present to clinic providers and staff. The 28-slide presentation began with an overview of the evidence base in support of HPV vaccination as an effective means of preventing cancer in both males and females. The presentation then guided coaches through each step of the QI coaching session, including reviewing the report card, setting a goal for improvement, selecting strategies to improve HPV vaccination, and creating an action plan.

**Menu of recommended improvement strategies.** CDC's standard AFIX protocols provided QI coaches with a list of 19 improvement strategies that varied in feasibility and potential to increase HPV vaccination rates in clinics. The research team reviewed the list and identified strategies with the greatest potential for feasibility and improvements, based on input from academic and practice-

based stakeholders with expertise in HPV vaccination and the AFIX program. As a result, the coaching protocols specified 1 primary strategy (advising providers to recommend same-day HPV vaccination for all patients aged  $\geq 11$  years) and 3 secondary strategies (reviewing CDC guidelines with all immunization staff, training front desk staff on scheduling, and establishing standing orders).

**Protocols for guiding clinics in action planning.** The PowerPoint presentation included slides that prompted participants to identify who is responsible for specific vaccination roles in their clinic, such as scheduling appointments, reviewing and flagging charts, and prescribing vaccines. It also prompted participants to start planning how they would work with people identified to improve clinic vaccination coverage.

AFIX encouraged QI coaches to invite additional clinic staff to participate in the 1-time coaching visit. To increase participation and motivate providers to attend, the intervention offered clinical medical education (CME) credits.

To support QI coaches in using the tools and protocols, the research team engaged 8 coaches and 5 of their supervisors in a 2-day, in-person training. The research team then engaged coaches in weekly conference calls to review coaching and data collection protocols and to solve problems that challenged implementation as they were encountered.

## Evaluation Methods

This mixed methods evaluation involved the collection of quantitative data through effort-tracking logs, and qualitative data by using in-depth interviews with QI coaches who worked in AFIX programs in 3 states, from 2018 to 2019. The University of North Carolina Institutional Review Board reviewed the trial and classified it as exempt.

We selected 3 states to participate in the trial on the basis of their geographic diversity, robust state immunization registries, active AFIX programs, and interest of AFIX program staff. These states were in the southwest (state A), the northeast (state B), and the midwest (state C). Baseline HPV vaccine initiation coverage (for patients aged 13–17 y) was 67.2% for state A, 69.8% for state B, and 64.1% for state C (2).

In each state, clinics were eligible for inclusion if they were pediatric or family medicine practices, Vaccines for Children providers, had between 200 and 7,000 patients (aged 11–17 y), and had baseline HPV vaccine initiation coverage below 85%. The federally funded Vaccines for Children program provides free vaccines to high-priority populations, including children who are

under- or uninsured. Clinics were ineligible if they belonged to a network with over 30 clinics or were pharmacies or school health clinics. States A and C conducted work statewide, while state B worked in 3 large counties. AFIX visits were open to providers, other members of the primary care team including nurses and medical assistants, and administrative staff.

We collected data on the implementation outcomes of clinic adoption, providers and staff reach, and QI coaching fidelity (11), and on contextual factors that might explain variations in those outcomes. AFIX staff in each state maintained a tracking log of the number and proportion of clinics that agreed to participate (ie, adoption) and the number of staff and providers who participated in each visit (ie, reach). Providers were physicians, nurse practitioners, and physician assistants. All other participants were classified as staff. A researcher conducted in-depth phone interviews with QI coaches in each state to assess how they used the HPV coaching tools (fidelity) and to explore contextual factors that might have contributed to variations in implementation outcomes. Interviews followed a semi-structured interview guide that queried coaches about their experiences recruiting clinics and providers for participation in an HPV QI coaching visit and how they delivered QI coaching. The focus of the guide was the coaches' use of recommended tools and fidelity to protocols.

For quantitative data, we compared adoption and reach among the 3 states. We determined if adoption rates varied across states by using logistic regressions followed by Wald tests. We determined if reach to providers and staff (number per clinic who attended AFIX visit) varied across states by comparing rank means using the Kruskal–Wallis and Dunn tests because of skewing of data. Because of the skewed nature of those data, we report medians rather than means for reach. For qualitative data, we recorded interviews, with consent of participants, and transcribed them. We used content analysis to analyze data (12). We developed a set of codes for implementation outcomes and contextual factors that influenced outcomes. For implementation outcomes, codes specified performance of core components of HPV QI coaching, including distributing the clinic report card, setting a goal for improvement, sharing the presentation, selecting improvement strategies, and creating an action plan. During the coding process, codes were developed as needed to fully capture all relevant contextual factors. Coders used ATLAS.ti (Scientific Software Development GmbH), a qualitative software management program, to code the interviews. Coders met to compare and reconcile coding. Once coding was complete, data were put into a matrix that organized findings by QI coach and state, and the research team identified themes related to factors influencing implementation outcomes and how those factors varied across states.

## Results

The total sample for our process evaluation ( $N = 11$ ) consisted of 9 AFIX QI coaches and 2 supervisors who provided HPV QI coaching to 89 clinics in 3 states. State A had 2 QI coaches with a mean of 11.0 years of experience (range, 4–18 years), state B had 5 QI coaches with a mean of 2.3 years of experience (range, 1–6 years), and state C had 2 QI coaches with a mean of 2.3 years of experience (range, 1.5–3 years).

### Implementation Outcomes

**Clinic adoption of HPV QI coaching.** Overall, 63% of invited clinics agreed to participate in QI coaching and completed a coaching visit. Adoption was higher in states A and B, as compared with state C (both  $P < 0.01$ ), with 30 of 32 (94%) clinics adopting in state A, 40 of 44 clinics adopting in state B (91%), and 19 of 65 (29%) adopting in state C.

**Staff and provider reach.** A median of 2 providers and other staff from clinics participated in the QI coaching visit. The total number of participants varied across all 3 states. AFIX visits in state A had a median of 1 participant per visit, and all were staff. State B had a median of 2 participants (1 staff and 2 providers), and state C had a median of 4 participants (4 staff and 1 provider).

**QI coach fidelity to coaching protocols.** QI coaches consistently reported that they used the report card to provide feedback on clinic vaccination data and worked with clinics to set a goal for improving vaccination rates over the next 6 months. Coaches in states B and C reviewed the presentation with participants in the coaching visit. In state A, coaches converted the information into a 1-page handout that they reviewed with participants. Across all 3 states, coaches reported that they worked with clinics to select specific strategies for improving their HPV vaccination coverage. However, coaches did not consistently promote the short list of recommended strategies from the coaching protocol. When interviewed, one-third of QI coaches could not name any of the 4 recommended strategies, and most coaches continued to recommend strategies from the longer list of 19 from the standard AFIX protocol. Only the QI coaches in state C reported conducting action planning with clinics and reported that it was fairly limited. QI coaches in states A and B reported conducting no action planning (Table 1).

### Factors that might explain variations in implementation outcomes

Analysis of the qualitative data suggested several factors that might explain variability in the 3 implementation outcomes (Table 2) of clinic adoption, staff and providers reached, and QI coach fidelity to intervention tools and protocols, as follows.

