PREVENTING CHRONIC DISEASE

PUBLIC HEALTH RESEARCH, PRACTICE, AND POLICY

U.S. Department of Health and Human Services
Centers for Disease Control and Prevention

The Childhood Obesity Research Demonstration (CORD) Project

PREVENTING CHRONIC DISEASE
PUBLIC HEALTH RESEARCH, PRACTICE, AND POLICY

COLLECTION: CHILDHOOD OBESITY RESEARCH DEMONSTRATION (CORD)

Implementation of Multisetting Interventions to Address Childhood Obesity in Diverse, Lower-Income Communities: CDC's Childhood Obesity Research Demonstration Projects

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PREVENTING CHRONIC DISEASE
PUBLIC HEALTH RESEARCH, PRACTICE, AND POLICY
Volume 14, E140 DECEMBER 2017

COMMENTARY

Implementation of Multisetting Interventions to Address Childhood Obesity in Diverse, Lower-Income Communities: CDC's Childhood Obesity Research Demonstration Projects

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Accessible Version: www.cdc.gov/pcd/issues/2017/17_0491.htm

Suggested citation for this article: Dooyema CA, Belay B, Blanck HM. Implementation of Multisetting Interventions to Address Childhood Obesity in Diverse, Lower-Income Communities: CDC's Childhood Obesity Research Demonstration Projects. Prev Chronic Dis 2017;14:170491. DOI: https://doi.org/10.5888/pcd14.170491.

Childhood obesity continues to be a local, state, and national problem affecting not only children but their families, schools, employers, and communities. Obesity affects approximately 12.5 million (17%) US children and adolescents aged 2 to 19 years, with higher levels among some groups of children, including those living in low-income households. Obesity can have harmful effects during childhood. Children who have obesity are more likely to have high blood pressure and high cholesterol, which are risk factors for cardiovascular disease. They are more likely to have asthma, sleep apnea, fatty liver, insulin resistance, and type 2 diabetes. Obesity is also related to psychosocial problems in children, such as anxiety, depression, low self-esteem, and social problems such as bullying and stigma (1). To address obesity, the National Academy of Medicine (formerly the Institute of Medicine), among other groups, has called for interventions to alter nutrition and physical activity environments and promote behavior change in multiple settings to reach adults and children. For children, in addition to the home setting, other settings that can help support obesity prevention and aid healthy child growth include early care and education (ECE) or child care, schools, community, and health care (2).

In 2011, the Centers for Disease Control and Prevention's (CDC's) Division of Nutrition, Physical Activity, and Obesity funded 3 grantees under the 4-year Childhood Obesity Demonstration (CORD) Project. The 3 grantees are located in Massachusetts (MA CORD), California (CA CORD), and Texas (TX CORD). The aim of CORD was to improve weight and healthy growth among low-income children by improving obesity-related behaviors, including diet, physical activity, screen time, and sleep. Grantees engaged with community coalitions and organizations to deliver evidence-based interventions in the places where families live, learn, and seek health care, and they used the Obesity Chronic Care Model (3). The framework and research design of CORD are described elsewhere (4). The MA CORD project was conducted in 2 cities, one with approximately 40,000 residents and the other with approximately 95,000 residents. CA CORD took place in 3 rural communities along the California–Mexico border, and the TX CORD covered catchment areas in 2 large cities.

This special collection features 5 articles authored by CORD grantees and focuses on the real-world implementation of evidence-based interventions across multiple settings (5–9). CORD built on each community's existing work and aimed to improve the knowledge and skills of parents, providers, teachers, and organizational leaders in nutrition, physical activity, and obesity. The collection explores and identifies factors that are critical to stakeholder engagement and implementation of interventions in racially and ethnically diverse communities.

The collection also helps highlight the importance of implementation science. The National Cancer Institute defines implementation science as the "study of methods to promote the adoption and integration of evidence-based practices, interventions and policies into routine health care and public health settings in order to improve our impact on population health" (10). This collection helps further our understanding of how interventions are adopted and integrated into existing organizations such as schools, health care facilities, and child care centers and delves into the factors neces-

sary to build support and engagement for successful implementation. The collection can help local health departments, researchers, organization leaders, and community coalitions plan for and integrate evidence-based prevention and lifestyle-management interventions into routine settings for all children, by describing not only what to do but how to do it.

Overview of articles in the collection

The article by Ganter et al (5), CORD researchers in Massachusetts, examines the role of stakeholder engagement to support the implementation of the multisetting CORD intervention and uses qualitative methods to identify successes and lessons learned. It offers insight into whole-of-community interventions and helps us understand the need for administrative and leadership support, early involvement of intervention implementers, and the importance of regular communication, especially across the intervention sectors. Researchers cite some of the successes of the MA CORD implementation, including high levels of acceptability of the intervention among target audiences, increased linkages to community resources, and opportunities to implement new intervention activities to benefit children and families in their community. Stakeholders also reported that increased engagement of parents was a vital feature associated with health care visits to primary care providers and providers in the Special Supplemental Nutrition Program for Women, Infants, and Children program. Parent engagement also improved participation rates in school activities. Stakeholders posited that improvements could have resulted from MA CORD's consistent messaging to parents and families about 5 critical health behaviors along with increased community awareness of the problem of childhood obesity.

Researchers in CA CORD, Chuang et al (6), examined factors affecting implementation of the CA CORD intervention. They interviewed stakeholders and project leaders across each of the 3 rural CORD settings (school, ECE, and health care) and found similar implementation facilitators and barriers across the settings. Facilitators included engaging parents and obtaining support from all levels of the organization, including higher levels of organization leadership and key staff members, such as teachers who carried out intervention activities. Reported barriers included staff turnover and limited access to supportive resources in the community at large. Addressing these barriers may be particularly important in rural communities like those in CA CORD.

Byrd-Williams et al (7) help further our understanding of the perspectives of ECE providers such as directors and teachers. Their cross-sectional study elucidates how Head Start directors and teachers were meeting best practices for nutrition and physical activity and the barriers these important caregivers faced in implementing best practices. Common barriers such as lack of time, resources, and funds were cited by both teachers and directors. Public health practitioners may consider addressing these barriers when planning and implementing evidence-based ECE interventions.

CDC's *School Health Guidelines to Promote Healthy Eating and Physical Activity* recommends comprehensive school interventions that have an impact on both nutrition and physical activity (11). However, more can be learned about how stakeholders in schools can increase capacity to undertake comprehensive interventions. The article by Blaine et al (8) focuses on the school setting. It uses a mixed-methods approach to describe facilitators and barriers to implementation in the 2 school districts in Massachusetts that participated in the CORD intervention. Facilitators included having the principal as a champion, using students as peers to engage other students, and integrating school-wide messaging strategies. Barriers included competing needs from standardized testing and academic requirements, teachers not being informed about the intervention, and staff turnover. The authors outline 4 essential lessons that may be helpful to researchers and practitioners in carrying out school-based interventions.

Finally, an article by Barlow et al (9) describes the real-world experiences in the health care setting related to recruitment and enrollment of low-income children with obesity from primary care practices into an intensive childhood obesity intervention based in the community. This descriptive analysis provides insight into what factors might cause providers to refer children to behavioral weight-management programs such as those in TX CORD and, more importantly, what factors influence families to enroll in these programs. Information in this article can help inform others about what strategies might be effective for recruiting children in low-income families into family-centered childhood weight-management programs.

This collection sheds light on factors affecting the implementation of multisector interventions or whole-of-community interventions, including what resonates with diverse stakeholders. These articles contribute to knowledge about how to effectively coordinate and implement approaches that aim to prevent childhood obesity and support children and families in diverse communities already struggling with obesity.

Acknowledgments

The authors acknowledge the principal investigators and research staff at each CORD study site as well the guidance and efforts of CDC staff in the Division of Nutrition, Physical Activity, and Obesity and Division of Population Health: School Health Branch. The findings and conclusions in this report are those of the authors and do not necessarily represent the official position of CDC.

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PREVENTING CHRONIC DISEASE
PUBLIC HEALTH RESEARCH, PRACTICE, AND POLICY
Volume 13, E147 OCTOBER 2016

ORIGINAL RESEARCH

Factors Affecting Implementation of the California Childhood Obesity Research Demonstration (CA-CORD) Project, 2013

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Suggested citation for this article: Chuang E, Brunner J, Moody J, Ibarra L, Hoyt H, McKenzie TL, et al. Factors Affecting Implementation of the California Childhood Obesity Research Demonstration (CA-CORD) Project, 2013. Prev Chronic Dis 2016;13:160238. DOI: http://dx.doi.org/10.5888/pcd13.160238.

PEER REVIEWED

Abstract

Introduction
Ecological approaches to health behavior change require effective engagement from and coordination of activities among diverse community stakeholders. We identified facilitators of and barriers to implementation experienced by project leaders and key stakeholders involved in the Imperial County, California, Childhood Obesity Research Demonstration project, a multilevel, multisector intervention to prevent and control childhood obesity.

Methods
A total of 74 semistructured interviews were conducted with project leaders (n = 6) and key stakeholders (n = 68) representing multiple levels of influence in the health care, early care and education, and school sectors. Interviews, informed by the Multilevel Implementation Framework, were conducted in 2013, approximately 12 months after year-one project implementation, and were transcribed, coded, and summarized.

Results
Respondents emphasized the importance of engaging parents and of ensuring support from senior leaders of participating organizations. In schools, obtaining teacher buy-in was described as particularly important, given lower perceived compatibility of the intervention with organizational priorities. From a program planning perspective, key facilitators of implementation in all 3 sectors included taking a participatory approach to the development of program materials, gradually introducing intervention activities, and minimizing staff burden. Barriers to implementation were staff turnover, limited local control over food provided by external vendors or school district policies, and limited availability of supportive resources within the broader community.

Conclusion
Project leaders and stakeholders in all sectors reported similar facilitators of and barriers to implementation, suggesting the possibility for synergy in intervention planning efforts.

Introduction

Approximately one-third of US children are overweight or obese (1). Rates are particularly high among Hispanic children and those living in rural communities (1). To more effectively prevent and control childhood obesity, policy makers and practitioners have begun to promote social ecological approaches that simultaneously target changes in multiple sectors and at multiple levels of influence (2).

Preliminary evidence suggests that multisector, multilevel approaches can promote health behavior change and prevent child weight gain (3,4). However, the success of such approaches is contingent on their ability to effectively engage and coordinate activities across diverse community stakeholders (5,6). Differences in community stakeholders' readiness and willingness to implement policy, system, and environmental changes can significantly affect whether targeted improvements to children's health and well-being are achieved and sustained (7–9).

We conducted semistructured interviews to identify facilitators of and barriers to implementation experienced by project leaders and stakeholders involved in a multisector, multilevel intervention for

childhood obesity prevention and control. Participating stakeholders were located in 3 sectors with high potential to affect childhood obesity — health care, early care and education, and schools — and represented multiple levels of influence within their respective organizations (eg, organizational leaders and frontline staff). Findings contribute to knowledge about how to more effectively coordinate and implement social ecological approaches for obesity prevention and control.

Methods

Data were drawn from the evaluation of the Imperial County, California, Childhood Obesity Research Demonstration project (CA-CORD) (10). Rates of childhood overweight and obesity in Imperial County are among the highest in California (47% in Imperial County vs 38% in the state overall) (11). Most residents are Hispanic/Latino (83%), and almost one-quarter (24%) live in poverty (12). CA-CORD is 1 of 3 studies funded by the Centers for Disease Control and Prevention to test the effectiveness of integrated health care and public health evidence-based approaches to prevent and control childhood obesity (13). CA-CORD used a 2 × 2 factorial study design to assess changes in body mass index in 1,183 children aged 2 to 11 years assigned to 1 of 4 conditions (health care and public health intervention, health care intervention only, public health intervention only, or control). Intervention activities focused on improving 4 health behaviors: fruit and vegetable consumption, water consumption, physical activity, and sleep. Consistent with a social ecological approach (14), CA-CORD activities spanned multiple sectors (eg, health care, early care and education, schools) and levels of influence (individual, family, organization, and community); cross-sector coordination occurred via a CA-CORD community advisory committee that included members of each sector, some of whom were also members of the Childhood Obesity Prevention Alliance led by the local public health department. A brief overview of CA-CORD intervention activities is provided in Table 1; more detailed information is available elsewhere (11,15).

A multiple holistic case study design was used, with participating organizations as the unit of analysis (16). Of the 29 organizations from the health care, early care and education, and school sectors participating in CA-CORD during fiscal year 2013, 27 agreed to participate in this study. We interviewed 68 key stakeholders from these organizations (25 from health care, 17 from early care and education, and 26 from schools), including senior leaders responsible for the decision to participate in CA-CORD (eg, clinic CEO, school superintendents [n = 8]), middle managers and other leaders whose support or participation could affect implementation (eg, principals, clinic managers [n = 30]), and frontline staff directly responsible for implementation (eg, health care and early care and education providers, community health workers, school teachers [n = 30]). CA-CORD project leaders responsible for liaising with organizations to implement CA-CORD activities (n = 6) were also interviewed to provide context about the status of intervention activities in each sector, resulting in a total of 74 respondents.

All interviews were conducted in 2013, approximately 12 months after year-one implementation of CA-CORD intervention activities. Interviews were conducted by trained interviewers in respondents' language of choice (English or Spanish) using a semistructured interview guide tailored to respondents' role in the organization. Interview questions (available from the authors upon request) were informed by the Multilevel Implementation Framework (MIF) (15), a conceptual framework of factors affecting implementation of multisector, multilevel approaches. Organization-specific constructs relevant to this study included previous experience promoting healthy behaviors, compatibility with organizational values and priorities, compatibility with existing work processes, leadership support, and implementation climate (ie, the extent to which intervention use is expected and rewarded by the organization). Additional constructs of interest included the characteristics of people involved (ie, frontline staff responsible for implementing CA-CORD and of participating children and/or families), connections to the broader community, and the strength of the external support system (eg, trainings and intervention-specific materials provided by academic-community partners).

On average, interviews lasted from 30 to 60 minutes. With respondents' permission, most (95%, n = 70) were recorded. For the remaining interviews (n = 4), notes were used in place of a recording.

All recordings were transcribed verbatim. Interviews conducted in Spanish were translated into English by a certified translator. Final transcripts and interview notes were imported into the qualitative software NVivo 10.0 (QSR International) for analysis. We used template analysis (17), in which an initial codebook informed by the MIF was refined to incorporate emergent themes. Initial codes were applied to a subset of 6 transcripts. Coding was compared for consistency by a second person, and the codebook was revised to clarify construct definitions or better highlight critical themes. All transcripts were subsequently coded by 2 investigators. Discrepancies in coding were discussed until consensus was reached. Within-case and between-case analyses focused on the degree to which specific constructs emerged in the data and the degree to which each construct was perceived as affecting implementation. Coded data were also analyzed to identify similarities and differences by sector.

Results

Three community health care clinics, 13 early care and education centers, and 11 schools agreed to participate in the study. On average, respondents from these organizations were aged 45 years and had been with their organization for 8 years. Most were female (86%) and Latino/Hispanic (69%). All respondents reported facilitators of and barriers to implementing CA-CORD. We summarized major themes according to key MIF constructs (Table 2) and provided illustrative quotations (Table 3).

Previous experience promoting healthy behaviors

Previous experience promoting healthy behaviors varied across sectors. In the clinic setting, providers and staff reported distributing educational materials to families but otherwise did not have prior experience promoting healthy behaviors among pediatric patients. For these providers and staff, CA-CORD was viewed as providing important, additional resources that supported their work with children and families. By contrast, respondents in most early care and education centers (10 of 13) and all schools (11 of 11) had prior experience implementing programs to promote healthy behavior, such as Head Start's I Am Moving, I Am Learning initiative (18). For staff in these centers and schools, CA-CORD was often perceived as supplementing existing curriculum by providing additional, structured activities they could engage in with the children (Table 3, quotation 1). In a few cases, these activities were perceived as competing with other programs (quotation 2). In several schools, a previous failed effort by the district to implement the SPARK (Sports, Play, and Active Recreation for Kids) physical education program (SPARK-PE) (19), because of insufficient teacher training, was identified as contributing to teacher resistance to implementing CA-CORD.

Compatibility with organizational values/priorities and existing work routines

In general, respondents in the health care and early care and education sectors described CA-CORD as highly compatible with organizational priorities (Table 3, quotations 3 and 4). Perceptions of CA-CORD were more mixed in schools; respondents in 5 of 11 schools identified CA-CORD as a low priority for their organizations. Primary reasons given for this low rating included competing demands and a need for teachers to focus on academic outcomes for which they were held accountable, such as reading and math (quotation 5). Respondents who rated CA-CORD more highly typically perceived a greater association between healthy behaviors and successful learning or felt that activities achieved multiple purposes (eg, improved both physical health and cooperative social behavior).

Perceptions of CA-CORD's compatibility with existing work routines also varied across sectors. In the health care sector, respondents described CA-CORD as highly compatible with their existing work routines and not particularly time-consuming to implement (Table 3, quotations 6 and 7). In schools and to a lesser extent in the early care and education sector, CA-CORD activities were described as time-consuming to learn and difficult to implement given competing demands on teachers' and providers' time. This perception was particularly true for SPARK-PE activities, which were often outside teachers' and providers' comfort zones and viewed as more difficult to implement than other CA-CORD activities (quotation 8).

Leadership support and implementation climate

Senior leaders in all 3 sectors were generally supportive of CA-CORD. However, this support was typically passive, with the most commonly reported indicator being permission to participate in CA-CORD activities. The major exception was the superintendent of one school district who was heavily involved in district wellness committee meetings and willing to allocate significant resource support for CA-CORD. Many respondents within this district identified this resource support, which included funds to hire a part-time physical education support staff member, as a valuable facilitator to project implementation.

Respondents indicated that middle managers, such as early care and education directors and school principals, varied in their support for the project. For example, in several schools, principals were described as actively engaged in promoting CA-CORD, for example, by frequently interacting with teachers to ensure they had the support needed to implement intervention activities (Table 3, quotation 9). In other schools, principals either took no action or engaged in behaviors that negatively affected implementation (eg, in one case by reprimanding a teacher who allowed students to leave the classroom to get a drink of water).

In all 3 sectors, respondents indicated that engaging in CA-CORD activities was not expected or rewarded by leaders in their organizations (Table 3, quotation 10). This perception was particularly strong in the school sector. For example, even though California's education code requires that students engage in 200 minutes of physical education every 10 school days, several respondents admitted that teachers often did not achieve this requirement and that conformity to education code requirements was not enforced by leadership (quotation 11). However, multiple respondents also indicated that regular, supportive contact from CA-CORD staff during training sessions and staff meetings created a positive implementation climate even in the absence of more proactive leadership support and follow-up within the organization (quotation 12).

Characteristics of frontline staff and children and families

Respondents in the health care and early care and education sectors identified the supportive attitudes of frontline staff as facilitating the implementation of CA-CORD activities. In schools, teacher buy-in was inconsistent and served as either a barrier or a facilitator, depending on whether teachers resisted or championed the project (Table 3, quotation 13). Consequently, CA-CORD staff reported needing to allocate time to engage teachers as well as principals (quotation 14).

Respondents in all 3 sectors identified parent engagement (or lack thereof) as significantly affecting implementation, because it affected whether healthy behaviors were reinforced in the home (quotations 15 and 16). Although some respondents reported ongoing efforts to engage parents (eg, by distributing materials that would allow parents to try CA-CORD activities at home), most simply identified lack of parental engagement as a barrier to improving targeted health behaviors. In the health care setting, several respondents identified income and language barriers as contributing to lack of parent engagement in CA-CORD (quotation 17).

In 2 of the 3 sectors (early care and education and school), respondents also identified child engagement as affecting implementation. For example, several teachers and providers noted that they could not force resistant children to participate in SPARK exercises or to try healthy foods (quotation 18). However, in some centers and schools, highly engaged children enhanced teachers' and providers' enthusiasm for the project and also spurred behavior change in teachers.

Connection to broader community and external support system

Although CA-CORD project staff identified many initiatives intended to promote healthy behaviors that were taking place in the broader community, most frontline staff were either not aware of them or felt they were still not sufficient. Several respondents expressed frustration that their efforts to promote healthy behaviors were not reinforced by others in the community, either because of limited resources or general lack of support (Table 3, quotations 19–21). Nonetheless, respondents in all sectors felt that connections to the broader community were critical for reinforcing the healthy behaviors promoted by CA-CORD and ensuring sustainable change.

In all 3 sectors, respondents identified technical assistance and support provided by CA-CORD project staff as critical for maintaining project momentum and ensuring activities did not fall by the wayside (quotation 22). Additional facilitators to implementation included the use of a participatory approach by CA-CORD project staff and the decision to gradually introduce intervention activities in a way that would minimally disrupt existing work schedules (quotation 23).

Other facilitators and barriers

In all sectors, staff turnover was described as a barrier to implementation. In the health care sector, turnover of community health workers contributed to project costs and delayed implementation of educational workshops for families. In the school sector, turnover of principals and other administrative personnel negatively affected leadership support for CA-CORD and necessitated additional effort by CA-CORD staff to re-engage staff at the affected schools. In the early care and education sector, participating centers were all part of large agencies that purposely rotated staff annually. This movement of early care and education providers, supervisors, and even directors was a barrier that had to be taken into account when planning and implementing CA-CORD activities.

Discussion

Theoretical constructs identified in the MIF were useful for summarizing the major facilitators and barriers experienced by key stakeholders in implementing CA-CORD. Perceptions of the strengths of the external support system and of the importance of parent engagement were remarkably congruent across sectors and consistent with previous research indicating the importance of robust academic–community partnerships and family engagement for health behavior change in rural communities (20). Respondents also consistently emphasized the importance of the broader community for reinforcing health behaviors. Similar to previous literature on innovation implementation (21), study findings confirmed that prior experience with programs promoting healthy behaviors helped strengthen perceived compatibility of CA-CORD with existing work processes. However, particularly in cases of prior failed implementation (eg, in the school district that had previously implemented SPARK-PE with limited success), previous exposure could also increase staff resistance to implementation. Respondents in all 3 sectors identified turnover at multiple levels of the organization as a barrier that should be addressed in the program planning process (eg, by incorporating a train-the-trainer model or other strategies for minimizing knowledge loss due to turnover) (22).

Several sector-specific issues were also identified. In the school sector, lower perceived compatibility of obesity prevention and control activities with organizational priorities contributed to variable leadership support and greater emphasis on the importance of

obtaining teachers' buy-in and support for CA-CORD. Strict scheduling in the school sector also meant that planning for CA-CORD activities needed to be completed by the end of the previous academic year. In the early care and education sector, where centers were often smaller or reliant upon relationships with external vendors to provide services, space constraints and limited control over foods served to children limited staff ability to implement CA-CORD as intended.

In general, however, similarity in the facilitators of and barriers to implementation identified by project leaders and key stakeholders suggest the possibility of common ground in collaborative efforts to develop and sustain social ecological approaches to prevent and control obesity. In particular, findings reinforce the importance of taking a participatory approach during the planning process and of ensuring that proposed changes are introduced in a time frame and manner compatible with stakeholders' work processes and priorities. Specific actions taken by the CA-CORD team to facilitate implementation included conducting formative assessments to assess organizations' receptivity to proposed project activities and engaging community members to better understand organizations' different needs and priorities. Study findings also indicate that the support of senior leaders is necessary but not sufficient for program success; strategies for cultivating buy-in of staff at multiple levels within participating organizations should be considered.

This study had several limitations. First, implementation is often a dynamic, nonlinear process (23). These data provide an overview of key facilitators and barriers to implementation encountered by organizations during the first intervention year of CA-CORD but may not represent a comprehensive list of relevant issues over time. Second, this study focused on a limited number of organizations within a single, rural county in California, which may limit generalizability to other settings. Finally, resource constraints and our desire to minimize respondent burden meant we only interviewed a limited number of people within each participating organization. Although we interviewed a diverse sample of respondents at different levels within each organization and theoretical saturation was achieved (ie, later interviews did not generate new insights to research questions), study findings may not capture all facilitators and barriers encountered during implementation.

Despite these limitations, this study contributes to the literature by capturing the perceptions of project leaders and key stakeholders regarding facilitators and barriers experienced in implementing multilevel approaches to childhood obesity prevention and control. Congruity in perceptions of certain facilitators and barriers represents not only critical points to consider during intervention planning, but also key areas in which stakeholders could fruitfully collaborate in developing and implementing social ecological approaches to obesity prevention and control.

Acknowledgments

This research was supported by the Centers for Disease Control and Prevention (award no. U18DP003377) and by the Johns Hopkins Global Obesity Prevention Center, which is funded by the National Institute of Child Health and Human Development (no. U54HD070725). The authors thank Hena Din and Priscilla Rios for their assistance with conducting interviews.

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Tables

Table 1. Summary of Key Intervention Components in Each Sector,[a] California Childhood Obesity Research Demonstration Project (CA-CORD), 2013

Sector/Personnel	Intervention Component
Health care Providers, medical assistants, patient care coordinator, CHWs, and CHW coordinator	• 3 largest primary care clinics within 1 federally qualified health center • Delivery system design (eg, obesity care team, modifications to electronic health records to facilitate assessment and treatment of childhood overweight and obesity) • Practice team preparation including staff and provider training (4.5 hours for providers, 4 hours for staff, 136.5 hours for CHWs) • CHW-led family wellness and physical activity workshops (11 hours total per family) based on previous, evidence-based interventions (24–26)
Schools[b] Administrators, teachers, school nurses, school wellness committee	All public elementary schools (N = 13) • School wellness policy change • SPARK (19) (3–6 hours of training and curriculum access) • BMI measurement (4–8 hours of training) • Structural water promotion • Sleep curriculum and tip sheets • Parent outreach (eg, letter tailored to child BMI) • Social marketing campaign
Early care and education centers[c] Directors, providers	Early care and education centers in 4 agencies (N = 13) • NAP SACC (27) • Wellness policy change • SPARK (19) (7 hours of training and curriculum access) • Quarterly trainings (3 hours each) and technical assistance • Physical activity equipment • Cooking toolkits • Social marketing campaign
Community Coalition coordinator, public health officials, parks and recreation coordinators, restaurant managers/ owners	• CA-CORD Advisory Committee that included members of COPA, which is led by local public health department (quarterly meetings to raise awareness of activities in each sector) • Community-level social marketing campaign

Abbreviations: BMI, body mass index; CHW, community health worker; COPA, Imperial County Childhood Obesity Prevention Alliance; NAP SACC, Nutrition and Physical Activity Self-Assessment for Child Care; SPARK, Sports, Play, and Active Recreation for Kids.

[a] This study focused only on facilitators of and barriers to implementation experienced by key stakeholders in the health care, schools, and early care and education sectors. Data on community recreation departments are not included, because intervention activities were being conceptualized during intervention year one; data on restaurants and on factors affecting family engagement with CA-CORD are described elsewhere (28,29).

[b] To be eligible for CA-CORD, school-aged children needed to attend one of these schools.

[c] Early care and education intervention activities were conducted in 2 temporally distinct waves; this study includes only the 13 early care and education centers that participated in intervention year-one CA-CORD activities.

Table 2. Factors Affecting Implementation of California Childhood Obesity Research Demonstration Project (CA-CORD), by Sector, 2013

Factor	Sector		
	Health Care Clinics (N = 3)	Early Care and Education Centers (N = 13)	Schools (N = 11)
Prior experience promoting healthy behaviors	Clinics previously distributed educational materials to families but otherwise no experience promoting healthy behaviors among children	• 10 of 13 centers had previous experience with programs promoting healthy behaviors • Prior experience made staff more receptive to CA-CORD • Curriculum from other programs may "compete" with CA-CORD activities	• All schools had prior experience with programs promoting healthy behaviors • Other programs can "compete" with CA-CORD activities • Previous implementation failures can generate resistance
Compatibility with organizational values and priorities	In all 3 clinics, CA-CORD described as high priority because of high prevalence of chronic disease in the patient population and the importance of preventive care	• Six of 13 centers identified CA-CORD as a high priority; only 2 centers described it as a low priority • Behavior changes promoted via CA-CORD perceived as beneficial for center staff as well as children	• In 5 of 11 schools, CA-CORD described as low priority; only 2 schools identified it as a high priority • Perceptions of compatibility strongly affected by respondents' individual values • Perceived compatibility higher for multipurpose activities that address not only physical activity but also positive social interactions
Compatibility with existing work processes	CA-CORD activities relatively easy for providers and staff in all 3 clinics to incorporate into daily schedule	• Once trained, no difficulty incorporating CA-CORD activities into staff's daily routine • Staff release time to participate in voluntary physical education training can be challenging	• CA-CORD activities can be difficult to incorporate into daily schedules given limited time and teachers' need to focus on academic outcomes
Leadership support	• High level of leadership support in all 3 clinics • Support from senior leadership primarily expressed by permitting providers and staff to participate in CA-CORD • Providers described by staff as highly supportive	• Leadership supportive of CA-CORD at all 13 centers • Support primarily expressed by permitting center staff to participate in CA-CORD	• Leadership support highly variable across districts and schools • In 3 of 11 schools, new principals were not aware of previous or current programs promoting healthy behaviors
Implementation climate	• Implementation by providers not recognized or rewarded by leadership • Limited data made available regarding clinic performance in assessing or treating overweight or obese pediatric patients	Implementing CA-CORD not required or rewarded by leadership	• Implementing CA-CORD not required or rewarded by leadership • Consistent, supportive contact from CA-CORD staff can create positive implementation climate even in the absence of more proactive leadership support within the organization
Characteristics of individuals involved	• Front office staff can assist with distributing promotional materials to families • Family engagement significantly affects implementation • For low-income families, cost of care, limited time, and lack of transportation are major barriers to engaging in CA-CORD • Important to present information in families' primary language	• Child engagement can affect staff's ability to implement CA-CORD as intended • CA-CORD activities could better engage parents to ensure healthy behaviors are reinforced in the home	• Teacher buy-in significantly affects CA-CORD implementation and is strongly affected by perceived program benefits and ease of use • Many teachers not comfortable implementing physical education and require additional support • Parents' lack of interest can be a barrier to promoting healthy lifestyles in the broader community
Connection to broader community	• Informational materials should be distributed in many places, not just the pediatric department	Staff were not aware of broader efforts in the community but thought such efforts were critical for ensuring actual behavior change	• Principals in 4 of 11 schools were aware of broader efforts in the community

Abbreviation: SPARK-PE, Sports, Play, and Active Recreation for Kids physical education program.