**Clinic adoption.** QI coaches perceived strong relationships with clinic staff as key to gaining entry to the clinics. In state A, where coaches reported strong relationships with clinic staff, clinic-level adoption was 94%. Low turnover

rates of both AFIX coaches and clinic staff in state A may have contributed to the strength of the relationships. As one of the coaches in state A reported, "When I call them, they see my name. I've been here for 18 years. A lot of the people know me already, so they know when I call, I'm like, 'Guess what? It's time for me to come out again,' and they'll be like, 'All right.'"

In states A and B, coaches reported that they promoted clinic adoption by presenting the coaching visit as a required meeting, with some coaches adding that the visit is required for participation in the Vaccines for Children program. Coaches in state C did not tell clinics they were required to participate in an HPV vaccination coaching visit, which may have contributed to low adoption rates in that state. The prevalence of large clinic networks in state C also might have contributed to a low adoption rate. More than 85% of the clinics in state C were part of a network, and more than 10% of those networks involved 11 or more clinics. In contrast, in state A, none of the clinics were part of a network, and in state B, 52% of clinics were part of networks, most of which (>94%) were small with 4 or fewer clinics. QI coaches in state C reported that they had difficulty directly recruiting clinics that were part of a network. Instead, they had to navigate the network's multilevel hierarchy to identify an individual with the authority to approve a visit. As one QI coach from state C noted, "And then there's also a lot of big systems where the person you call at the clinic is not authorized to say, 'Yes, you can come in and talk to our providers.' And so, [we] may have to go up the chain, but often gets lost..." In state C, administrative personnel often contacted clinics to schedule the HPV vaccination coaching visit, as compared with the other 2 states where most scheduling was done by the QI coaches.

**Reach to providers and staff.** Although state C had the lowest clinic adoption rates, it had the highest average number of staff and providers participating in coaching visits. In contrast, state A had the highest clinic adoption rates and the lowest rate of staff and provider participation in coaching visits. One factor that might account for this is the staff with whom the coach scheduled the visits. In state C, coaches often scheduled visits with a higher-level representative of the healthcare system, such as a quality improvement leader. In state A, QI coaches scheduled their visits with medical assistants in individual clinics who might have lacked influence in the clinic and been unable to persuade providers to attend the visit.

Across all states, time of year appeared to influence provider participation. QI coaches reported that providers were least available to participate in visits during the summer when vacations reduced the number of providers and staff in the clinic; however, workload increased because of sports- and school-related physical examinations. Only a few of the QI coaches viewed CME as an effective incentive to get providers to participate in the visit. Several QI coaches were either not aware that CMEs were available as an incentive or did not know how to request the CME. Several QI coaches reported that, although physicians typically did not participate, they often came in for at least part of the visit.

**QI coach fidelity to HPV coaching protocols.** Factors that appeared to influence QI coaches' overall fidelity to the HPV vaccination coaching protocols were perceived tension for change, knowledge of and beliefs about the HPV vaccination coaching protocols, perceptions of the needs and capacity of the

person participating in the QI coaching visit, and perceptions of the HPV vaccination coaching tools. Coaches who provided high fidelity coaching perceived a need to change their current approach to QI coaching (ie, tension for change). QI coaches in states B and C acknowledged that their QI coaching could be improved, whereas those in state A were content with their current approach and saw little need to change. QI coaches in state A had the most years of experience providing QI coaching and the greatest success persuading clinics to adopt an AFIX visit, both of which might have contributed to a low perceived tension for change.

Knowledge of HPV vaccination coaching protocols varied among coaches, which appeared to limit their ability to deliver the protocols with fidelity. Knowledge of the protocols did not appear to vary by state, but did vary by whether coaches were among the 8 who attended the 2-day training on HPV coaching. In many interviews, when asked about their process of advising clinics on the selection of improvement strategies, QI coaches who did not attend the training reported that they suggested strategies other than those on the list of strategies from the HPV QI coaching protocol.

QI coaches also described how they tailored delivery to match their perceptions of the needs and capacity of clinic staff and providers. This was particularly salient in state A, where medical assistants were the only participants in AFIX visits. QI coaches reported that their perceptions of participant needs and capacity particularly influenced use of the presentation slides and action planning. For example, QI coaches skipped sections of the slides if they felt that the content was already well known. Similarly, they skipped action planning if they felt the person they were meeting with lacked the capacity to make changes to clinic processes. Low fidelity to protocols for coaches working with clinics to develop an action plan was largely due to the perception that action planning fell outside the role of the person participating in the coaching visit. In the words of a QI coach, "[Clinic staff] weren't able to see kind of beyond their role and to talk about other people's roles." In a few cases, reviewers stated that clinics were already performing well and did not perceive a need to participate in efforts to improve their HPV vaccination rates.

QI coaches' positive perceptions of the report card, goal setting protocols, and the presentation slides appeared to encourage their relatively high levels of fidelity in the use of those tools. Across all 3 states, QI coaches reported appreciation for the report card's clarity and conciseness. They all reported using the report card during the coaching visit; however, their perception of the utility of the report card was dampened by clinic staff and provider skepticism about the accuracy of the data reported. Data came from the state immunization registry rather than the clinic's electronic health records. In some cases, clinic electronic health records lacked a direct interface with the state registry, and delays could occur in clinics uploading their data.

The high level of coaches' fidelity to goal setting might be explained by their positive perceptions of the way the vaccination report card stated goals as both a number and percentage of patients. As one QI coach noted, "Putting [the goal] into people, rather than a percentage, really helped them understand it. And they're like, 'Oh...that's only like X amount of kids a month.'"

Coaches in all 3 states valued the way the slide presentation outlined the evidence in support of HPV vaccination. In states B and C, QI coaches also valued the PowerPoint format as a way to structure the visit. A QI coach reported, when people "start going off topic, or they start talking about other stuff, it's really useful to have that PowerPoint to keep the meeting on pace and kind of helping you bring people back."

## Implications for Public Health

The HPV vaccination coaching intervention provided training and tools to support delivery of evidence-based, data-driven coaching to participating clinics in 3 states. Research has demonstrated that QI coaching is effective in improving the implementation of evidence-based interventions (8); however, the effects are often small and little is known about how, why, and when QI coaching works (13). Implementation outcomes in our study varied across the 3 states, providing an opportunity to explore variations in how QI coaching was delivered and factors that might begin to explain when and why those variations occurred.

Among the 3 states, rates of clinic adoption and provider participation varied such that QI coaches either achieved high adoption or high reach, but not both. In states A and B, where QI coaches gained easy access to clinics, coaches were less successful at getting additional staff to participate in the coaching visit. In contrast, in state C, QI coaches had difficulty gaining entry to clinics but were successful in getting multiple providers and staff to participate. This finding suggests that successful implementation of HPV coaching depends not only on clinic adoption of the approach but also on clinic readiness to improve their HPV vaccination practices. In implementation science, readiness is conceptualized as organizational commitment to implementing an innovation, including commitment and involvement of managers and leaders (14). In states A and B, where adoption rates were relatively high, coaches presented the visit as a mandate, and in state A, they additionally scheduled visits with medical assistants who had limited authority. Although clinics in these states adopted the HPV vaccination coaching visit, their leadership was not involved in the decision making, and the clinics might not have been ready to implement change. In state C, where the adoption rate was low, QI coaches had to work through multiple levels of network hierarchy to gain access to clinics. The extra effort required to get network leader-

ship to approve HPV vaccination QI coaching might explain the success those coaches had engaging multiple staff to participate in the coaching visit. Coaches in state C chose not to present coaching as a mandate but instead focused on the benefits of the visit to patient care, which possibly contributed to higher levels of commitment to and participation in the coaching visit. Our findings have implications for the design of future QI coaching initiatives. Careful thought needs to be given to how coaches recruit clinics to ensure that clinics are committed to engaging providers and staff in efforts to improve their HPV vaccination processes. The format of the coaching visit might need refinement to take advantage of the finding that providers often join the visit only briefly. For example, the QI coach may include a brief visit with providers as part of a longer visit with staff. Lastly, as clinic networks continue to grow, QI coaches will need to learn how to effectively engage with these networks.