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(continued)

Table 2. Factors Affecting Implementation of California Childhood Obesity Research Demonstration Project (CA-CORD), by Sector, 2013

Factor	Sector		
	Health Care Clinics (N = 3)	Early Care and Education Centers (N = 13)	Schools (N = 11)
	• Some awareness of CA-CORD activities in the broader community		• Supportive resources for children who were overweight or obese not always readily available in the community
External support system	• CA-CORD promotional materials helped reinforce verbal messages from providers and staff • Participatory approach in the planning stages of the project important for buy-in	• Gradual introduction of CA-CORD activities can prevent staff from being overwhelmed • Careful adaptation of CA-CORD activities to match existing resources at each center can help minimize burden on staff • Hands-on demonstrations of how to implement CA-CORD activities critical for effective implementation by staff, particularly for SPARK-PE	• Regular attendance at staff meetings and/or other follow-up important for obtaining buy-in from teachers • Developing a curriculum guide with structured lesson plans can enhance teacher buy-in by making it easier to implement the intervention • Resource support particularly important for building teacher comfort with CA-CORD activities related to physical education
Other facilitators and barriers	Turnover of community health workers can increase training costs	• Turnover in administrators and frontline staff can negatively affect buy-in to the program and the consistency with which it is implemented • Smaller centers able to implement CA-CORD more quickly • Space constraints can limit ability to implement CA-CORD activities • Centers serving prepackaged meals purchased from external vendors cannot control foods served to children	• Administrative turnover, particularly of principals, can negatively affect support for CA-CORD activities • To accommodate academic scheduling needs, planning for intervention activities must be completed before end of previous academic year

Abbreviation: SPARK-PE, Sports, Play, and Active Recreation for Kids physical education program.

Table 3. Illustrative Quotes, by Theoretical Construct, California Childhood Obesity Research Demonstration Project (CA-CORD), 2013

Construct	Quote
Prior experience promoting healthy behaviors	1. "We always had movement songs and exercises in previous years, but with SPARK now we follow specific instructions to the songs on the CD." 2. "Yes, [but] we had to cut other activities in order to implement [CA-CORD]. . . ."
Compatibility with organizational values and priorities	3. "This is a high priority for us. We have a high incidence of our population from children to adults that are obese. . . . It's really a chronic disease issue. . . . Obesity turns into hypertension and diabetes and other issues. . . . It is really a big factor within our organization." 4. "We are doing it for the children's benefit . . . for better, healthy, nutritious lives." 5. "Basically, what teachers are held accountable for, what they feel most strongly about in terms of teaching and their expected outcomes, is math, reading, language arts . . . that's where the priority is."
Compatibility with existing work processes	6. "For me, [CA-CORD] is less than I was doing prior. Before, I was trying to do everything on my own. Now I can say, 'Here, I have help!' . . . and I'm not doing everything on my own. It saves me time, maybe an hour or two per week." 7. "I still see patients as usual . . . nothing [changes] except putting in the referrals . . . an hour a week, I guess." 8. "PE is outside a lot of teachers' comfort zones."
Leadership support	9. "Our principal wants us to try [CA-CORD]. . . . She's definitely very supportive. . . . She's always asking 'Do you need anything? How's it going? Do you need more training?' You just know she's there if needed."
Implementation climate	10. "No one comes to me once a week and says, 'This is what we need to do, this is what we need to improve.' No one has come to me with this information." 11. "Some teachers didn't even take their kids out to PE. Even though it was education code, they would skip it completely. There's no follow-through from administration to make sure teachers do what they're supposed to do." 12. "[CA-CORD staff] kept checking up with us every month or so to see how we were doing in and present to the staff, so, yes, it felt like we were expected to participate."
Characteristics of individuals involved	13. "Some teachers really gung-ho. They're enjoying it, they like it. And others are like, 'Oh no, another program, another thing to do.' . . . We've got one, she's all gung-ho on it, and she's got us all going." 14. "We did well with superintendents and principals, but where we missed the boat initially was coordinating with teachers and nursing staff. . . . They never got the communication from district administration, and they were the ones that were going to be crucial for actually implementing project activities." 15. "You have to have your parents on board. A major factor for this project, the main thing that will either be successful or unsuccessful, is the parent participation with the children." 16. "I think it's good that parents be included in children's activities, so they know what the program is about. . . . I don't know if you could include these activities in a parent conference or staff–parent meeting, include activities they can do with the children at home." 17. "Families are low-income . . . it's harder for them, plus the schedules, a lot of families work out in the fields . . . they're not going to be wanting to come . . . it's hard for them." 18. "Some of those children . . . they don't always participate in all the activities we offer, and we can't force them. . . . We offer it, we encourage them, but if they don't do there's nothing we can do . . . "
Connection to broader community	19. "Right now, the public health department only has one nutritionist, so it's not enough for the community . . . " 20. "The [families] that wanted to get resources, we didn't have enough to send them to . . . we didn't really solve the true problem in getting them help. . . . We don't have buy-in from the private pediatricians, and we don't have resources locally . . . " 21. "The school nurse mentioned she would send out the referral, and then . . . the pediatrician would tell them 'Oh, you don't really have a problem' . . . and the parents were upset with the nurse . . . so we didn't really have that collaborative support . . . "
External support system	22. "Teachers are not PE specialists. They were trained to teach the academics, so it's nice to bring people in that are PE credentialed to provide that staff development, teach lessons, provide lesson plans for teachers to be able to do with the kids." 23. "In the beginning it was hard. As we became more familiar with [CA-CORD], our contact would say, 'If you guys have any difficulty . . . if you don't understand it, let me know and I'll come and teach you.' That was helpful."

Abbreviations: CD, compact disc; PE, physical education; SPARK, Sports, Play, and Active Recreation for Kids.

PREVENTING CHRONIC DISEASE
PUBLIC HEALTH RESEARCH, PRACTICE, AND POLICY
Volume 14, E08 JANUARY 2017

ORIGINAL RESEARCH

Lessons Learned by Community Stakeholders in the Massachusetts Childhood Obesity Research Demonstration (MA-CORD) Project, 2013–2014

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Suggested citation for this article: Ganter C, Aftosmes-Tobio A, Chuang E, Kwass JA, Land T, Davison KK, et al. Lessons Learned by Community Stakeholders in the Massachusetts Childhood Obesity Research Demonstration (MA-CORD) Project, 2013–2014. Prev Chronic Dis 2017;14:160273. DOI: https://doi.org/10.5888/pcd14.160273.

PEER REVIEWED

Abstract

Introduction
Childhood obesity is a multifaceted disease that requires sustainable, multidimensional approaches that support change at the individual, community, and systems levels. The Massachusetts Childhood Obesity Research Demonstration project addressed this need by using clinical and public health evidence-based methods to prevent childhood obesity. To date, little information is known about successes and lessons learned from implementing such large-scale interventions. To address this gap, we examined perspectives of community stakeholders from various sectors on successes achieved and lessons learned during the implementation process.

Methods
We conducted 39 semistructured interviews with key stakeholders from 6 community sectors in 2 low-income communities from November 2013 through April 2014, during project implementation. Interviews were audio-recorded, transcribed, and analyzed by using the constant comparative method. Data were analyzed by using QSR NVivo 10.

Results
Successes included increased parental involvement in children's health and education, increased connections within participating organizations and within the broader community, changes in organizational policies and environments to better support healthy living, and improvements in health behaviors in children, parents, and stakeholders. Lessons learned included the importance of obtaining administrative and leadership support, involving key stakeholders early in the program planning process, creating buffers that allow for unexpected changes, and establishing opportunities for regular communication within and across sectors.

Conclusion
Study findings indicate that multidisciplinary approaches support health behavior change and provide insight into key issues to consider in developing and implementing such approaches in low-income communities.

Introduction

In the United States, the prevalence of childhood obesity is high: 16.9% of children and adolescents aged 2 to 19 years were obese in 2011–2012 (1). Racial/ethnic and socioeconomic disparities between children of normal weight and obese children also persist (2–4). Obesity is a multifaceted disease, demanding sustainable, multidimensional approaches that support change at the individual, community, and systems levels (5–7). Multidisciplinary approaches are more successful in addressing childhood obesity than are single-site interventions (8,9). A 2016 review showed the promising results of multicomponent community-based interventions designed to prevent childhood obesity (10). In public health research, multidisciplinary interventions play an important role

and should be emphasized (11–14). Funded by the Centers for Disease Control and Prevention, the Childhood Obesity Research Demonstration (CORD) project addressed this demand by incorporating evidence-based approaches (15). CORD is a multisite program that was implemented from September 2012 through August 2014 in Massachusetts, California, and Texas. Obesity is most prevalent in families with low socioeconomic status (4); therefore, CORD targeted underserved children aged 2 to 12 years (15).

This study focused on the Massachusetts site of CORD (MA-CORD). Evidence-based interventions were implemented in 5 community sectors: health care; early care and education; the Special Supplemental Nutrition Program for Women, Infants, and Children (WIC); schools; and after-school programs (16,17). Interventions targeted 5 key behaviors: fruit and vegetable consumption, sugar-sweetened beverage consumption, physical activity, screen time, and sleep duration. These behaviors have strong associations with children's weight development (17). To date, little information is known about the successes and lessons learned from a stakeholder's perspective for implementing multidisciplinary interventions. A Cochrane review called for more qualitative research as part of intervention implementation (18). Although researchers can gain valuable insight from stakeholders' experiences with interventions such as MA-CORD, few studies provide a detailed qualitative account of the implementation process (9,18,19). This qualitative study addressed this gap by outlining successes and lessons learned from the perspective of community stakeholders directly engaged with MA-CORD, including stakeholders from after-school programs, elementary and middle schools, health care, WIC, the parks and recreation department, and coordinators from each community.

Methods

MA-CORD was implemented in 2 communities in Massachusetts (population, 40,545 and 94,958) from September 2012 through August 2014. Poverty rates in both communities are approximately twice as high as the state's average, with a mean income per capita between $12,600 and $14,500 lower than the state average (20,21). Both communities have large non-Hispanic white (~68%) and Hispanic (16%–22%) populations. Interventions were implemented in multiple community sectors (Figure). Details on the intervention components and evaluation design for MA-CORD are available elsewhere (16,17,22).

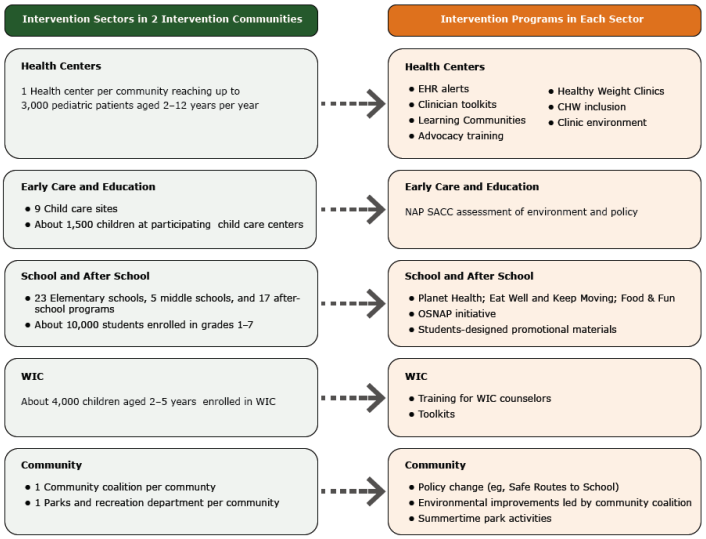

Figure. Summary of intervention sectors and intervention programs (17), study of success stories and lessons learned in Massachusetts Childhood Obesity Research Demonstration project, 2013–2014. Abbreviations: CHW, community health worker; EHR, electronic health record; NAP SACC, Nutrition and Physical Activity Self-Assessment for Child Care; OSNAP, Out-of-School Nutrition and Physical Activity; WIC, Special Supplemental Nutrition Program for Women, Infants, and Children.

Stakeholders from all sectors who were directly (eg, teachers, pediatricians) or indirectly (eg, school principals, program directors) engaged in implementing MA-CORD were invited by email from October 2013 through April 2014 to participate in an interview. We had no other inclusion or exclusion criteria. Up to 2 follow-up emails were sent; stakeholders who did not reply after the third email were counted as nonresponders. We contacted 183 stakeholders and 40 (22% response rate) completed an interview. The study was approved by the institutional review board at the Harvard T.H. Chan School of Public Health. Stakeholders received a $20 gift card as compensation.

A semistructured interview guide was developed to support standardization of interview procedure (Box). Two authors (A.A., C.G.) conducted all interviews by telephone from November 2013 through April 2014. One interview was conducted with 2 stakeholders, the previous and current coordinator from 1 community, resulting in 39 interviews with 40 participants. Demographic information was collected at the end of each interview. The average interview length was 34 minutes, with a range of 16 to 87 minutes.

Box. Sample questions from the semistructured interview guide used for qualitative study of MA-CORD (Massachusetts Childhood Obesity Research Demonstration) project

Organizational and individual role in MA-CORD
What are your organization's and your own role in MA-CORD?
What specific things have you done as part of MA-CORD?
Institutional fit
Does MA-CORD fit with your organization's priorities?
Do you feel it is a high, medium, or low priority for your organization?
What gives you that impression?
Were any competing priorities voiced by staff?
Does MA-CORD fit with your current work tasks and job description?
Can you please explain that a little bit?
Do you feel that your role and work in MA-CORD is valued and recognized?
Successes and barriers, time commitment
Thinking back on your experiences with MA-CORD over the past year, what do you think has been working well?
What problems or challenges (if any) have you, or the staff implementing MA-CORD, experienced?
Parent involvement
How, if at all, has parents' awareness of and/or involvement in childhood obesity changed since MA-CORD was launched?
What do you think is necessary to increase parent involvement and awareness of childhood obesity prevention?
Changes over time
Have there been any major changes in your organization since MA-CORD started?
Linkage
Have you noticed any connection between MA-CORD activities within your organization and obesity prevention efforts within the broader community?
To your knowledge, have children who are overweight or obese been referred to other obesity prevention programs in your community (eg, Healthy Weight Clinic, after-school programs)?
As part of MA-CORD, do you interact with other sectors (eg, school system, health clinics, after school, child care, parks and recreation) in the community?
Closing
If you were giving the choice to be a part of MA-CORD again, would you choose to?
If yes: Why?
If no: Why not?
Is there anything I haven't asked about MA-CORD that you think is important for me to know?

Data analysis

Audio files were transcribed and transcripts were reviewed for accuracy by 1 interviewer (C.G.). Final transcripts were entered into QSR NVivo 10.0 (QSR International Pty Ltd). Data analyses were conducted by using the constant comparative method based in grounded theory. An inductive approach was used (11,23). One coder (C.G.) read 5 randomly selected transcripts representing different sectors to develop a coding framework that reflected successes and lessons learned. This framework was then discussed (A.A., C.G., K.K.D.), and 2 coders (A.A., C.G.) coded 5 additional, randomly chosen interviews. Coding was compared and discrepancies were resolved by the 2 coders (A.A., C.G.). Additional categories were also discussed and added as needed. Remaining transcripts were coded by 1 coder (C.G.). The framework was scrutinized for overlap and subcategory relevance, and a final framework (Table 1) was developed by 3 authors (A.A., C.G., K.K.D.) To attain reliability within the coding process, each decision on changes to the codebook was discussed and documented. Additional coding was conducted if needed. During data collection, an audit trail was used to track interview participants and procedures (24). All 3 coders have a background in public health and experience in qualitative research.

Results

Of the 40 stakeholders, 20 were from schools, 8 from health care, 4 from after-school programs, 3 from WIC, 2 from parks and recreation, and 3 were coordinators from the communities (Table 2). A summary of key successes and lessons learned follows, along with an illustrative quote. Additional quotes are provided in Table 3.

Success stories

Intervention acceptability. Most stakeholders (24 of 39, 62%) supported the program and made it a medium or high priority, and most (27 of 39, 69%) felt that MA-CORD fit into their organization, for example, by delivering similar messages. One stakeholder from WIC said, "I think [MA-CORD] should just be a normal part of everyone's curriculum and messaging."