QI coaches in all 3 states demonstrated high fidelity to some HPV vaccination coaching tools and protocols and mixed or low fidelity to others. Coaches' knowledge of and attitudes toward the tools were central factors influencing fidelity. In all 3 states, QI coaches reported consistent use of the report card and goal setting, which they perceived to be clear and concise. Coaches also valued the content of the presentation slides, particularly the concise presentation of evidence supporting HPV vaccination. Fidelity using the presentation slides was mixed, however, with coaches in 1 state converting slides into a 1-page hand-out. In the other 2 states, coaches reported skipping information or sections of the presentation that were not applicable to staff participating in the coaching visit.

Coaches reported limited fidelity to HPV vaccination coaching protocols for selecting QI strategies and action planning. Although coaches engaged clinic staff in strategy selection, they often promoted the strategies recommended by the traditional AFIX program, rather than the shorter list of strategies included in the HPV vaccination coaching protocols. This highlights the importance of providing booster trainings to ensure that all QI coaches are knowledgeable about the tools and protocols. QI coaches reported that they did little action planning, largely because the staff person participating in the coaching visit lacked the authority to do so. The lack of fidelity to action planning provides further support for the importance of recruiting clinics that are ready to improve HPV vaccination coverage, and, therefore, have the capacity and motivation to develop an action plan. Lastly, study findings on fidelity raise the question of when adaptation might be appropriate to improve the suitability of a tool or protocol to the needs of a particular state or clinic, and when adaptation is not appropriate because it alters 1 of the intervention's 4 core components. Fur-

ther research is needed to answer questions about which aspects of HPV vaccination QI coaching are essential to its effectiveness and which can be adapted.

Our study had several limitations. The HPV vaccination QI coaching intervention was evaluated in only 3 states; therefore, the ability to generalize the findings to other states remains to be established. Factors identified to explain variations in implementation outcomes are based on QI coaches' perceptions; therefore, they are exploratory. Further study is needed to establish which factors influence QI implementation outcomes as well as the impact of those outcomes on vaccine coverage rates.

One of our intervention's strengths was its alignment of tools and protocols with widely recognized QI coaching competencies, including skill in using data to drive change, knowledge of the evidence base informing change, familiarity with strategies to implement change, and skills in communication and relationship building. These 4 competencies provide a foundation for exploring core components of QI coaching. We found that QI coaches maintained fidelity to tools and protocols related to using data to drive change (report card, goal setting). They also maintained fidelity to the presentation of the evidence supporting the change. Even when they switched content to a 1-page format, they retained focus on informing clinics of the evidence base supporting HPV vaccination. Fidelity results were mixed for tools and protocols related to strategies to implement change and begin action planning. This is a concern, because evidence suggests that using data to drive change is most effective when it is coupled with guidance on QI and other change strategies (10). Findings also point to the importance of designing tools and protocols to support communication and relationship building. Careful consideration needs to be given to ensuring that QI coaches engage someone in the clinic (or delivery system hierarchy) who will verify the clinic's readiness to improve HPV vaccination rates and engage providers and staff in the HPV vaccination QI coaching visit.

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## Tables

**Table 1. Quality Improvement Coach Fidelity to Human Papillomavirus Vaccination Coverage Improvement Tools and Protocols**

Tool	State A	State B	State C
Report card: Distribute a one-page summary of vaccination coverage rates.	Yes	Yes	Yes
Goal setting: Set a 6-month goal for improving vaccination coverage rates.	Yes	Yes	Yes
Slide presentation: Present data on the benefits of vaccination.	Partial	Yes	Yes
Improvement strategy selection: Select strategies to improve vaccination coverage rates.	Partial	Partial	Partial
Action planning: Identify specific next steps that clinic staff will take.	No	No	Partial

**Table 2. Possible Factors in Outcome Variation in QI Coaching to Improve Human Papillomavirus Vaccination Coverage**

Factors	Outcomes
Clinic adoption (ie, agreeing to participate in the QI coaching)	Strong relationships between quality improvement coaches and clinic staff were key to gaining entry to the clinics.
	Low turnover rates for both quality improvement coaches and clinic staff contributed to the strength of the relationship.
	Presenting quality improvement coaching as a requirement facilitated adoption.
	Large clinic networks were a barrier to gaining entry to the clinics.
Staff and providers reached (ie, participation in the human papillomavirus coverage coaching visit)	Working with large clinic networks facilitated reach to staff and providers.
	Scheduling visits with medical assistants was a barrier to reaching other staff and providers.
	Summer was a difficult time to reach providers.
	Not all coaches offered clinical medical education (CME) credits and reported mixed perceptions of the effectiveness of CME as an incentive.
QI coach fidelity to coaching tools and protocols	QI coaches who perceived a need to change their current approach reported greater fidelity (ie, tension for change).
	QI coaches who were knowledgeable of QI coaching tools and protocols reported greater fidelity.
	QI coach perceptions of clinic staff and providers participating in the coaching visit (needs and capacity) might have affected fidelity.
	QI coach perceptions of the utility of coaching tools might have explained fidelity.

Abbreviation: QI, quality improvement.

## IMPLEMENTATION EVALUATION

# An Evidence-Based Walking Program in Oregon Communities: Step It Up! Survivors

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## PEER REVIEWED

**Summary****What is already known on this topic?**

Providing technical assistance and small-grant funding to community organizations is a promising approach to support implementation of evidence-based programs.

**What is added by this report?**

Community organizations are challenged by some aspects of implementing an evidence-based program, particularly balancing fidelity and adaptation and conducting a rigorous evaluation.

**What are the implications for public health practice?**

Difficulties experienced by some organizations in balancing fidelity and adaptation of the Step It Up! Survivors program indicate that flexible, individualized guidance and enhanced technical assistance are needed when they are in the process of adapting, implementing, and sustaining an evidence-based program locally.

## Abstract

Physical activity can help mitigate the long-term symptoms and side effects of cancer and its treatment, but most cancer survivors are not active enough to achieve these benefits. An evidence-based strategy to promote physical activity among adults is a community group-based walking program. However, many evidence-based programs do not achieve intended population health outcomes because of the challenges of real-world implementation. We used the Interactive Systems Framework for Dissemination and Implementation to conceptualize implementation of a

capacity-building intervention to support delivery of a community group-based walking program. We adapted an evidence-based guide for community group-based walking programs for cancer survivors and their support network. We provided a capacity-building intervention (technical assistance and small-grant funding) and evaluated this implementation intervention. We assessed effectiveness of the intervention by measuring adoption, acceptability, appropriateness, feasibility, fidelity, implementation costs, and penetration through monthly progress reports, site visit observations, interviews, and a final report. Eight organizations received a small grant and technical assistance and implemented Step It Up! Survivors (SIUS). SIUS helped cancer survivors increase their physical activity, establish social connections, and be part of a supportive environment. Despite receiving monthly technical assistance, some grantees experienced challenges in recruiting participants, developing community partnerships, and adhering to the prescribed implementation plan. Implementation facilitators included community partners and specific components (eg, incentives for participants, webinars). Organizations needed different amounts and types of assistance with adaptation and implementation. Overall fidelity to SIUS ranged from 64% to 88%. Some integrated SIUS within existing organizational programming for sustainability. The provision of funding and technical assistance was a successful implementation intervention. Our results suggest a need to better tailor technical assistance while organizations are in the process of adapting, implementing, and sustaining an evidence-based program in their local communities.

## Introduction

In 2019, approximately 16.9 million cancer survivors were living in the United States, and their number is estimated to increase to 22.1 million by 2030 (1). Cancer survivors experience long-term symptoms and side effects of cancer and its treatment, including pain, fatigue, sleep disturbances, mood disturbances, reduction in quality of life (2), decreased physical functioning, and bone and muscle loss (3). Physical activity can mitigate many of these long-



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term symptoms and side effects (1,3,4). Additionally, regular sufficient physical activity may reduce the risk of recurrence, cancer mortality and all-cause mortality (1,3,4). The American Cancer Society recommends that cancer survivors engage in 150 minutes per week of moderate activity, such as brisk walking (4). The American College of Sports Medicine indicates 90 minutes of moderate level activity mitigates symptoms and side effects of cancer and its treatment (5). Less than half of cancer survivors are sufficiently physically active (6).

Group exercise is a promising approach for cancer survivors. Group and/or supervised exercise has resulted in greater improvements in primary outcomes (eg, fitness, muscle strength) compared with unsupervised and/or home-based interventions among cancer survivors (7). Group walking programs, an evidence-based strategy recommend by The Guide to Community Preventive Services (8), is a promising approach to enhance physical activity among cancer survivors because it is simple, geographically convenient, inexpensive, and suitable for most people. Community-based group walking programs enhance adherence because of the social support and cohesion developed among group members (9).

Public health programs, such as group-based walking programs, should reflect the best available evidence. However, many evidence-based programs (EBPs) do not achieve intended health outcomes because of challenges in implementation. Capacity-building interventions enhance community public health practitioners' adoption and implementation of EBPs (10). The Interactive Systems Framework for Dissemination and Implementation (ISF) describes a process for translating research evidence and supporting community organizations to implement programs to achieve the intended outcomes with capacity building as the central component (11,12). The ISF describes 3 interacting systems: the Prevention Synthesis and Translation system, which distills research, the Prevention Support System, which provides capacity building, and the Prevention Delivery System, which delivers the program (12).

Standard approaches are needed to assess the implementation of evidence-based cancer prevention, control, and treatment interventions. Proctor and colleagues developed a taxonomy of implementation outcomes that includes acceptability, adoption, appropriateness, feasibility, fidelity, cost, penetration and sustainability (13). Using a standard approach to assessing the effectiveness of implementation of capacity-building interventions can allow comparisons across interventions and provide information on the best approaches to promote implementation of EBPs.

## Purpose and Objectives

The goals of this study were to 1) adapt an evidence-based guide for community walking programs for cancer survivors and their friends and family, 2) provide capacity-building support (technical assistance and small-grant funding) for community organizations to implement this program, and 3) evaluate the success of the implementation of the intervention.

We used the ISF to conceptualize implementation of a capacity-building intervention to support delivery of a community group-based walking program. We adapted an evidence-based guide for delivering group-based walking programs for cancer survivors and their friends and family and called the program Step It Up! Survivors (SIUS). We provided capacity-building support, technical assistance, and small-grant funding to community and public health organizations in Oregon.

We used a mixed-methods design to assess the implementation outcomes. We collected qualitative and quantitative data from several sources during the study period. The study was approved by the Oregon Health & Science University (OHSU) Institutional Review Board. The study, including planning, took place from July 2017 through February 2019.

## Intervention Approach

We completed implementation strategies and activities in each of the 3 interacting systems delineated in the ISF: The Prevention Synthesis and Translation System and the Prevention Support System were represented by OHSU and the Knight Cancer Institute. The Prevention Delivery System was represented by the community-based organizations.

### Prevention Synthesis and Translation System

We identified the core elements of a walking program and its key characteristics to meet the needs of cancer survivors through a literature review. We searched PubMed by using the following search terms without limiting study year or study type: "group-based," "community," and "walking program." We adapted an action guide developed by the Partnership for Prevention with support from the Centers for Disease Control and Prevention, *Establishing a Group Based Walking Program to Increase Physical Activity Among Youth and Adults* (14), to create a user-friendly toolkit for use by community-based organizations with programs designed for cancer survivors. Our toolkit (Figure 1) outlined 7 steps to implementing the program. It included a week-by-week timeline and guidance for completing each step and additional resources and deliverables for grantees. The program included

friends and family members of survivors because of the importance of social support for behavior change.



### Program Implementation Steps

- Step #1: Community Engagement
- Step #2: Recruit Walking Leaders
- Step #3: Train Walking Leaders (Train-the-Trainer model)
- Step #4: Select & Map Walking Routes
- Step #5: Publicize Step It Up! Survivors
- Step #6: Organize the Kick-Off Event
- Step #7: Maintain Walking Group & Participant Interest

**Figure 1.** Cover of toolkit developed for Step It Up! Survivors walking program, Oregon, 2017–2019.

## Prevention Support System

### Innovation-specific capacity building

**Small grant funding.** We added a special request for applications to the OHSU Knight Cancer Institute Community Partnership Program ([www.ohsu.edu/knight-cancer-institute/community-partnership-program-grants](http://www.ohsu.edu/knight-cancer-institute/community-partnership-program-grants)), which provides small grants (\$10,000–\$50,000) to community organizations. We issued a request for proposals for implementation of SIUS. Community groups, health and medical clinics, public health departments, and health systems in Oregon that did not have an active walking program were eligible to submit an application for a 1-year \$15,000 grant, plus technical assistance. Before the application submission date, we hosted a webinar about the competitive funding process, and funding decisions were based on proposal review by members of our Cancer Prevention and Control Research Network’s Tribal and Rural Advisory Board, a previous Community Partnership Program grantee, and OHSU researchers. Final funding decisions were made by Community Partnership Program leadership. Funding was provided from January 2018 through December 2018.

**Technical assistance.** The team of researchers worked with grantees to implement the SIUS, including assistance with any relevant regulatory approvals. In March 2018, representatives from each organization attended a train-the-trainer webinar on how to train local community members to be walking group leaders. We facilitated 8 monthly, 60-minute webinars on recruitment, retention, and motivation of walking group leaders and participants, adaptation logs, and program sustainability. Each month, a different grantee made a 30-minute presentation on various topics (eg, data collection techniques, recruiting and retaining walking participants, engaging community partners), leaving 30 minutes for discussion facilitated by the research team. The webinars provided

an opportunity for organizational leaders to learn from and support each other. Additionally, we responded to questions and provided individual guidance to grantees via telephone calls and email.