Increase in parent involvement. About half of stakeholders (20 of 39, 51%) reported an increase in parent involvement. They observed higher participation rates in activities at schools and after-school programs, increased involvement during appointments at health care and WIC offices, and children bringing more healthful lunches to school. Stakeholders pointed to consistent messaging about 5 key behaviors throughout the community, an increase in community-wide strategies, and awareness of childhood obesity as reasons for these changes. A health care stakeholder noted, "The parents are asking questions. They're more engaged when they come in for the visit. . . . Parents are actually coming over to the table asking questions, asking for the brochures — never happened before."

Increased linkages. Two-thirds of stakeholders (26 of 39; 67%) reported improved connections to community resources, such as food services, the Safe Routes to School program, Head Start, and several community parks. Nine (23%) stakeholders said that visible and consistent messaging about MA-CORD and events helped to create linkages between community agencies and foster greater collaboration within organizations. As a WIC stakeholder noted, "We counsel on these same messages, so it's great that they're hearing it out in the community, too, whether it be at Head Start, at the park, at different after school programs."

Opportunities to implement new activities. Most stakeholders (35 of 39; 90%) participating in MA-CORD were able to implement new activities to support increased physical activity and improved nutrition, such as regular walks to school, providing physical activity equipment, adding more healthful choices for breakfast and lunch in schools, offering more fruits and vegetables in schools and after-school programs, and changing menu options in public restaurants. One school stakeholder mentioned, "I've always done something with a walking program, but I really focused a lot on that. We have a walking club. I do it every morning early on. A lot of these things have started or have continued because of the program."

Opportunities to change policies and/or organizational environment. About half of stakeholders (20 of 39; 51%) talked about changes in the policy or food environments, such as eliminating vending and soda machines, providing water instead of soda, and changing the staff handbook to discourage staff consumption of unhealthful snacks in front of the children. A school stakeholder noted the following:

> [The school] took the chocolate milk right off the menu. The kids have white milk or water. . . . The girl that I work with, she said . . . 'The white milk tastes like plastic.' Then after a while she says, "Now that I had the white milk . . . I'm getting used to the taste. I had the chocolate milk and it's so sweet.

Stakeholders' behavior change, buy-in, and perceived responsibilities as role models. Sixteen (41%) stakeholders reported positive changes in staff and child behaviors. In schools, several stakeholders reported that school staff made more healthful choices to model behaviors and that children subsequently changed their eating behaviors. As one teacher said, "I used to bring in a salad every morning. . . . My students actually started doing the same. Instead of eating chips and cupcakes and cookies every day, I'd say probably at least one-third of my kids started bringing in salads in the morning and healthy snacks."

Nine (23%) stakeholders indicated that awareness about childhood obesity and the 5 key behaviors increased. Stakeholders mentioned that they are more aware than before that children are watching too much television or eating too much sugar or that parents are sending requests for more information about the MA-CORD program.

All stakeholders said that they would participate in MA-CORD again, because they were aware of the childhood obesity problem and the impact it was having on their communities and because they believed in the program, as stated from a stakeholder from a parks and recreation department.

> I think that the concept and the structure of it [MA-CORD] is a really good model for other communities to follow. I feel like policy, system, and environmental change really provides the biggest impact at the community level, versus working with individual-level behavior change. Then . . . in terms of all the sectors, with the consistent messaging, is also best practice that other communities should be looking into. Everyone is on the same page with a common vision.

Lessons learned

Leadership and administrative support. Almost all stakeholders (35 of 39; 90%) reported that the presence of leadership and administrative support for the program reduced feelings of conflict between program implementation and other priorities among staff members. A school stakeholder mentioned, "We have very, very good support . . . with the principals in each building. They're extremely approachable about anything that we ask. If we say, 'Hey, you've got an assembly coming up. . . . Can one of those have a MA-CORD component?' They're like, 'Okay.'"

Likewise, the challenges resulting from a lack of buy-in from leaders were described by a school stakeholder who experienced challenges with program implementation when administrative support waned: "They do not even mention it [MA-CORD] anymore. . . . Last year it was 'We want you to do this curriculum,' and this year it's not even mentioned by the administration."

Preparation for unexpected changes. Most stakeholders (22 of 39; 56%) named several unforeseen events during planning and implementing MA-CORD. Turnover caused by retirements, job loss, and resignations was experienced at all levels of staff. A stakeholder from the health care sector said, "The school department, they're so understaffed right now. . . . Trying to get into the school department to try to spread the message or be involved is tough."

Also, new staff were hired and became part of the implementation process. Another unpredictable event was inclement weather, which lead to cancellations of many trainings in the school and after-school sectors, causing delays in program implementation.

Early involvement of stakeholders to assess existing resources. Twelve stakeholders mentioned the importance of assessing the processes and tools that organizations have in place before planning and implementing interventions. They mentioned that they already had access to resources (eg, a system to track height and weight in the clinical sector) and informational material on childhood obesity prevention before MA-CORD was implemented, and either did not understand why their systems should change, or did not find the changes helpful. A stakeholder from the healthcare sector noted, "A lot of the things that they're discussing now, we've already learned or done."

Regular communication. More than half of the stakeholders (23 of 39; 59%) wished for more regular communication and greater clarity about their role in MA-CORD, as described by a school stakeholder:

> I'll be honest with you, I wish I knew more of what was available through MA-CORD. . . . There were a couple of your colleagues here . . . and they were telling me all the things that were available, and I was like, "I didn't know any of that." . . . Sometimes communication in the district is a little difficult. I just wish I knew more about what was available to us.

Cross-sector communication was particularly important. Twelve (31%) stakeholders cited the benefits of exchanging information and ideas during cross-sector training sessions, which helped them to explore new ideas and to discuss their experiences with intervention components and events they had planned. Additionally, stakeholders addressed a communication tool, such as an online platform as opportunity to discuss what is and is not working. An afterschool stakeholder said, "The opportunity to share with the other teams and hear what they're doing, working with the administrators of the program and the specialists to get ideas has been good."

Account for family life circumstances and other barriers. Although a range of strategies were used to accommodate the various needs of families to improve involvement in MA-CORD, 19 (49%) stakeholders named families' lack of financial support and transportation challenges as two of the most common reasons for low program attendance. One WIC stakeholder mentioned, "Our participants are coming in with a range of needs including housing, lack of food, other social issues. Sometimes nutrition is not what we talk about."

Discussion

Overall, we found a high level of stakeholder and community buy-in to MA-CORD with all stakeholders reporting they would implement MA-CORD again. Stakeholders said that the program was a priority for their organization because it was consistent with their organization's goals and provided opportunities to implement new and old activities and policies and support existing ones. Other studies show that changing existing policies or using new policies can ensure program sustainability (19). A novel finding of this study is that stakeholders served as positive role models for families and were motivated to change their own behaviors. These successes may be due to the fact that MA-CORD was implemented by community organizations rather than by researchers. This type of experiential learning can be a motivational tool for behavior change when working with community stakeholders.

Half of all stakeholders described increases in parent participation in activities. Parent involvement is necessary for successful implementation of child health interventions (13,25,26). MA-CORD used diverse strategies for approaching and involving parents; these strategies ranged from in-person counseling at WIC and health care visits, school events that included a MA-CORD media competition (27), and materials promoting the 5 target behaviors that were distributed across sectors. Stakeholders also observed that families faced many challenges beyond nutrition; these are described elsewhere (28). In future interventions, parent involvement could be further enhanced through a more holistic approach that moves beyond a focus on children's diet and physical activity.

Although levels of community and stakeholder buy-in were high in both communities, levels of administrative and leadership support were sometimes low. During these periods, other events, such as an anti-bullying program, were given higher priority. A strong communication strategy directed toward administrators and leaders can help gain their necessary support. Regular staff turnover, particularly in schools, created challenges, because training new staff was logistically problematic. Developing a comprehensive training manual and using a train-the-trainer model may have alleviated some of these challenges. Unforeseen events can be addressed effectively if the project anticipates these possibilities from the beginning. Training sessions were often difficult to reschedule given the number of people involved. In the future, it may be advisable to prepare web-based trainings as alternative. Finally, stakeholders were enthusiastic about cross-sector interactions and communication. However, few of these opportunities were provided in MA-CORD. Future programs would benefit from creating multiple opportunities for cross-sector training and learning collaborations to permit the sharing of resources and lessons learned.

Qualitative studies add to existing epidemiological and behavioral evidence because they may suggest ideas for adapting interventions to community and individual needs (29). This study has several limitations. First, a low response rate could indicate a selection effect in which only the stakeholders most committed to MA-

CORD chose to participate. Another limitation was the use of convenience sampling. Aside from stakeholders' existing involvement with MA-CORD, no other exclusion criteria were defined. As a result, our sample over-represents stakeholders from the school sector. Because we invited all eligible stakeholders to participate, chances were high that a higher portion of school participants would be interested in participating. Finally, because MA-CORD was implemented only in 2 low-income communities in the northeastern United States, findings may not be generalizable to all communities; however, providing a detailed description about the study sample and the 2 intervention communities may still help other researchers to apply our results to their studies (17).

This study contributes to implementation research by identifying important successes and lessons learned in the context of a multisite and multisector program to prevent and control childhood obesity. The insight gained through this process will benefit future interventions by streamlining the implementation processes and anticipating challenges before they occur (18).

Acknowledgments

MA-CORD was funded by the National Center for Chronic Disease Prevention and Health Promotion at the Centers for Disease Control and Prevention (award no. U18DP003370) and by the Pilot Studies Core of the Johns Hopkins Global Obesity Prevention Center, which is funded by the National Institute of Child Health and Human Development (U54HD070725). The authors thank the interview participants, Meghan Perkins, Savannah Lee Vicente, and Katie Giles for connecting us to the communities, Dr Rebecca E. Lee and Neha Khandpur for giving input into qualitative research, the MA-CORD coalition leaders in both communities, and the MA-CORD project team.

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Tables

Table 1. Coding Framework, Including Main Themes, Subthemes, and Definitions for Study on Success Stories and Lessons Learned by Stakeholders (N = 40) in the MA-CORD Project, Massachusetts, 2013–2014

Main theme	Subtheme	Definition
Success stories	Intervention acceptability	Stakeholder's support of MA-CORD. Includes information about whether MA-CORD was prioritized and about the organizational fit.
	Increase in parent involvement	Increase of parent participation and interest in activities related to childhood obesity (eg, participation in school programs, greater interest at physician appointments). Includes information about parents behavior change since MA-CORD.
	Increased linkages	Increase of collaboration, communication, and connections, either within the community or within the organization.
	Opportunities to implement new activities	Opportunities to implement or maintain new activities (eg, nutrition, physical activity, policies) with the help of MA-CORD.
	Opportunities to change policies, organizational environment, or both	Stakeholders talking about the opportunity to change policies, the organizational environment, or both to prevent and control childhood obesity with help of MA-CORD.
	Stakeholders' behavior change, buy-in, and perceived responsibilities as role models	Change in stakeholders' behaviors and how that might have influenced children's behaviors.
	Stakeholders' future intention to participate in MA-CORD	The answer to the interview question "If you were given the choice to be part of MA-CORD again, would you chose to?" was coded here.
Lessons learned	Leadership and administrative support	Information given about the importance of support needed to implement MA-CORD (eg, leadership, staff, administration).
	Preparation for unexpected changes	Any information about unforeseen events (eg, staff turnover, new hiring, weather) that were problematic during the implementation process.
	Early involvement of stakeholders to assess existing resources	All information on the importance to involve stakeholders early in the process (eg, for needs assessment).
	Regular communication	When stakeholders talked about lack of communication or the support of a good communication and communication tools (eg, within the MA-CORD team, within the program itself, within the sector).
	Account for family life circumstances and other barriers	Barriers and circumstances families face in preventing childhood obesity.

Abbreviation: MA-CORD, Massachusetts Childhood Obesity Research Demonstration.

Table 2. Demographic Characteristics of Community Stakeholders (N = 40) in Study on Success Stories and Lessons Learned by Stakeholders in the MA-CORD Project, Massachusetts, 2013–2014

Characteristic	All, N = 40	Community 1, n = 19	Community 2, n = 21
Community sector			
School	20	10	10
Health care	8	4	4
After-school programs	4	1	3
Special Supplemental Nutrition Program for Women, Infants, and Children	3	2	1
Community coordinators	3	1	2
Parks and recreation department	2	1	1
Sex			
Female	36	16	20
Male	4	3	1
Age, y			
18–29	2	0	2
30–39	7	5	2
40–49	8	4	4
50–59	17	7	10
≥60	6	3	3
Ethnicity			
Not Hispanic	38	18	20
Hispanic	2	1	1
Race			
White	36	17	19
Asian	1	0	1
African American	1	1	0
Unknown	2	1	1

Abbreviation: MA-CORD, Massachusetts Childhood Obesity Research Demonstration.

Table 3. Main Themes, Subthemes, and Illustrating Quotes in Study on Success Stories and Lessons Learned by Stakeholders (N = 40) in the MA-CORD Project, Massachusetts, 2013–2014

Main Theme/Subtheme	Quote
Success stories	
Intervention acceptability	"Oh, it's a high priority because it just kind of goes along with what we're trying to do." (WIC)
	"It is right up there with my priorities, because if we don't have healthy kids, we aren't gonna have kids in school to educate." (School)
	"Some of the wellness policies for the city are now going back into the school and then into individual schools. I think it's all tied in well, and right around the same time. MA-CORD, I think, helped to strengthen that message." (School)
Increase in parent involvement	"I think there's certainly in our community just a heightened awareness because of all the efforts that have been done to raise awareness around youth obesity. I certainly think because of the work in all the sectors that there's awareness." (Community coordinator)
Increased linkages	"Some other successes, our peer leaders are . . . going to the Healthy Weight Clinic. They're gonna start going there once a month to help just do activities for kids and promote the five healthy behaviors for the kids going to the Healthy Weight Clinic." (Parks and recreation)
Opportunities to implement new activities	"A couple of the things that we were working on was limiting screen time, serving 100 percent water outside of snack 'cause we serve milk with snack, and to ensure that all children get vigorous physical activity at least 15 minutes a day." (After-school program)
Opportunities to change policies, organizational environment, or both	"There's been a lot of policy changes, I guess you could say, in looking very closely at improving activity opportunities and nutritional value and nutritional — what can be eaten in school and what shouldn't be." (School)
	"I mean, we have no more vending machines. We have water easily accessible to everybody in the health center, including patients, staff." (Health care)
Stakeholders' behavior change, buy-in, and perceived responsibilities as role models	"We mirror what we're trying to teach them. I'm trying very hard to work on the workplace wellness to emulate all of those messages for kids so that it is a constant stream of information and they're not getting mixed messages." (Health care)
	"Because I think I have to model it. If I don't value it, no one else is gonna value it. People look to the leadership to see what's of a value to them. If they look at the leadership and realize it is not of value to the leadership, they won't get behind it." (School)
	"When I first changed the policies for the staff handbook, there was no negative feedback. They completely understood, and they understood that they have to be the positive role models." (After-school program)
	"We can't just preach it to the kids, we have to model it." (After-school program)
Stakeholders' future intention to participate in MA-CORD	"'Cause I think it's so important. I think that we need to focus on these things. WIC is a perfect partner to help with that because of the number of kids that we see, the number of families that we interact with and have a positive effect on them. Absolutely, I would hate to see us not participate." (WIC)
	"I think that the concept and the structure of it is a really good model for other communities to follow. I feel like policy system and environmental change really provide the biggest impact at the community level, versus working with individual-level behavior change. Then, I feel like the model, in terms of all the sectors, with the consistent messaging, is also [a] best practice that other communities should be looking into. Everyone is on the same page with a common vision." (Parks and recreation)
	"I would. I think it's a good program." (School)
Lessons learned	
Leadership and administrative support	"It matters to the superintendent. It matters to the mayor. It matters obviously to the school committee as well, but it matters to our PTO [parent–teacher organization], because the PTO has said to me that it's not as vibrant at other schools because they feel that the principal is not pushing it as much as I am." (School)
	"My director and manager are super supportive and continuously praising us." (Health care)
Preparation for unexpected changes	"Because of the budget cuts and people's positions being lost, there was a lot of movement this month. We have some folks that are teaching fourth and fifth grade this year, who were not teaching at that grade level last year, so we have new people to train." (Community coordinator)
	"We've had to do more with less staff due to budget cuts." (WIC)

Abbreviations: MA-CORD, Massachusetts Childhood Obesity Research Demonstration; WIC, Special Supplemental Nutrition Program for Women, Infants, and Children.