### General capacity building

In January 2018, we held a training session developed by the Cancer Prevention and Control Research Network, Putting Public Health Evidence into Action ([www.cpcrn.org/training](http://www.cpcrn.org/training)). This 1-day in-person training session provides instruction on implementation of EBPs in public health. This instruction was applied by grantees to the SIUS program, but the skills could also be applied by grantees in future programs.

## Prevention Delivery System

Each grantee was responsible for implementing the SIUS in their community using the toolkit. Program Implementation was divided into 4 phases. The first 3 months involved start-up and program planning, which encompassed the first 6 of 7 steps: engaging the community; recruiting walking leaders; attending a train-the-trainer session; training the walking leaders; selecting and mapping walking routes, securing indoor location for use as needed; publicizing SIUS; and organizing a kick-off event. The second 3 months involved implementation of the program by holding weekly community walking groups for cancer survivors, their family and friends (step 7), continuing to publicize and recruit participants, maintaining interest and attendance in the program, and continuing to engage with the community. The third phase was a 2-month maintenance phase, and the final phase was 2 months for follow-up. In addition, each organization had 2 months to complete a final report.

## Evaluation Methods

We assessed effectiveness of the implementation intervention by measuring acceptability, adoption, appropriateness, feasibility, fidelity, implementation costs, penetration, and sustainability as described by Proctor and colleagues (13), through monthly progress reports, site visit observations, interviews, and a final report (Table 1).

**Community organization reports.** Monthly grantee progress reports described strategies for publicizing SIUS, tactics and incentives used to motivate participants and leaders, walking route, number of groups held, and attendance. A final report gathered data on SIUS objectives and outcomes (eg, create a safe and supportive environment for cancer patients, survivors, and their friends and family to come together for socializing through movement), project reach (eg, number of unique individuals attending groups), community partnerships (eg, number and role of community part-

ners), strengths and benefits of the project, barriers, challenges and lessons learned, future plans, and evaluation of the technical assistance (eg, webinars, trainings, toolkit). The monthly and final reports were completed in a secure online database. Additionally, the grant applications provided information on the grantee (eg, size, rural/urban).

**Fidelity assessment: observation and stakeholder interviews.** For each grantee, research staff members observed a walking group and interviewed the program manager to assess fidelity. During the observation, the researchers completed a fidelity checklist of the key components of conducting a walking group outlined in the toolkit. Key components included characteristics of the walking leaders, the routes, use of team building and social support strategies, and accessibility and aesthetics of walking routes.

One research staff member conducted 30- to 60-minute semistructured interviews with key leadership at each organization and a second staff member completed the fidelity checklist and took notes during the interview. Key components of implementation described in the toolkit that were not possible to observe during the walking group were asked about during interviews, including types of stakeholders engaged in planning and implementation, identification and training of walking group leaders, alternate routes for inclement weather, minimizing loss of interest, and resources used to plan routes.

**Adaptation logs.** We provided organizations with an adaptation log to record adaptations to the program, the date and description of the adaptation, reason for the adaptation, and its level of importance. These logs allowed for comparison across organizations.

**Walking group participant survey.** Walking group leaders invited cancer-survivor participants to complete an online survey at baseline, 3 months, and 6 months. The survey included 11 statements about their experience and satisfaction with SIUS; respondents rated agreement on a scale from 1 to 6 (1 = strongly disagree, 6 = strongly agree). At baseline, the survey also collected information on cancer-survivor participants' demographic characteristics (age, race, ethnicity, highest academic degree attained, marital status, employment status), height and weight, and cancer (type of cancer and number of years since diagnosis).

## Data analysis

**Qualitative data analysis.** We exported notes taken during the leadership interviews and coded them line by line. We exported text from the final project reports into Dedoose version 8.1 (Dedoose, LLC), a web-based program for analyzing qualitative and mixed-methods data. Two researchers coded the texts independently and met to reach agreement. The coding focused on implementation outcomes, barriers, and facilitators.

**Quantitative data analysis.** We exported quantitative data from the monthly progress reports and site visits into R statistical software version 3.5.1 (R Foundation for Statistical Computing), data from the online participant surveys into Stata version X (StataCorp LLC), and data from the fidelity checklist and monthly and final reports into Excel (Microsoft). We calculated descriptive statistics for each organization.

Walking group attendance was recorded each month by each organization. The average weekly attendance is the mean number of people attending a walking session across all groups hosted by an organization. Some organizations had more than one walking group that met weekly. The average monthly attendance is the average total attendance for all organizations across weeks in a particular month.

We measured fidelity to the SIUS implementation toolkit by using a checklist, which we completed during site visits (observations of the group walks), and an interview guide, which we used during interviews of organizations' leadership. We calculated a fidelity score for each of the 7 steps of program implementation as a percentage. The checklist included 9 yes/no questions and 12 questions answered on a scale of 1 to 5; the checklist was also used to record the location and date of the site visit. To assign questions equal weight among the fidelity scores, we coded the rating-scale questions from 1 to 5, and we coded dichotomous questions yes = 5 and no = 1. We did not count responses marked as not applicable or missing in the calculation of the fidelity percentage. This method is commonly used in analysis of survey data (15).

**Mixed-methods analysis.** We placed the coded text and the quantitative results into an implementation outcomes matrix for further analysis. The mixed-methods analysis for organizational-level data spanned 3 areas: measuring program success using attendance data for each organization, assessing fidelity to the SIUS toolkit, and analyzing strategies and tactics to recruit and incentivize walking leaders and participants. Walking group attendance was a quantitative measure of program success, with larger attendance numbers indicating better program engagement. A higher fidelity percentage indicated greater fidelity to the SIUS toolkit. Strategies to recruit and incentivize walking leaders and walking group participants were deduced from the monthly reports, and qualitative themes were deduced from site visit data and monthly reports. We created a case-based matrix with the organizations in rows and the strategies in columns.

Results

Cancer survivor survey results

Sixty cancer-survivor participants completed eligibility screening, 35 met eligibility requirements, 30 consented to participate and completed the baseline survey, and 17 completed the survey at 3 and 6 months. Eligibility requirements included a cancer diagnosis, participation in an SIUS walking group, being aged 18 or older, and ability to speak English. Grantees did not prioritize completion of the online surveys.

Of the 30 cancer-survivor participants who completed the baseline survey, the average age was 60.4 (range, 44–79). Most were non-Hispanic (n = 28) and White (n = 28), had a bachelor’s degree or higher (n = 20), and were married (n = 26). About half were retired (n = 13), and half were employed full-time or part-time (n = 12). The most common form of cancer was breast cancer (n = 21) with time from diagnosis ranging from 4 months to 30 years.

Implementation outcomes

**Adoption.** Ten organizations responded to the request for proposals for implementing SIUS; 8 organizations received awards. Organizations that received awards were local health departments (n = 3), community cancer centers (n = 3), a nonprofit organization that supports cancer survivors (n = 1), and a physical therapy practice (n = 1); 6 were in rural communities.