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(continued)

Table 3. Main Themes, Subthemes, and Illustrating Quotes in Study on Success Stories and Lessons Learned by Stakeholders (N = 40) in the MA-CORD Project, Massachusetts, 2013–2014

Main Theme/Subtheme	Quote
	"Then we also have some brand new staff that are really new to [MA-CORD]. They don't know the bigger picture . . . and that's a little more time-consuming getting them up to speed." (School)
Early involvement of stakeholders to assess existing resources	"I have one school that was like, 'Oh my! This is perfect! We needed it so much!' Then I have another school . . . [the physical activity equipment] sat in boxes in the nurse's office for three months." (School)
	"Some of the things that were being discussed on the conference call, as a team, we had already established here or we already had those types of things in place here." (Health care)
Regular communication	"I like listening to different ideas as other schools have done things, so if they have a forum or a blog that we could share information. I think that would be really helpful, because . . . if other schools that have the same kind of demographics that we have, if they've tried something that works, and vice versa, it would be great to hear, so we're not trying to reinvent the wheel. It would take less time and energy to get something in place if they, if some school's already done it." (School)
	"And again it's an opportunity to share information and share ideas and help each other. That's been really helpful." (After-school program)
Account for family life circumstances and other barriers	"Like I was telling you earlier, our participants are coming in with a range of needs, including housing, lack of food, other social issues. Sometimes nutrition is not what we talk about." (WIC)

Abbreviations: MA-CORD, Massachusetts Childhood Obesity Research Demonstration; WIC, Special Supplemental Nutrition Program for Women, Infants, and Children.

PREVENTING CHRONIC DISEASE
PUBLIC HEALTH RESEARCH, PRACTICE, AND POLICY
Volume 14, E03 JANUARY 2017

ORIGINAL RESEARCH

Using School Staff Members to Implement a Childhood Obesity Prevention Intervention in Low-Income School Districts: the Massachusetts Childhood Obesity Research Demonstration (MA-CORD Project), 2012–2014

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Suggested citation for this article: Blaine RE, Franckle RL, Ganter C, Falbe J, Giles C, Criss S, et al. Using School Staff Members to Implement a Childhood Obesity Prevention Intervention in Low-Income School Districts: the Massachusetts Childhood Obesity Research Demonstration (MA-CORD Project), 2012–2014. Prev Chronic Dis 2017;14:160381. DOI: https://doi.org/10.5888/pcd14.160381.

PEER REVIEWED

Abstract

Introduction
Although evidence-based interventions to prevent childhood obesity in school settings exist, few studies have identified factors that enhance school districts' capacity to undertake such efforts. We describe the implementation of a school-based intervention using classroom lessons based on existing "Eat Well and Keep Moving" and "Planet Health" behavior change interventions and schoolwide activities to target 5,144 children in 4th through 7th grade in 2 low-income school districts

Methods
The intervention was part of the Massachusetts Childhood Obesity Research Demonstration (MA-CORD) project, a multisector community-based intervention implemented from 2012 through 2014. Using mixed methods, we operationalized key implementation outcomes, including acceptability, adoption, appropriateness, feasibility, implementation fidelity, perceived implementation cost, reach, and sustainability.

Results
MA-CORD was adopted in 2 school districts that were facing resource limitations and competing priorities. Although strong leadership support existed in both communities at baseline, one district's staff reported less schoolwide readiness and commitment. Consequently, fewer teachers reported engaging in training, teaching lessons, or planning to sustain the lessons after MA-CORD. Interviews showed that principal and superintendent turnover, statewide testing, and teacher burnout limited implementation; passionate wellness champions in schools appeared to offset implementation barriers.

Conclusion
Future interventions should assess adoption readiness at both leadership and staff levels, offer curriculum training sessions during school hours, use school nurses or health teachers as wellness champions to support teachers, and offer incentives such as staff stipends or play equipment to encourage school participation and sustained intervention activities.

Introduction

Childhood obesity threatens the health of American children, especially those in low-income households (1,2). Although evidence

supports the efficacy of school-based interventions in reducing obesogenic behaviors and body mass index (BMI) among children (3–6), limited data describe school districts' capacity to undertake such interventions (7). In 2011, the Centers for Disease Control and Prevention funded 4 grantees to conduct a 4-year Childhood Obesity Research Demonstration (CORD) project aimed at improving low-income children's nutrition and physical activity behaviors. This study describes the implementation of a school-based obesity prevention intervention within the Massachusetts CORD project (MA-CORD) in 2 low-income school districts (8). Using a mixed methods design, we assessed facilitators and barriers to achieving implementation outcomes adapted from the taxonomy of Proctor et al (9). We hypothesized that a classroom-based health behavior intervention for 4th through 7th grade students would be most effective when the school staff felt activities were appropriate, feasible, and supported by district administrators.

Examining implementation outcomes (eg, extent to which an intervention is adopted by teachers) provides context for intervention outcomes (eg, change in children's BMI) and is needed to ensure that interventions are effectively adopted, translated, and sustained in community settings. Implementation outcomes can also serve as proximal indicators of intervention outcomes, which are described elsewhere (10). We provide an overview of MA-CORD adoption, implementation, and potential to be sustained, along with a summary of strategies for remediating implementation barriers.

Methods

MA-CORD was a multilevel, multisector intervention to prevent or control obesity among children aged 2 to 12 years in 2 low-income communities (mean annual per capita income <$35,000) in Massachusetts with greater-than-average prevalence of childhood obesity (combined mean, 26%) relative to national estimates (17%) (10). Community 1's population of approximately 40,000, and Community 2's population of approximately 95,000 each has a single school district. MA-CORD was implemented from 2012 through 2014 across 6 sectors (health care; early childhood care and education; school; afterschool; Women, Infants, and Children [WIC]; and the broad community). MA-CORD targeted obesity-related behaviors: fruit and vegetable consumption, sugar-sweetened beverage consumption, physical inactivity, screen time, and insufficient sleep duration and quality. Detailed information on MA-CORD intervention components is published elsewhere (8,10).

The MA-CORD school intervention consisted of evidence-based components: teacher training, curriculum delivery, use of wellness champions (eg, school nurses, teachers), provision of physical activity supplies (eg, balls, jump ropes), and educational materials (eg, flyers, banners). Each district used one part-time, paid coordinator to oversee administration of MA-CORD. Wellness champions were identified at baseline in each school and compensated $1,000 per academic year to lead school-wide wellness activities (eg, improved policies, fun runs, student media competitions) that reinforced MA-CORD messages and classroom interventions. School nurses received $500 per academic year to support MA-CORD data collection and wellness activities.

We focused on the role of teachers in administering adapted versions of evidence-based interventions designed for students in 4th and 5th grade elementary school (*Eat Well and Keep Moving*) and 6th and 7th grade middle school (*Planet Health*) (3,4). In year 1, teachers received a 3-hour training that introduced curricula materials to be integrated across major subjects (ie, math, language arts, and social studies). In Community 1, teachers were trained during school hours, and MA-CORD funds supplied substitute teachers for the time. In Community 2, teachers were trained after school hours and compensated $100. Teachers were encouraged to incorporate at least 6 lesson plans aligned with MA-CORD behavioral targets per academic year. In lieu of training all classroom teachers, Community 1 administrators opted to train health education teachers exclusively to implement the lessons across grades 4 through 7. Because each health teacher taught multiple classes across grades, this meant fewer teachers required training. In Community 2, both classroom teachers (grades 4 and 5) and health teachers (grades 6 and 7) received training.

We employed a convergent, parallel mixed-methods design (11) to examine facilitators and barriers to implementing MA-CORD. Informed by the taxonomy of Proctor et al of outcomes for implementation research (9), outcomes included were acceptability, adoption, appropriateness, feasibility, implementation fidelity, perceived implementation cost, reach, and sustainability. Throughout the intervention we collected data from school staff members using both qualitative methods (ie, in-depth interviews) and quantitative methods (eg, cross-sectional surveys) to assess these outcomes (Figure 1). Our design was ideally suited for process evaluation because interview findings provided context for outcomes not easily explained through survey data alone.

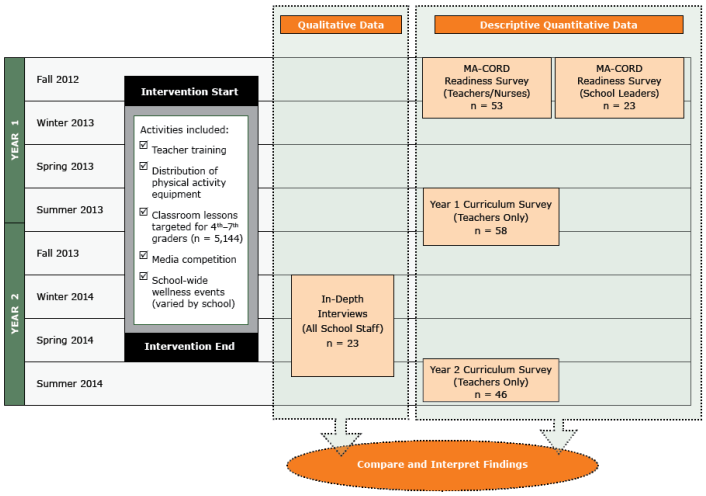

Figure 1. MA-CORD school sector implementation data used in a convergent parallel mixed methods design. The MA-CORD intervention occurred over a 2-year period and was evaluated using both quantitative and qualitative measures.

For both in-depth interviews and readiness surveys we used a convenience sample of school leaders (eg, principals, community coordinators, wellness champions) and staff members (eg, teachers, school nurses) in MA-CORD schools in Community 1 (n = 6) and Community 2 (n = 22). End-of-year curriculum surveys were collected from eligible teachers. The number of eligible teachers varied slightly by year in Community 1 (n = 7 in year 1; n = 6 in year 2) and Community 2 (n = 117 in year 1; n = 122 in year 2). Interviewees from each community were principals and superintendents (n = 5), wellness champions and school nurses (n = 11), and teachers eligible to offer the curricula (n = 7).

Two anonymous surveys were administered at baseline to assess stakeholder readiness for implementing MA-CORD (Figure 1). In addition, 2 anonymous surveys were administered to teachers at the end of each academic year to assess the delivery of the MA-CORD intervention. These surveys were administered online via Qualtrics Insight (Qualtrics) or pen-to-paper (Appendix A, Appendix B). In-depth interviews were conducted by telephone with school leaders and staff members in year 2 to assess implementation of MA-CORD activities. Study procedures were approved by the human subjects committees of the Massachusetts Department of Public Health, Harvard T.H. Chan School of Public Health, Massachusetts General Hospital, and Harvard Pilgrim Health Care Institute in June 2012 (#331765).

Measures

Readiness surveys. Two measures of organizational readiness for change were used to measure program acceptability. The first, provided to school leaders, contained items adapted from an existing tool (12) and assessed school and district readiness for adoption and leadership support for MA-CORD. The second survey given to school staff (eg, teachers, nurses) contained items adapted from an existing readiness-for-change scale for employees within an organization (13,14) to assess staff engagement and support for MA-CORD.

Curriculum surveys. Curriculum surveys collected at the end of years 1 and 2 assessed appropriateness (eg, lessons perceived as positive addition to curriculum), feasibility, perceived implementation cost (eg, perceived competence to teach curriculum, perceived effort to obtain materials to complete lessons), implementation fidelity (eg, proportion of MA-CORD lessons taught), and sustainability (eg, plans to continue offering the lessons in the following year).

In-depth interviews. Using semi-structured interview guides, participants were asked about appropriateness of MA-CORD, barriers and facilitators to adoption, implementation fidelity, perceived intervention cost, and changes in activities over time. To examine sustainability of MA-CORD activities, participants were also asked about intervention reach based on links to activities in their school and community.

Internal records. For each community, we obtained a census roll of superintendents, principals, school nurses, school coordinators, wellness champions, and eligible teachers. These records were updated regularly on the basis of reports from internal research group meetings (eg, staff layoffs, medical leave) or delays in intervention activities (eg, snow days). Sign-in sheets indicated the number of teachers who completed the MA-CORD curriculum training.

Data analysis

We used SAS 9.3 (SAS Institute) to generate descriptive statistics including means, standard deviations, and frequencies for survey and internal record data. Interviews were digitally recorded, transcribed verbatim, and analyzed using NVivo 10 (QSR International). A coding scheme was developed based on a conceptual framework (9) and piloted with 5 transcripts among 3 coders to ensure internal consistency (Appendix C). Transcripts were double coded using the constant comparative method (15) to identify emergent themes, and discrepancies were discussed through peer review to clarify coded passages and resulting themes. Finalized themes

within implementation outcome categories were coded and summarized within and across both MA-CORD communities (Appendix D). Qualitative and quantitative data were triangulated across outcomes to identify factors that influenced implementation.

Results

Table 1 summarizes characteristics of communities, schools, students and staff. Quantitative and qualitative measures were used to assess outcomes based on the taxonomy for implementation research outcomes of Proctor et al (9) (Table 2). MA-CORD implementation barriers and facilitators were assessed during year 2 using in-depth interviews and summarized based on implementation outcomes (Table 3).

Acceptability. Before the intervention, leaders in both districts reported high levels of support for MA-CORD (Table 2). Among school staff members, scores for organizational commitment, motivation, and confidence in their school's ability to support MA-CORD were lower in Community 2 than Community 1. In interviews, staff members in Community 2 discussed concerns about changing administrative priorities and focusing on standardized testing, which competed with outside activities. Acceptability facilitators were preexisting wellness activities related to nutrition and physical activity, parental involvement, and strong principal support.

Adoption. Teachers in both communities participated in MA-CORD curriculum training (C1:100%; C2:72%) and in a curriculum survey in year 1, which assessed initial adoption (C1:100%; C2:44%). Most teachers reported teaching at least one lesson during both year 1 (C1:100%, C2:60%) and year 2 (C1:100%; C2:75%) (Table 2). During interviews, participants from Community 2 described difficulty coordinating afterschool schedules of teachers for training sessions. Teachers in both communities described motivated wellness champions as a driving force behind adoption of MA-CORD lesson plans.

Appropriateness. In interviews, teachers and staff members in both communities reported that MA-CORD training and curricula were appropriate for their students and teaching priorities. In curriculum surveys, teachers in both communities unanimously agreed (n = 35, 100%) that the lessons were a positive addition to their curriculum.

Feasibility. Although teachers in both communities reported being able to obtain necessary lesson materials (>80%), fewer teachers in Community 2 reported feeling competent to teach the content (Community 2, 57% vs Community 1, 86%). In interviews, participants across both communities identified competing priorities for teachers' time as barriers to administering classroom lessons. Standardized tests, statewide campaigns (anti-bullying curriculum), and general burnout were cited as barriers to the staff teaching lessons on wellness or being involved in wellness activities.

Implementation fidelity. In year 1, teachers in Community 1 nearly met the teaching goal of 6 MA-CORD lessons per year (mean, 5.8: standard deviation [SD], 2.7); Community 2 reported fewer lessons (mean, 3.6; SD, 2.5) (Figure 2). In year 2, mean lessons taught dropped slightly for Community 1 and increased for Community 2. In Community 2, administrative changes, including a new superintendent, principal turnover, and district-wide teacher layoffs, were described in interviews as barriers to implementation fidelity.

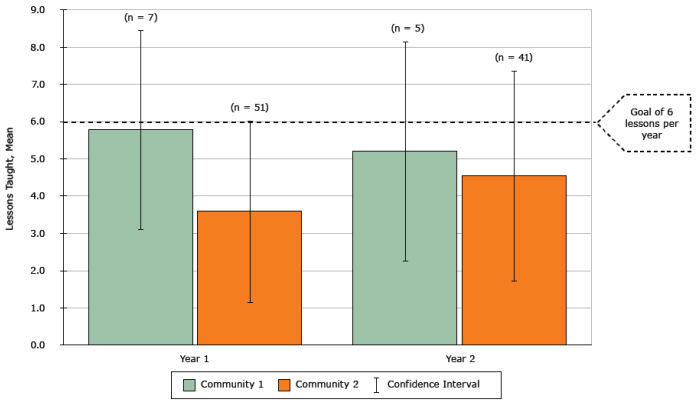

Figure 2. MA-CORD Implementation Fidelity: Curriculum lessons taught by 4th, 5th, 6th, and 7th grade school teachers, Massachusetts, 2012–2014. Using end-of-year surveys, teachers reported the number of lessons taught from the MA-CORD curricula, which were adapted from "Eat Well and Keep Moving" and "Planet Health" (Appendix A).

Perceived implementation cost. In surveys, school leaders in both communities were neutral or agreed that their schools had resources to support MA-CORD and could manage risks associated with implementing the intervention. In interviews, leaders and staff members in both communities reported satisfaction with the availability of supplies and resources needed to implement activities. Community 2 staff members reported receiving physical activity play equipment as a major benefit of MA-CORD participation.

Reach. On the basis of the number of 4th through 7th grade students eligible to receive the intervention; (Community1: 1,486; Community 2: 3,658) (Table 1) and the percentage of eligible teachers who completed trainings (Community 1, 100%; Community 2, 72%) (Table 2), we estimate that 1,486 students in Community 1 (100%) and 2,626 students in Community 2 (72%) were

reached by the intervention. In interviews, leaders and staffs in both communities reported classroom activities effectively tied into larger school and city-wide campaigns, thus increasing student and family awareness.

Sustainability. In end-of-year curriculum surveys in year 2, most teachers in Community 1 (100%, n = 5) and Community 2 (76%, n = 29) reportedly planned to continue teaching MA-CORD lessons. In interviews, staff members described health teachers as strong implementers of the curriculum. One principal made MA-CORD activities part of teachers' professional evaluation, ensuring MA-CORD lessons would be sustained through supervisory accountability. Barriers to long-term sustainability were teacher turnover, lack of ongoing leadership from principals, or lack of active wellness champions.

Discussion

Our study describes barriers and facilitators to implementing a school-based obesity intervention in 2 low-income communities. MA-CORD was adopted at a rate comparable to similar classroom-based lifestyle interventions (16–18) in districts facing competing priorities. Understanding factors facilitating implementation is necessary to develop targeted technical assistance and resources for successful implementation. Our findings provide insight into benefits of pre-intervention assessment of staff readiness and selection of ideal teachers and curricula to ensure activities are integrated and sustained in schools. Our study yielded 4 key lessons learned:

Lesson 1: Assess organizational readiness of all staff members. Strong leadership support for MA-CORD existed in both communities at baseline, but implementers (ie, teachers, nurses) in Community 2 reported lower perceived readiness to implement MA-CORD than did implementers in Community 1. In fact, proportionally fewer teachers in Community 2 engaged in training, taught lessons, completed curriculum surveys, or planned to sustain lessons post-intervention. These teachers described administrative shifts and staff turnover (45% of schools in Community 2 received new principals), in contrast with administratively stable Community 1, which also had a history of parent involvement and wellness activities before MA-CORD.

Health education teachers administered lessons in Community 1, whereas a mix of health education teachers and classroom teachers in Community 2 administered them. In low-resourced communities with few health education teachers, additional strategies to identify motivated teachers or parents could be beneficial. Lack of parental involvement is reported as a barrier to implementation in school-based obesity prevention projects serving low-income children (19,20). Interviewees suggested parents could support teachers delivering MA-CORD lessons by bringing healthy snacks to taste-test or by planning school wellness events. In future projects, school leaders should consider collaboratively addressing barriers to implementation by increasing parental involvement before launching intervention activities.

Lesson 2: Identify and support passionate wellness champions. Using school wellness champions was one of the strongest reported facilitators of MA-CORD implementation, consistent with previous research indicating the use of outside staff to implement an intervention significantly reduced its likelihood of being sustained (21). We found that champions who were health education teachers or nurses reported the highest satisfaction with their role because it fit well with their job description. In Community 2, busy principals and classroom teachers served as wellness champions, but some colleagues reported waning support from them because of shifting administrative priorities over time.

Although some schools may not have health education teachers or nurses who can take on additional roles, investigators may increase engagement and buy-in from champions by using strategies adapted from workplace wellness programs: ongoing training, recognition, and incentive programs linked with key intervention outcomes (22,23). Wellness champions who efficiently train and motivate busy teachers to adopt new classroom activities play a critical role in implementation success. These champions are also likely to support overall district and school-level wellness policy implementation.

Lesson 3: Build on existing curricula combined with incentives. Tailored messaging and print materials are valuable contributors to successful obesity-related intervention outcomes in school-based settings (24). In our study, teachers consistently conveyed satisfaction with the lesson plans and print materials adapted from existing interventions. For example, one *Eat Well and Keep Moving* lesson titled "Sugar Water: Think about Your Drink," contained activities crossing various core curricula (eg, multiplication to find grams of sugar in soda, interpreting a soda can label). Obesity prevention lessons that fulfill multiple core classroom subjects support adoption and sustainability of intervention activities in schools (18). Curriculum delivery was maximized by incentivizing aspects of program participation with grant funding. Teachers were compensated for attending MA-CORD training sessions after school or they attended sessions during the school day, which probably contributed to greater than 70% teacher participation in both communities. As an additional incentive, some schools received play equipment such as balls and hula hoops, which promoted active indoor play during winter months and supported the intervention's physical activity goal.

Lesson 4: Sustainability is maximized through ongoing training and institutional adoption. Teachers who continued to teach MA-CORD lessons beyond year 1 of the intervention described having a wellness champion who offered ongoing support through formal and informal training. Both in our study and elsewhere, staff turnover is a barrier to intervention sustainability in schools, because repeated training is expensive and difficult to coordinate across campuses (25–27). However, we identified sustainable strategies, which included incorporating the curricula into lesson plans that continued year-to-year (eg, math lessons, writing), acknowledging MA-CORD activities in performance evaluations, and schoolwide policies supporting messages taught during lessons (eg, no sugary drinks on campus). Additionally, online training modules are being considered as a low-cost way to train a school's staff on health topics (28) and could be a way to overcome issues related to staff turnover. One study found no significant difference in adoption of an after-school nutrition and physical activity intervention when the staff were trained online versus face-to-face (29).

As in other process analyses, our study's findings rely on self-report from a convenience sample (17). In one community, nearly half of eligible teachers did not complete follow-up curriculum surveys, reflecting possible unmeasured levels of implementation in nonparticipating schools. Because student-level data were not collected because of privacy restrictions, we based our estimate of reach on the number of eligible students and percentage of eligible teachers who attended MA-CORD trainings. Although small sample sizes limited our ability to generalize beyond our population, using mixed methods offered detailed context, which may be useful for others working to implement similar programs in resource-poor schools. Because long-term follow-up data beyond the intervention period were not available, we could not assess the intervention's long-term sustainability.

To improve child health and maximize limited resources, there remains a need for continued collection and publication of both quantitative and qualitative process evaluation data describing school-based obesity prevention interventions. Sharing null findings, barriers, and implementation failure is critical to refining and promoting best practices in implementation to identify strategies to encourage sustainable changes in schools.

Acknowledgments

Rachel E. Blaine and Rebecca L. Franckle contributed equally to this article and are co-first authors. This study was supported by the Centers for Disease Control and Prevention (CDC), National Center for Chronic Disease Prevention and Health Promotion (award: U18DP003370). R.E.B. was supported by a National Institutes of Health (NIH) Doctoral Training Grant in Cancer Epidemiology (no. T32CA0900). R.L.F. was supported by predoctoral (T32DK007703) and postdoctoral (T32HL098048) training grants from NIH. J.F. was supported by an American Heart Association postdoctoral fellowship (14POST20140055). The work is solely the responsibility of the authors and does not represent official views of the CDC or the NIH.

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Tables

Table 1. Characteristics of Communities, Schools, Students, and Staff Members Participating in the MA-CORD Intervention, Massachusetts, 2012–2014

Characteristic	Community 1	Community 2
Community		
Population total (30), **n**	40,318	95,072
Race/ethnicity (30), **%**		
White	68.2	67.9
Hispanic	21.6	16.7
African American	5.1	6.4
Multi-race, Non-Hispanic	3.7	5.7
Asian	3.6	0.9
Average per capita income (30), **$**	22,620	21,056
Persons below poverty level (30), **%**	20.6	23.5
School		
Schools eligible to participate in MA-CORD[a], n	6	22
Elementary schools	4	19
Middle schools	3	3
Health education staff		
Schools with nurses, n	6	25
Schools with a health education teacher, n (% of schools)	6 (100.0)	3 (13.6)
District-wide staff retention rates, n (% of schools)		
Superintendent	1 (100.0)	0 (0.0)
Principals	7 (87.5)	19 (79.2)
Teachers	315 (92.9)	777 (90.0)
Teacher		
Total eligible to teach MA-CORD curricula, n		
Year 1	7	117
Year 2	6	122
Female, % of eligible teachers (31)	81.3	81.4
Race/ethnicity, % of eligible teachers (31)		
White	90.5	90.7
Hispanic	6.8	2.5

Abbreviation: MA-CORD: Massachusetts Childhood Obesity Research Demonstration Project.
[a] Community 1 consisted of 6 schools, but 1 school served kindergarten through eighth-grade students and was counted as both an elementary and a middle school.
[b] Students enrolled in fourth, fifth, sixth, and seventh grade were eligible to receive the curricula used in MA-CORD.
[c] Defined as being eligible for either free or reduced price lunch, transitional aid to families, or the Supplemental Nutrition Assistance Program based on family household income.
[d] Intervention readiness surveys were distributed to MA-CORD school leaders and staff members (Table 2); participants were not identified by school.
[e] School principals, superintendents, intervention coordinators, and MA-CORD wellness champions.
[f] In-depth qualitative interviews conducted during year 1 of the intervention with school leaders (superintendent, principals, wellness champions), teachers, and nurses.

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Table 1. Characteristics of Communities, Schools, Students, and Staff Members Participating in the MA-CORD Intervention, Massachusetts, 2012–2014

Characteristic	Community 1	Community 2
African American	2.0	5.7
Multi-race, Non-Hispanic	0.2	0.6
Asian	0.5	1.3
Student		
Total eligible to receive MA-CORD curricula [b] (31), n	1486	3658
Race/ethnicity, % of students (31)		
White	38.2	49.2
Hispanic	46.6	31.1
African American	5.8	11.7
Multi-race, Non-Hispanic	5.7	6.1
Asian	5.5	0.8
Low-income[c] (31)	76.9	73.4
Engagement in Process Evaluation		
Surveys of intervention readiness[d]		
Leaders[e], n	5	18
Teachers or nurses, n	4	49
Qualitative interviews, n		
Schools represented in qualitative interviews, n (% of schools)[f]	5 (83.3)	11 (50.0)
Leaders[e], n	4	2
Teachers or nurses, n	7	10
Year-end teacher curriculum surveys, n (% of teachers)		
Year 1	7 (100)	51 (43.6)
Year 2	5 (83.0)	41 (33.6)

Abbreviation: MA-CORD: Massachusetts Childhood Obesity Research Demonstration Project.
[a] Community 1 consisted of 6 schools, but 1 school served kindergarten through eighth-grade students and was counted as both an elementary and a middle school.
[b] Students enrolled in fourth, fifth, sixth, and seventh grade were eligible to receive the curricula used in MA-CORD.
[c] Defined as being eligible for either free or reduced price lunch, transitional aid to families, or the Supplemental Nutrition Assistance Program based on family household income.
[d] Intervention readiness surveys were distributed to MA-CORD school leaders and staff members (Table 2); participants were not identified by school.
[e] School principals, superintendents, intervention coordinators, and MA-CORD wellness champions.
[f] In-depth qualitative interviews conducted during year 1 of the intervention with school leaders (superintendent, principals, wellness champions), teachers, and nurses.

Table 2. Outcomes of an Implementation Assessment of MA-CORD School-Based Intervention[a], Massachusetts, 2012–2014

Measures	Community 1	Community 2
Acceptability[b]		
Beliefs of school leaders[c,d], mean (standard deviation)		
Commitment to prevent or reduce childhood obesity in the community	4.9 (0.2)	4.7 (0.2)
Compatibility of program with organization's approach	4.2 (0.8)	4.3 (0.5)
Timing of implementation was good	4.3 (0.7)	4.0 (0.6)
Intervention will distract from other organizational priorities	2.4 (0.7)	1.7 (0.5)
Beliefs of school staff members[d,e], mean (standard deviation)		
Commitment of staff to implementation	4.2 (0.5)	3.8 (0.9)
Motivation of staff for implementation	4.3 (0.5)	3.6 (0.8)
Confidence of staff to implement tasks smoothly	4.0 (0.8)	3.6 (0.9)
Confidence of staff to handle implementation challenges	4.3 (0.5)	3.6 (0.8)
Confidence of staff members that organization can support them during transition to intervention	4.3 (0.5)	3.6 (0.8)
Adoption[f]		
Teacher adoption of MA-CORD lessons, n (% of teachers)		
Eligible teachers completed MA-CORD curriculum training in year 1[g]	7 (100.0)	84 (71.8)
Taught any MA-CORD lessons in year 1[h]	7 (100.0)	28 (59.6)
Taught any MA-CORD lessons in year 2[i]	5 (100.0)	39 (75.0)
Appropriateness[j]		
"Lessons I taught were a positive addition to my curriculum" (Agree or strongly agree)[i]	7 (100.0)	28 (100.0)
Feasibility[k]/Perceived Implementation Cost[l]		
Beliefs of MA-CORD eligible teachers, n (%)		
"I felt competent to teach the content" (agree or strongly agree)[i]	6 (85.7)	25 (56.8)
"Overall, the effort required to obtain needed materials not provided [by MiM Kids] was acceptable"[i]	4 (80.0)	29 (90.6)
Beliefs of school leaders[c,d], mean (standard deviation)		

Abbreviations: MA-CORD, Massachusetts Childhood Obesity Research Demonstration Project; MiM KIDS, Mass in Motion KIDS intervention.
[a] The community-level name for the intervention that was part of the larger MA-CORD project was MiM KIDS.
[b] Acceptability is the initial perception of the intervention's fit.
[c] Data obtained from survey of leaders in the school sector (administrators, principals, school wellness champions) using an adapted version of the Adoption Decision Questionnaire: Community 1 (n = 5), Community 2 (n = 18).
[d] Response options ranged from 1 (strongly disagree) to 5 (strongly agree).
[e] Data obtained from survey of staff members in the school sector (teachers, school nurses) using an adapted version of the Organizational Readiness for Change Questionnaire: Community 1 (n=4), Community 2 (n = 49).
[f] Adoption in initial participation.
[g] Based on sign-in sheets and internal records.
[h] Data obtained from year 1 curriculum survey of staff members eligible to teach MA-CORD curriculum: Community 1 (n = 7), Community 2 (n = 51).
[i] Data obtained from year 2 curriculum survey of staff members eligible to teach MA-CORD curriculum: Community 1 (n = 5), Community 2 (n = 41).
[j] Appropriateness is the perception of MiM Kids as being good for teachers/children
[k] Feasibility is the actual fit/compatibility of conducting MiM Kids activities in a school setting.
[l] Perceived implementation cost refers to the resources required to conduct activities (eg, financial, time, parent support).
[m] Implementation fidelity is the quantity and quality of MiM Kids activities conducted.
[n] Compared with goal of 6 MA-CORD lessons taught per year.
[o] Reach is the impact of MiM Kids on students, parents, staff, and community.
[p] Sustainability is the continuation/institutionalization of MiM Kids activities.