**Acceptability.** The average weekly attendance varied within and across organizations (Figure 2). One organization followed a different protocol to record walking group attendance than the other 7 organizations; we did not include these data in our analysis. The number of unique participants across all organizations was 258 and included cancer survivors, their family and friends, and community members. The median number of participants across all organizations was 34. The median number of monthly walking group attendees per organization ranged from 6 (Organization H) to 114 (Organization B). The median weekly attendees per group was 12 and the average weekly attendance per organization was 13.7.

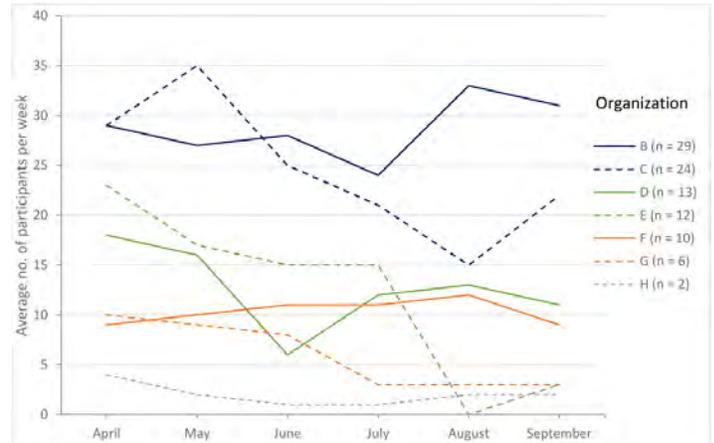


Figure 2. Average weekly attendance in walking group by organization and by month.

Overall participant feedback was positive. Six organizations reported that their participants enjoyed the program and kept coming back. Additionally, organizations reported that walking group participants developed connections with each other. Anecdotally, cancer survivors reported having stronger social connections and a more positive outlook on life than before participating in SIUS and the value of receiving and giving peer support to their fellow cancer survivors. One community organization reported the following: “There was an overwhelming support from individuals volunteering to become walking leaders, as well as walking participants. The success led to friendships and socializing. There is a core group of walkers that faithfully attend and help welcome in new walkers.” Another stated, “The greatest success was the social connections created. Everyone agreed that being with and meeting others was a huge highlight of the program.”

Of the 17 participants who completed the online survey at 3 months, 16 agreed or strongly agreed that they were satisfied with the walking leader, the walking routes, and the program. At 6 months, all 17 survey respondents slightly agreed, agreed, or strongly agreed that they were satisfied with the walking leader, the walking routes, and the program.

**Appropriateness.** Walking was generally considered by organizations’ leadership and walking leaders an appropriate form of exercise for cancer survivors because they could move at “their own pace and ability.” Five of 8 sites reported that their participants experienced increased physical activity, health benefits, and social connectedness and engagement. As one organization stated, “Having this weekly walking group has created a safe space for our patients who are currently undergoing treatment to come and move

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at their own pace and ability, while meeting and talking with survivors who have been in their shoes.” Another stated, “Participants reported significant improvements to health and cited increased social engagement as their primary participation benefit.”

At 6 months, 15 of 17 survey respondents agreed that the program helped them increase their physical activity, 17 agreed the program was a good way to be physically active, and 16 reported feeling connected to other members of the walking group who were supportive of each other.

Five organizations stated that participants wanted the groups to continue after the end of the project. Reasons provided by the organizations for discontinuing the walking groups included climate, (ie, high temperatures and unsafe air quality from wildfires), lack of commitment from organizational leadership, challenging retention during the summer because of summer travel and vacations, and weak community partnerships.

**Feasibility.** All organizations reported that they implemented at least 1 walking group during the study period. Some organizations experienced low attendance and challenges with keeping walking leaders engaged over the 3 months (Table 2). Challenges in retaining walking leaders included life changes (eg, changing job, moving away), summer travel, and physical limitations (some walking leaders were receiving cancer treatment that affected their ability to fulfill their role). All organizations found the data reporting requirements of the grant burdensome.

All organizations used the strategies suggested in the toolkit to publicize walking groups. The most common strategies were word of mouth, social media, and posters around the community. Other strategies for recruitment and retention included advertising with local media and engaging other community organizations or stakeholders. The grant required use of participant incentives to encourage retention; grantees used raffles, gift cards, and promotional products. One organization commented, “Program participation incentives were cited [by participants] as being an important element of the program’s success, making it fun to participate.”

Despite these strategies, organizations that were not connected with a cancer center reported difficulties reaching cancer survivors. Three organizations described challenges with recruitment. Five organizations expanded walking groups to include community members interested in prevention and making healthy choices. One organization reported challenges with recruiting walking leaders, and 1 organization reported challenges establishing community partners. All organizations used outdoor walking routes, and 4 organizations secured indoor locations for inclement weather (eg, poor air quality from forest fires, high ambient temperatures), allowing weekly groups to continue.

**Fidelity.** Fidelity was the degree to which the SIUS program was implemented as delineated in the toolkit. The number of adaptations across the 7 steps ranged from 0 to 4 (Table 3). Fidelity ranged from 62% (step 1; 225 of 360 possible points) to 86% (step 6; 212 of 245 possible points). Not counting missing responses and those marked not applicable toward scores, average fidelity across the steps for each organization ranged from 64% (163 of 255 possible points) to 90% (230 of 255 possible points). We asked grantees to propose and discuss adaptations with the research team to determine whether the proposed adaptation would affect the evidence-based components of the program; we planned to approve adaptations determined not to have an effect. This discussion often occurred, but the research team was not always aware of adaptations until after they had been made; some implemented adaptations were not approved by the research team.

Five organizations implemented program adaptations. The most common adaptations were aimed at increasing reach, receptivity, and participation, including design changes to SIUS outreach materials, such as expanding audiences to include all community members interested in becoming more physically active and social and increasing the frequency of walking group meetings to twice per week per the interest of walking group participants. One adaptation fundamentally changed SIUS from a group-based to an individual-based walking program: the definition of attending a walking group was changed to include participants who sent an email to the walking group leader indicating that they had walked that week. Although this adaptation was viewed as more inclusive, the expanded definition conflicted with a key premise of SIUS about the importance of the group in providing social support, connectedness, and accountability. This adaptation was not pre-approved.

**Cost.** Each organization received approximately \$15,000 to implement SIUS; this amount varied slightly depending on the budget requested by the organization. The grant required that at least \$1,000 be allocated for participant incentives. Organizations also received in-kind donations from community partners (eg, space, personnel paid by a partner, volunteer hours). All organizations reported implementation of SIUS within the budget as planned, including in-kind donations.

**Penetration.** The number of walking groups held in each organization ranged from 1 to 9, with a mean of 5.2 walking groups per organization. One organization stated, “We set a goal of establishing 1 walking group and significantly exceeded our expectations with 5 active walking groups in our community.”

Two organizations reported incorporating the walking program into existing organizational structures. One organization reported that SIUS was co-promoted with another well-known wellness

program in the organization, which contributed to successful recruitment. As one organization stated, “This walking group has become a part of the survivorship and cancer support/education group program that is led by the Oncology Social Worker, which promotes the likelihood of it continuing on into the next year.”