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Table 2. Outcomes of an Implementation Assessment of MA-CORD School-Based Intervention[a], Massachusetts, 2012–2014

Measures	Community 1	Community 2
Organization has resources necessary for implementation	3.5 (0.8)	3.8 (0.8)
Organization can manage risks associated with implementation	3.7 (1.0)	3.7 (0.5)
Implementation Fidelity[m]		
Lessons taught from MA-CORD curriculum in year 1 (mean, SD)[n]	5.8 (2.7)	3.6 (2.5)
Lessons taught from MA-CORD curriculum in year 2 (mean, SD)[n]	5.2 (3.0)	4.5 (2.8)
Reach[o]		
Estimated number of students who received MA-CORD curriculum[h] (31)	1,486	2,262
Sustainability[p]		
Teachers sustaining MA-CORD curriculum, n (%)		
Plan to teach curriculum after year 1 (yes vs no/undecided)[h]	7 (100.0)	40 (83.3)
Plan to teach curriculum after year 2 (yes vs no/undecided)[i]	5 (100.0)	29 (76.3)

Abbreviations: MA-CORD, Massachusetts Childhood Obesity Research Demonstration Project; MiM KIDS, Mass in Motion KIDS intervention.
[a] The community-level name for the intervention that was part of the larger MA-CORD project was MiM KIDS.
[b] Acceptability is the initial perception of the intervention's fit.
[c] Data obtained from survey of leaders in the school sector (administrators, principals, school wellness champions) using an adapted version of the Adoption Decision Questionnaire: Community 1 (n = 5), Community 2 (n = 18).
[d] Response options ranged from 1 (strongly disagree) to 5 (strongly agree).
[e] Data obtained from survey of staff members in the school sector (teachers, school nurses) using an adapted version of the Organizational Readiness for Change Questionnaire: Community 1 (n=4), Community 2 (n = 49).
[f] Adoption in initial participation.
[g] Based on sign-in sheets and internal records.
[h] Data obtained from year 1 curriculum survey of staff members eligible to teach MA-CORD curriculum: Community 1 (n = 7), Community 2 (n = 51).
[i] Data obtained from year 2 curriculum survey of staff members eligible to teach MA-CORD curriculum: Community 1 (n = 5), Community 2 (n = 41).
[j] Appropriateness is the perception of MiM Kids as being good for teachers/children
[k] Feasibility is the actual fit/compatibility of conducting MiM Kids activities in a school setting.
[l] Perceived implementation cost refers to the resources required to conduct activities (eg, financial, time, parent support).
[m] Implementation fidelity is the quantity and quality of MiM Kids activities conducted.
[n] Compared with goal of 6 MA-CORD lessons taught per year.
[o] Reach is the impact of MiM Kids on students, parents, staff, and community.
[p] Sustainability is the continuation/institutionalization of MiM Kids activities.

Table 3. Barriers and Facilitators to Implementation of the MA-CORD School-Based Intervention Based on In-Depth Interviews of School Administrators, Teachers, and Nurses (n = 23)[a], Massachusetts, 2013–2014

Implementation Outcome Constructs	Facilitators[b]	Barriers[b]
Acceptability[c]	Principal is a champion for health activities	Pressure of standardized testing or academic demands in district
	Existing wellness initiatives and policies (C1)	New superintendent and administrative turnover (C2)
	School nurses and health education teachers found the project fit well within their work tasks	
Adoption[d]	Rapport between wellness champions and the staff	Weather interrupting trainings (C2)
		Lack of time for teachers to attend trainings
		Teachers not informed about intervention (C2)
Appropriateness[e]	Training and curricula were well-received	Concerns about messages that children do not have control over (eg, safe outdoor play, sleep environments)
	Message appropriate for students	
	Teachers liked being part of a larger movement across schools	
Feasibility[f]/implementation fidelity[g]	A champion at the school who maintains enthusiasm	Lack of time for teachers to teach lessons
	Using students to engage other students	Competing priorities with other schoolwide campaigns
	Technical assistance to change policies in the school	Principal and teacher turnover (C2)
Perceived implementation cost[h]	Providing physical activity equipment to schools (C2)	Inadequate printing resources to provide materials for conducting lessons
Reach[i]	School-wide integration of messaging	Limited collaboration between some sectors
	Linkages with other school health priorities	
	Media coverage	
	Children bringing messages home from school	
Sustainability[j]	Health education teachers implementing curriculum	Staff turnover
	Enjoyable activities that are adopted long-term	Lack of ongoing leadership
	Intervention involvement acknowledged in teacher evaluations	

Abbreviations: C1, Community 1; C2, Community 2; MA-CORD Project, Massachusetts Childhood Obesity Research Demonstration Study.
[a] Based on sample of 11 school staff members in Community 1 and 12 school staff members in Community 2.
[b] Themes reported in both communities unless otherwise specified.
[c] Acceptability: Initial perception of intervention fit.
[d] Adoption: Initial participation.
[e] Appropriateness: Perception of Mass in Motion [MiM] Kids being good for teachers/children (MiM KIDS was the community-level name for the intervention that was part of the larger MA-CORD project).
[f] Feasibility: Actual fit/compatibility of conducting MiM Kids activities in school setting.
[g] Implementation Fidelity: Quantity and quality of MiM Kids activities conducted.
[h] Perceived implementation cost: Resources required to conduct activities.
[i] Reach: Impact of MiM Kids on students, parents, staff, and community.
[j] Sustainability: Continuation/institutionalization of MiM Kids activities.

Appendix A. – Questionnaires Used in Process Evaluation of School Intervention

This file is available for download as a Microsoft Word file at https://www.cdc.gov/pcd/issues/2017/docs/16_0381AppendixA.docx. [DOCX - 132KB]

Appendix B. – Interview Guides

This file is available for download as a Microsoft Word file at https://www.cdc.gov/pcd/issues/2017/docs/16_0381AppendixB.docx. [DOCX - 27KB]

Appendix C. – Interview Coding Scheme

This file is available for download as a Microsoft Word file at https://www.cdc.gov/pcd/issues/2017/docs/16_0381AppendixC.docx. [DOCX - 23KB]

Appendix D. – Key Illustrative Quotes Obtained From Qualitative Interviews of School Staff Members Participating in MA-CORD in Massachusetts, 2012–2013 (n = 23)

This file is available for download as a Microsoft Word file at https://www.cdc.gov/pcd/issues/2017/docs/16_0381AppendixD.docx. [DOCX - 26KB]

PREVENTING CHRONIC DISEASE
PUBLIC HEALTH RESEARCH, PRACTICE, AND POLICY
Volume 14, E139 DECEMBER 2017

ORIGINAL RESEARCH

Best Practices and Barriers to Obesity Prevention in Head Start: Differences Between Director and Teacher Perceptions

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Accessible Version: www.cdc.gov/pcd/issues/2017/17_0297.htm

Suggested citation for this article: Byrd-Williams C, Dooley EE, Sharma SV, Chuang RJ, Butte N, Hoelscher DM. Best Practices and Barriers to Obesity Prevention in Head Start: Differences Between Director and Teacher Perceptions. Prev Chronic Dis 2017;14:170297. DOI: https://doi.org/10.5888/pcd14.170297.

PEER REVIEWED

Abstract

Introduction
Practices and barriers to promoting healthy eating and physical activity at Head Start centers may influence children's energy balance behaviors. We examined differences between directors' and teachers' perspectives on best practices and barriers to promoting healthy eating and physical activity in Head Start centers.

Methods
We conducted a cross-sectional study of directors (n = 23) and teachers (n = 113) at 23 Head Start centers participating in the baseline assessment of the Texas Childhood Obesity Research Demonstration study. Participants completed surveys about practices and barriers to promoting healthy eating and physical activity. Multilevel regression models examined differences between director and teacher responses.

Results
More than half of directors and teachers reported meeting most best practices related to nutrition and physical activity; few directors or teachers (<25%) reported conducting physical activity for more than 60 minutes a day, and less than 40% of teachers helped children attend to satiety cues. Significantly more directors than teachers reported meeting 2 nutrition-related best practices: "Teachers rarely eat less healthy foods (especially sweets, salty snacks, and sugary drinks) in front of children" and "Teachers talk to children about trying/enjoying new foods" ($P < .05$). No barrier to healthy eating or physical activity was reported by more than 25% of directors or teachers. Significantly more teachers than directors reported barriers to healthy eating, citing lack of food service staff support, limited time, and insufficient funds ($P < .05$).

Conclusion
More barriers to healthy eating were reported than were barriers to physical activity indicating that more support may be needed for healthy eating. Differences between responses of directors and teachers may have implications for future assessments of implementation of best practices and barriers to implementation related to nutrition and physical activity in early care and education centers.

Introduction

Head Start, the largest federally funded early care and education (ECE) program for preschoolers in the United States, provides comprehensive education, social, and health services to low-income families. Approximately one-third of children who attend Head Start centers are overweight or obese (1–3). As part of health services, Head Start providers are required to incorporate efforts to combat childhood obesity in their programs.

Many studies have been conducted in the ECE setting to examine the effect of an intervention program on obesity in early childhood (4). To understand an intervention's effects on childhood obesity requires an understanding of how employees perceive the degree to which best practices are being met at ECE centers and the barriers they perceive to promoting preschoolers' energy balance behaviors.

Research has documented barriers to implementing obesity prevention efforts at ECE centers, including Head Start centers. In a national study, Head Start directors reported that primary barriers

are lack of staff time, resources, and knowledge about nutrition and physical activity (5). Results from several statewide surveys of ECE centers indicate similar barriers to promoting healthy eating and physical activity (6,7). However, studies were conducted at the center level and did not include classroom-level or teacher-reported attitudes or practices.

Teachers are generally responsible for implementing obesity prevention efforts in the ECE center (4). As such, it is important to understand the perspectives of Head Start teachers. Therefore, the purpose of this study was twofold: 1) to describe director-reported and teacher-reported best practices and perceived barriers to promoting nutrition and physical activity in Head Start centers and 2) to examine differences in perceptions as reported by directors and teachers.

Methods

The data for this cross-sectional, exploratory analysis was collected as part of the baseline assessment for the Texas Childhood Obesity Research Demonstration (TX CORD) study, a multilevel intervention to address childhood obesity in low-income populations (8). The methods for data collection of TX CORD have been reported elsewhere (8,9). Before the implementation of TX CORD, Head Start center managers (hereinafter directors) and classroom teachers at 23 Head Start centers in Austin, Texas, and Houston, Texas, were surveyed in the summer and fall of 2012. Study staff members distributed and collected survey materials from center directors and teachers. Surveys examined the center's current practice regarding adherence to best practice standards around nutrition and physical activity and the current barriers faced by the Head Start center staff. The institutional review boards at The University of Texas Health Science Center–Houston and Baylor College of Medicine approved all protocols and procedures.

Directors (n = 23) and teachers (n = 113) were recruited from the 23 Head Start centers participating in TX CORD. Inclusion criteria were that the respondent be employed at the Head Start center and be able to complete the survey in English. All those approached met both inclusion criteria. Directors and teachers completed written surveys that consisted of questions from the Nutrition and Physical Activity Self-Assessment for Child Care (NAP SACC) (10) and The Child Care Nutrition and Physical Activity Assessment Survey (11). NAP SACC has been used to survey both directors and teachers (12). The original NAP SACC questions were used to assess current nutrition-related and physical activity-related behaviors. Each question had 4 unique, practice-specific response options, including the best practice for that item. NAP SACC questions were dichotomized into whether the best practice was reported as met or not. A best practice recommendation was reported as met if selected and as not met if any of the other 3 response options were selected. Questions about perceived barriers to promoting healthy eating and physical activity in child care centers were adapted from The Child Care Nutrition and Physical Activity Assessment Survey (11) to examine healthy eating and physical activity elements separately. For example, the original survey question asked "Are any of the following barriers to promoting healthy eating and physical activity practices in your center?" with a check-all-that-apply response option. Our study examined healthy eating and physical activity separately without modifying the response options (ie, "Are any of the following barriers to promoting healthy eating practices in your center?" and "Are any of the following barriers to promoting physical activity practices in your center?"). Response options to the barrier questions were dichotomous (yes/no).

Descriptive analyses were conducted on survey responses. We computed means, frequencies, and percentages of director and teacher responses and difference in percentages between director and teacher responses. To account for nesting, multilevel regression models were used to examine differences between director and teacher responses. Differences were considered significant at $P < .05$. All statistical analyses were performed using SPSS version 24.0 (IBM Corp) and SAS version 9.4 (SAS Institute, Inc).

Results

Directors and teachers were predominantly female (96%) and considered English their primary language (>90%), and about 40% were Hispanic (Table 1). Directors and teachers had a mean age of 51 years (standard deviation [SD], 8 y) and 43 years (SD, 11 y), respectively, and more than half were college graduates (78% and 57%, respectively). More than 70% of both directors and teachers reported that several nutrition and physical activity best practices were being implemented.

Of the 7 nutrition-related best practices, we found no significant differences in the number of best practices that directors (mean, 4.65; SD, 0.88) and teachers (mean, 4.15; SD, 1.72) reported meeting ($P = .12$). Overall, more than 60% of directors and teachers reported meeting nutrition-related best practices except for those related to attending to satiety cues (Table 2). Significantly more directors than teachers reported meeting 2 specific nutrition-related best practices: 1) "Teachers rarely eat less healthy foods (especially sweets, salty snacks, and sugary drinks) in front of children" (100% vs 69%, $P = .001$); and 2) "Teachers talk to children about trying and enjoying new foods" (87% vs 63%, $P = .02$).

No significant differences were found between director and teacher responses for meeting the other 5 nutrition-related best practices (Table 2).

Of the 6 physical activity-related best practices, we found no significant differences in the number that directors (mean, 3.00; SD, 1.26) and teachers (mean, 3.01; SD, 1.34) reported being met (P = .12). Most directors and teachers reported that teachers never restrict activity for children who misbehave (>78%) and that teachers join children in active play and make positive statements about the activity (>65%, Table 2). Less than 25% of directors and teachers reported that teachers provide more than 60 minutes of active play each day. No significant differences were found in director and teacher responses for any physical activity–related best practices. (Table 2).

In response to the 14 nutrition-related barriers questions, teachers (mean, 1.56; SD, 2.28) reported significantly more barriers to promoting healthy eating than directors (mean, 0.39; SD, 1.47) (P = .001). Limited time and insufficient funds were the barriers to promoting healthy eating most frequently reported by both teachers and directors (Table 3). Significantly more teachers than directors reported 1) "Insufficient funds" (23% vs 4%, P = .02); 2) "Limited time for teaching nutrition" (23% vs 4%, P = .03); and 3) "Lack of support from food service staff" (17% vs 0%, P = .03). Among the other 11 perceived barriers to promoting healthy eating, no significant differences were found between teacher and director responses.