**Sustainability.** Four organizations reported that their program was highly likely or somewhat likely to be active 1 year after the funding period. These organizations reported that the largest contributing factors to expected sustainability were integration of the walking groups into existing programs (within their own organization or a community partner) and participant enjoyment. Another contributing factor was the use of volunteers to lead the walking groups. One organization noted, “[The city’s] recreation program has taken on the long-term coordination of Step It Up! Survivors in our town. The group is peer led and does not rely on paid staff [to lead the walking groups].”

## Implications for Public Health

This capacity-building intervention of providing technical assistance and small-grant funding was a successful approach to promoting implementation of an evidence-based community walking program for cancer survivors, their friends, and families. The 8 grantees varied in their capability to achieve success, suggesting the need for tailored technical assistance. Fidelity to the toolkit varied across the 7 steps in the program implementation and across the 8 organizations, suggesting the need for more clarity, more education about the importance of fidelity, and more individualized guidance on balancing fidelity and adaptation. Integration of SIUS into existing programs in the organization and participant enjoyment contributed to the likelihood of sustaining SIUS for at least 1 year beyond the funding period.

Six of the 8 organizations that implemented SIUS were in rural (Rural–Urban Continuum Codes 4–9) communities (16). Rural residents of the United States experience health disparities because of geographic isolation. Compared with their urban counterparts, they have lower socioeconomic status, fewer job opportunities, higher rates of health risk behaviors, limited access to health care specialists and subspecialists, and less likelihood to have employer-provided health insurance coverage; if they are experiencing poverty, they are often not covered by Medicaid (17–19). Cancer survivors living in rural areas are diagnosed at later stages of disease and have more barriers to cancer prevention, control, and treatment than their urban counterparts (17,19). SIUS provided a supportive health promotion activity to cancer survivors, their family, and friends in an environment where health disparities persist.

Organizations commented that walking groups were an important source of social support for cancer survivors. Extension of the walking groups to cancer survivors’ friends and family and, in some locations, the broader community expanded the network of social support.

Capacity-building interventions providing technical assistance and/or small-grant funding have been found to enhance the adoption and implementation of EBPs (10,20–24). Similar to this study, other mini-grant programs have resulted in the recipient organizations building and strengthening partnerships with other community organizations (20,24). However, community organizations are typically set up for program delivery and not for evaluation; thus, it was challenging for community organizations receiving capacity-building interventions to complete the evaluation steps (eg, data collection, data analysis). All grantees reported that they did not prioritize participants completing the online surveys, as reflected in the low number who completed eligibility screening, and they found the grant reporting requirements burdensome. Similarly, in a mini-grant program, community organizations found it challenging to prioritize data collection for evaluation (23), and in a countywide mini-grant initiative, organizations did not have the capacity for evaluation (eg, lack of time, skill, and resources) (25). It is critical to determine the effectiveness of capacity-building interventions to enhance organizational capacity to adopt, implement, and sustain delivery of EBPs as well as ascertain the effectiveness of the EBP to achieve desired outcomes in the local setting. Thus, the Prevention Support System delivering the capacity-building intervention may need to provide additional support for data collection and evaluation to ensure evaluation of effectiveness.

Although key leadership from each grantee received training on fidelity and adaptation, we found a range of fidelity to and adaptations of the SIUS toolkit. A potentially inappropriate adaptation could compromise an underlying evidence-based component of a group-based walking program, as we found in the broadening of the definition of a walking group attendee. In a mini-grant program in which recipients received training on adaptation and fidelity of evidence-based interventions, the organizations made substantial alterations that might have changed the evidence-based components of the programs (22). In another, the grantees were challenged by balancing fidelity with adaptation, and some grantees dropped core program elements (26). Although retaining the core elements that produce the desired outcomes from the EBPs is critical, some adaptation is necessary to enhance a program’s relevance, community reach, alignment with local resources, and program sustainability (26). This balancing of fidelity and adaptation is difficult and requires careful consideration of the underlying theory and evidence base of the program as well as

the community needs, desires, barriers, and facilitators to program implementation. The challenges of balancing fidelity and adaptation of EBPs, despite generalized training on these concepts, suggests that in addition to generalized training, individualized local guidance on fidelity and adaptation is needed. Our rural SIUS grantees faced several challenges, including a small number of community partners with whom to collaborate in program promotion and recruitment of walking leaders and participants. Additionally, Oregon had an active wildfire season in 2018. Poor air quality was more prevalent in rural locations than urban locations and affected scheduled walking sessions.

We found that community organizations with previous program implementation experience were able to build on that experience and move through the steps in the SIUS toolkit better than organizations with less experience. Although we delivered technical assistance through multiple modalities, including telephone calls, emails, training sessions, and monthly webinars, we did not tailor our approach to the experience of each organization. Providing technical assistance in a flexible manner that aligns with and addresses organizational realities (eg, leadership, resources) and is both relationship building and content driven has been effective in promoting implementation of EBPs (21,27). Assessing community and organizational readiness for implementing an EBP and tailoring technical assistance approach, type, and intensity to that level of readiness could enhance the effectiveness of the capacity-building intervention and harmonize the overall allocation of resources for the intervention.

Our study has several limitations. It was conducted in Oregon only, so results may not be generalizable to other areas of the United States. We did not audio record interviews with key stakeholders and despite careful notes taken during the interviews, some responses from interviewees may not have been fully reflected. Because of a short funding cycle, we could not follow up 1 year after the start of the walking groups to assess sustainability. The community organizations had challenges recruiting and retaining cancer survivors, and most opened the groups to any community member. Strengths of this study include use of theoretical framework, ISF (12), to conceptualize the capacity-building intervention; the implementation and evaluation of a community walking program for cancer survivors, a group for whom few community programs exist, particularly in rural areas; and the use of implementation outcomes suggested by Proctor and colleagues (13). Overall, we believe this study provides support for the use of capacity-building interventions to promote the implementation of EBPs by community organizations.

Use of the ISF helped us to conceptualize the elements and relationships of key stakeholders (eg, universities, community organizations) involved in providing a capacity-building intervention

aimed at disseminating and implementing an evidence-based community health walking program for cancer survivors. The capacity-building intervention (technical assistance and small-grant funding) was a successful approach for dissemination and implementation of SIUS. Difficulties experienced by some organizations in balancing fidelity and adaptation of the SIUS program indicates that flexible, individualized guidance and enhanced technical assistance are needed while organizations are in the process of adapting, implementing, and sustaining an EBP locally. Use of capacity-building interventions to promote and guide the implementation of EBPs by community organizations is an effective method to achieve a program's intended population health outcomes. Members of this research team have applied for funding to expand the scope of group walking programs for cancer survivors, their family and friends, as well as community members in rural locations throughout Oregon.

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## Tables

**Table 1. Implementation Outcome Definitions and Data Sources for Implementation of an Evidence-Based Walking Program in Oregon Communities: Step It Up! Survivors, 2018**

Outcome	Definition	Data Sources
Acceptability	Perception among stakeholders that the program was agreeable and satisfactory	Final project report; satisfaction survey; attendance records
Adoption	Uptake of the program by the organization and community	Grant application; monthly progress report
Appropriateness	Perceived fit, relevance, and compatibility of the program for a given setting	Final project report; monthly progress report; satisfaction survey
Feasibility	The extent to which the program can be carried out	Monthly progress report; final project report
Fidelity	The degree to which the program was implemented as prescribed	Site visits; interviews; adaptation logs
Implementation costs	The costs of implementing the program	Monthly progress report; final project reports
Penetration	The degree to which the program is integrated within the setting	Final project report; monthly progress report
Sustainability	The extent to which the newly implemented program will be maintained or institutionalized	Final project report

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**Table 2. Challenges and Facilitators, by Implementation Step and by Organization, During Implementation of an Evidence-Based Walking Program in Oregon Communities: Step It Up! Survivors (SIUS), 2018**

Organization: Rural/Urban and Type	Step 1: Community Engagement	Step 2: Recruit Walking Leaders	Step 3: Train Walking Leaders	Step 4: Select and Map Walking Routes	Step 5: Publicize SIUS	Step 6: Kick-off Event	Step 7: Maintain Walking Group and Participant Interest
<b>Organization A: Rural, nonprofit organization</b>							
Facilitator	Program promotion; garnered support of community leaders; established community partners	Committed walking group leaders	Walking group leader toolkit	Public partnership with community partners provided walking routes and maps	Promoted walking group among cancer survivor support groups	None reported	Solicited and integrated input from walking group leaders for quality improvement; integrated program into organization's budget; support from organization's leadership
Challenge	Community engagement required significant investment of staff time	None reported	None reported	None reported	None reported	None reported	None reported
<b>Organization B: Rural, nonprofit</b>							
Facilitators	Community partnerships resulted in exceeding expectations for walking group participation; Program built on and enhanced existing community partner walking and physical activity programs to create awareness and participation countywide	Community partner provided a volunteer staff member who helped recruit walking leaders and supported program coordination; Celebration of walking group leaders at a community cancer tribute event co-hosted by and the American Cancer Society revitalized partnership between the two organizations and renewed interest in community for programs for cancer survivors	Community partner helped recruit walking group leaders	Community partner provided walking group venue, mapped walking routes, registered participants, and reported attendance data from their group to project coordinator; Walking group leader toolkit	None reported	None reported	Participants liked walking venues/routes; Participants established important social bonds and were the impetus to sustain the program
Challenges	None reported	None reported	None reported	None reported	None reported	None reported	None reported
<b>Organization C: Urban, for-profit</b>							
Facilitators	Recruiting through existing cancer survivor support groups	Community of active cancer survivors ready and willing to lead walking groups	Walking group leader toolkit	Parks and Recreation Department active and supportive in developing walking group routes	Targeted recruitment to cancer survivors and their networks	None reported	Program organizer participated as active member in walking group; Participant incentives
Challenges	None reported	None reported	None reported	None reported	Flyers were not an effective recruitment tool	None reported	Low walking group participation; walking leader

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Organization: Rural/Urban and Type	Step 1: Community Engagement	Step 2: Recruit Walking Leaders	Step 3: Train Walking Leaders	Step 4: Select and Map Walking Routes	Step 5: Publicize SIUS	Step 6: Kick-off Event	Step 7: Maintain Walking Group and Participant Interest
							was in active cancer treatment limiting ability; Inability to continue providing participant incentives
<b>Organization D: Rural, public health/government</b>							
Facilitator	None reported	Recruited at community events and cancer center; Cancer center provided walking group leaders	Walking group leader toolkit	County Sherriff provided guidance in determining walking routes	Cancer center and community partners publicized SIUS	Offered flexibility by hosting 2 kick-off events	Community partner provided incentives to participants
Challenge	Finding community groups/organizations interested in partnering on this project	None reported	None reported	None reported	None reported	None reported	Difficulty finding time and location amenable to all participants
<b>Organization E: Rural, nonprofit</b>							
Facilitator	Interest in the community to participate; Participant incentives	Support from individuals volunteering to become walking leaders and participants	Walking group leader toolkit	Community partners located indoor walking route as alternative for inclement weather	Cancer center publicized SIUS	Kick-off event used to increase awareness and number of participants	Friendships, opportunity to socialize, and peer support from cancer survivors led to sustaining walking groups; Cancer Center absorbed advertising and participant incentive costs to sustain program
Facilitator	None reported	None reported	None reported	None reported	None reported	None reported	Hazardous air quality from wildfire smoke led to postponement of walking groups for a period of time
<b>Organization F: Rural, public health/government</b>							
Facilitator	Community nonprofit and for-profit partners promoted SIUS and supported in recruiting walking group participants and leaders	Adopted a flexible recruitment strategy through social media, in-person direct contact, and community partners	Walking group leader toolkit	None reported	Promoted SIUS through Facebook, local recreation activities guide, and presentations to service groups	Community partner donated food	Yoga studio and a local gym offered discounts for walking group participants; community parks and recreation department assumed program operations and management
Challenge	Lack of follow-through promoting SIUS among some community partners; Problematic to recruit cancer survivors because	None reported	None reported	None reported	None reported	None reported	None reported

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	no cancer center or oncology practices are in the community						
<b>Organization G: Rural, public health/government</b>							
Facilitator	Higher education institution was an important community partner	Community organizations helped recruit walking leaders	Walking group leader toolkit	Community partners provided walking routes on their property; Walking routes included indoor and outdoor options	Community partners promoted program internally and encouraged participation	Community partners donated gift cards for walking group participants	None reported
Challenge	None reported	Retaining walking group leaders was difficult	None reported	None reported	None reported	None reported	Walking group leader inability to continue in role led to group disbanding; Walking group attendance declined during summer months; Program suspended because of staff turnover and inability of other staff in organization to assume program management
<b>Organization H: Urban, nonprofit</b>							
Facilitator	Developed SIUS marketing materials and distributed to oncology centers in a metro area	Paid walking group leaders a stipend	Walking group leader toolkit; weekly informational sessions on fitness (eg, hydration, safety, shoes, nutrition)	Used "Map My Walk" app for walking route flexibility and variation	Created and distributed recruitment materials through various media sources (flyers, posters, social media, neighborhood group meetings); Welcome kits distributed to participants	None reported	Walking groups scheduled at 2 locations, with a selection of multiple days and times (weekday, weekend, morning, and evening)
Challenge	Some community groups unwilling to share information and allow access to survivor groups	None reported	None reported	None reported	None reported	None reported	Program ended prematurely because it lacked sustainable program management leadership

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**Table 3. Step It Up! Survivor Adaptations, by Program Implementation Step, During Implementation of an Evidence-Based Walking Program in Oregon Communities: Step It Up! Survivors, 2018**

Implementation Step	No. of Adaptations	Adaptation Description Reported by Organization
Publicize Step It Up! Survivors (Step 5)	4	Changes to layout, design, and content of promotional flyer
Maintain walking group and participant interest (Step 7)	3	Increased frequency of walking group meeting sessions, changed time of walking group meeting, implemented protocol for walker to maintain participation while on vacation
Train walking leaders (Step 3)	1	Trained new walking group leaders after program implementation began
Select and map routes (Step 4)	1	Added new walking routes after program implementation began
Organize the kick-off event (Step 6)	1	Liability language added to walker registration form
Community engagement (Step 1)	0	None
Recruit walking leaders (Step 2)	0	None

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