In responses to the 8 questions about physical activity barriers, we found no significant differences in the number of barriers reported by teachers (mean, 0.46; SD, 0.94) and directors (mean, 0.34; SD, 1.11) (P = .59). Insufficient funds and lack of physical education resources were the most frequently reported perceived barriers to promoting physical activity reported by both teachers and directors. There were no significant differences between directors' and teachers' responses to any of the questions about perceived barriers to promoting physical activity (Table 3).

Discussion

We examined differences in best practices and perceived barriers related to promoting healthy eating and physical activity at ECE centers. In general, directors and teachers reported meeting most best practices. Best practices to help children to attend to satiety cues and to provide adequate opportunities for physical activity were identified as areas needing improvement. We found significant differences between directors' and teachers' responses to several of the questions about best practices and perceived barriers. Teachers are generally responsible for the implementation of nutrition and physical activity interventions in the classroom; thus, differences between director and teacher responses on reports of practices within the center suggest that directors may not be fully aware of the need to improve the implementation of policies, programs, and best practices.

More than 70% of both directors and teachers reported that several nutrition and physical activity best practices were being implemented, and more than 93% of directors and teachers reported that food is never used as a reward. High implementation rates of the best practices are promising and have been seen in previous studies (6). One study of ECE programs in Minnesota and Wisconsin found 68% of ECE centers refrained from using food as a reward, and of those not meeting this best practice, 91% said it would not be difficult to implement the practice (6). In our study, more than 75% of directors and teachers endorsed the physical activity–related best practice that teachers never restrict active play time for children who misbehave. In the previously cited study (6), 66% of ECE centers did not restrict active play as punishment, and of those not implementing this practice, 83% reported that it would not be difficult to implement. The high rates of adherence to these best practices seen in this study and others and the perceived ease of their implementation suggest that they may be some of the easiest policies to implement at ECE centers.

ECE directors and teachers reported that the best practices least frequently met were helping children to attend to satiety cues and providing opportunities for physical activity. Attending to satiety cues, such as helping children determine if they are still hungry before serving requested seconds and helping children determine if they are full before removing their plate, are areas for improvement. In other Head Start centers, 50% (6) to 72% (5) of centers allowed children to decide when they were full during meal and snack times, suggesting that implementation of nutritional best practices across Head Start centers may vary. One of the physical activity practices rarely met according to both directors and teachers was providing more than 60 minutes of active play time. Although previous studies found that 59% (5) to 75% (6) of centers reported providing 60 minutes of daily activity, when physical activity was measured objectively, no centers were found to provide 60 minutes of moderate to vigorous physical activity per day (13). This suggests that teachers and directors need to be aware of the daily physical activity recommendations for early childhood and need to be mindful of the length and intensity of the activity provided. Future research studies should examine how to most effectively train caregivers so that they are aware of and able to implement best practices to promote healthy eating and physical activity.

In this study, directors were significantly more likely than teachers to respond that teachers rarely or never eat or drink less healthy foods, especially sweets, salty snacks, and sugary drinks, in front

of children (100% vs 69%, respectively) and that teachers talk with children about trying and enjoying healthy food (87% vs 63%, respectively). Teachers' behaviors and modeling regarding healthy and unhealthy foods are important, because caregivers' practices have been found to affect children's eating behaviors (14,15). Although most directors and teachers reported meeting these 2 best practices, which is consistent with the literature (16), directors were more likely to report the best practice as met, which may indicate their assessment of the ECE environment was not complete. When surveying the nutrition and physical activity environment of an ECE center, many studies solicit information from directors only. Although it is more costly and logistically more complicated, future studies could consider also collecting information from classroom teachers.

When asked if lack of support from teachers or administrators was a barrier to promoting healthy eating and physical activity, few directors or teachers said yes. This suggests that support for obesity prevention programs exists at multiple levels in Head Start centers, which could account for a potential link between attending Head Start and better preschool weight status reported in a recent study (17). Overall, teachers reported more barriers to promoting healthy eating than directors, suggesting that teachers may need more support to effectively encourage healthy eating. The highest reported barriers to promoting healthy eating according to teachers were limited time, insufficient funds, and lack of support from food service staff. A previous study of Head Start directors reported similar barriers. In that study, insufficient funds (51%) was the highest barrier to implementation of nutrition programs, followed by lack of support by food service providers (25%) and limited time (22%) (5), which suggests that these barriers may be common in Head Start centers. Future interventions should consider these barriers in program development and implementation.

This study had limitations. The sample was restricted to recruited Head Start centers in Austin and Houston, Texas, which may limit our ability to generalize the results to ECE centers that do not participate in Head Start or to centers outside of these cities. Given the self-reported nature of the survey, director and teacher responses were based on their perceptions of best practices and barriers, which may not reflect the actual ECE center environment. Self-reported data are subject to response bias, and social desirability bias may result in the directors and teachers overstating best practices and downplaying barriers. Considering that directors were more likely to report best practices and less likely to report barriers, the social desirability bias may affect directors more, which highlights the need to survey both teachers and directors when assessing the ECE center. Strengths of this study include the use of validated and widely used scales (NAP SACC and the Child Care Nutrition and Physical Activity Assessment Survey) to assess the practices and perceived barriers that enable comparison with similar studies in the United States, though the questions were modified in 2 ways. First, to determine the different barriers faced for promoting healthy eating and physical activity, we adapted the original Child Care Nutrition and Physical Activity Assessment Survey (11) to ask about barriers per subject separately. Second, in the original validation study (11) for the Child Care Nutrition and Physical Activity Assessment Survey, the surveys were completed by center directors, not classroom teachers as in our study. Future validation studies are needed to ensure the validity of the modified instruments.

This study was one of the first to compare Head Start teachers' and directors' perceptions of the implementation of best practices related to promoting healthy eating and physical activity and barriers to their implementation in their ECE programs. Because teachers are the direct caregivers responsible for implementation of policies, programs, and practices in the classroom, it is important to assess their perceptions of barriers and best practices rather than to rely solely on responses from directors. Future research should continue to use validated instruments to assess perceptions of teachers or primary caregivers as they relate to promoting healthy eating and physical activity.

Acknowledgments

We thank all who participated in the study for their time. This research was supported by cooperative agreement RFA-DP-11-007 from the Centers for Disease Control and Prevention (CDC). Additional support was provided by the Michael and Susan Dell Foundation through the Michael & Susan Dell Center for Healthy Living. This work is a publication of the US Department of Agriculture (USDA) Agricultural Research Service (ARS) Children's Nutrition Research Center, Department of Pediatrics, Baylor College of Medicine, Houston, Texas, and had been funded in part with federal funds from USDA/ARS under cooperative agreement no. 58-6250-0-008. The contents of this publication do not necessarily reflect the views or policies of USDA, nor does mention of trade names, commercial products, or organizations imply endorsement by the US government. The content is solely the responsibility of the authors and does not necessarily represent the official views of CDC.

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Tables

Table 1. Baseline Characteristics, Directors and Teachers (N = 136) in Head Start Centers Participating in the TX CORD Study, Texas 2013

Characteristic	Directors (n = 23)[a]	Teachers (n = 113)[a]
Age, mean (standard deviation), y	50.8 (8.0)	42.5 (11.2)
Sex (female)	95.7 (22)	96.0 (105)
Primary language		
Speak English only	60.9 (14)	46.8 (51)
Speak more English than another language	8.7 (2)	18.4 (20)
Speak both English and another language, equally	30.4 (7)	25.7 (28)
Speak another language more than English	0	9.2 (10)
Speak only another language	0	0
Highest grade completed		
High school graduate	4.4 (1)	11.0 (12)
Some college or technical school	17.4 (4)	32.1 (35)
College graduate	78.3 (18)	56.9 (62)
Race/ethnicity		
Non-Hispanic white	4.3 (1)	3.7 (4)
Hispanic or Latino	39.1 (9)	44.0 (48)
Black or African-American	52.2 (12)	48.6 (53)
Other	4.3 (1)	3.7 (4)

Abbreviation: TX CORD, Texas Childhood Obesity Research Demonstration.
[a] Values are % (no.) unless otherwise indicated.

Table 2. Nutrition-Related and Physical Activity–Related Best Practices in Head Start Classrooms Reported by Head Start Directors and Teachers (N = 136), TX CORD Study, Texas 2013

Best Practice	Directors (n = 23)[a], % (no.)	Teachers[a,b], % (no.)	Difference in Percentage[c]	*P* Value[d]
Nutrition				
Food is rarely or never used to reward a desired behavior	95.7 (22)	93.7 (104)	2.0	.64
Children who are picky eaters (able to eat food but resisting) are encouraged to try a new less favorite food	65.2 (15)	60.7 (68)	4.5	.69
When children eat less than half of a meal or snack, the teachers help determine if they are full before removing the plate	39.1 (9)	32.7 (36)	6.4	.56
Teachers talk with children about trying and enjoying healthy food	87.0 (20)	63.4 (71)	23.6	.02
Teachers rarely or never eat or drink less healthy foods (especially sweets, salty snacks, and sugary drinks) in front of the children	100.0 (23)	68.8 (77)	31.3	.001
When children request seconds, teachers help determine if they are still hungry before serving the requested food	17.4 (4)	19.4 (21)	−2.1	.85
Teachers or staff provide nutrition education for children 1 or more times per week	60.9 (14)	78.2 (86)	−17.3	.08
Physical activity				
Children are allowed to watch videos, television, or play computer games 1 time per week or less	59.1 (13)	58.2 (64)	0.9	.89
Teachers never restrict active play time for children who misbehave	91.3 (21)	78.9 (86)	12.4	.14
When weather is not suitable to go outdoors, indoor play space is available for all activities, including running	30.4 (7)	13.5 (15)	16.9	.05
During active (free) play time, teachers often or always join children in active play and make positive statements about the activity	65.2 (15)	70.3 (78)	−5.1	.62
Active (free) play time is provided to all children (including indoor and outdoor) more than 60 minutes each day	13.0 (3)	24.1 (27)	−11.1	.26
Teacher-led physical activity is incorporated into the curriculum 2 or more times each day	40.9 (9)	57.1 (64)	−16.2	.15

Abbreviation: TX CORD, Texas Childhood Obesity Research Demonstration.

[a] Each question had 4 unique response options that were specific to the item; one response was the best practice recommendation from the Nutrition and Physical Activity Self-Assessment for Child Care (NAP SACC) for that item (10). Answer options were then dichotomized by best practice recommendation being met if selected or not met if any of the 3 other response options were selected. The table provides the response of the best practice recommendation for each item.

[b] Teacher number varies from 108 to 112 because of missing data.

[c] Difference between number of director-reported and teacher-reported practices. A negative score indicates teachers are more likely to report a practice; a positive score indicates directors are more likely to report it.

[d] *P* values were calculated by using multilevel regression models to account for nesting of teachers within centers.

Table 3. Perceived Barriers to Promoting Healthy Eating and Physical Activity Reported by Head Start Directors and Teachers (N = 136), TX CORD Study, Texas 2013[a]

Barrier	Directors, n = 23, % (no.)	Teachers[b], % (no.)	Difference in Percentage[c]	*P* Value[d]
Do any of the following prevent you from promoting healthy eating at your center?				
Serving unhealthy foods to children at center parties/social events	4.3 (1)	5.4 (6)	−1.1	.79
Lack of support from teachers	0	1.8 (2)	−1.8	.52
Lack of support from parents/families	8.7 (2)	13.6 (15)	−4.9	.52
Sales of unhealthy foods as fundraisers	0	5.4 (6)	−5.4	.26
Lack of training for food service staff	0	5.4 (6)	−5.4	.26
Lack of established policies on nutrition	0	6.4 (7)	−6.4	.21
Limitations of food service provider	4.3 (1)	11.6 (13)	−7.3	.27
Lack of support from administration	0	7.3 (8)	−7.3	.17
Lack of teacher training on nutrition education	4.3 (1)	12.6 (14)	−8.3	.25
Inadequate food preparation or storage facilities	4.3 (1)	13.5 (15)	−9.2	.12
Lack of nutrition education resources	4.3 (1)	15.3 (17)	−11.0	.06
Lack of support from food service staff	0	17.3 (19)	−17.3	.03
Limited time for teaching nutrition	4.3 (1)	23.4 (26)	−19.1	.03
Insufficient funds	4.3 (1)	23.4 (26)	−19.1	.02
Do any of the following prevent you from promoting physical activity at your center?				
Lack of support from administration	0	0	0	NA
Lack of teachers training on physical education	8.7 (2)	5.6 (6)	3.1	.56
Limited opportunities for physical education	8.7 (2)	5.6 (6)	3.1	.57
Lack of support from teachers	0	0.9 (1)	−0.9	.65
Lack of established policies on physical activity	4.3 (1)	6.4 (7)	−2.1	.59
Lack of support from parents/families	4.3 (1)	7.3 (8)	−3.0	.64
Insufficient funds	4.3 (1)	11.0 (12)	−6.7	.33
Lack of physical education resources	4.3 (1)	11.9 (13)	−7.6	.28

Abbreviation: NA, not applicable; TX CORD, Texas Childhood Obesity Research Demonstration.
[a] Answer options were yes or no.
[b] Teacher number varies from 108 to 112 because of missing data.
[c] Difference between number of director-reported and teacher-reported practice. A negative score indicates teachers are more likely to report the barrier; a positive score indicates directors are more likely to report it.
[d] *P* values were calculated by using multilevel regression models to account for nesting of teachers within centers.

PREVENTING CHRONIC DISEASE
PUBLIC HEALTH RESEARCH, PRACTICE, AND POLICY
Volume 14, E138 DECEMBER 2017

IMPLEMENTATION EVALUATION

Strategies to Recruit a Diverse Low-Income Population to Child Weight Management Programs From Primary Care Practices

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Accessible Version: www.cdc.gov/pcd/issues/2017/17_0301.htm

Suggested citation for this article: Barlow SE, Butte NF, Hoelscher DM, Salahuddin M, Pont SJ. Strategies to Recruit a Diverse Low-Income Population to Child Weight Management Programs From Primary Care Practices. Prev Chronic Dis 2017; 14:170301. DOI: https://doi.org/10.5888/pcd14.170301.

PEER REVIEWED

Abstract

Purpose and Objectives
Primary care practices can be used to engage children and families in weight management programs. The Texas Childhood Obesity Research Demonstration (TX CORD) study targeted patients at 12 primary care practices in diverse and low-income areas of Houston, Texas, and Austin, Texas for recruitment to a trial of weight management programs. This article describes recruitment strategies developed to benefit both families and health care practices and the modification of electronic health records (EHRs) to reflect recruitment outcomes.

Intervention Approach
To facilitate family participation, materials and programs were provided in English and Spanish, and programs were conducted in convenient locations. To support health care practices, EHRs and print materials were provided to facilitate obesity recognition, screening, and study referral. We provided brief training for providers and their office staffs that covered screening patients for obesity, empathetic communication, obesity billing coding, and use of counseling materials.

Evaluation Methods
We collected EHR data from 2012 through 2014, including demographics, weight, and height, for all patients aged 2 to 12 years who were seen in the 12 provider practices during the study's recruitment phase. The data of patients with a body mass index (BMI) at or above the 85th percentile were compared with the same data for patients who were referred to the study and patients who enrolled in the study. We also examined reasons that patients referred to the study declined to participate.

Results
Overall, 26% of 7,845 patients with a BMI at or above the 85th percentile were referred to the study, and 27% of referred patients enrolled. Enrollment among patients with a BMI at or above the 85th percentile was associated with being Hispanic and with more severe obesity than with patients of other races/ethnicities or less severe obesity, respectively. Among families of children aged 2 to 5 years who were referred, 20% enrolled, compared with 30% of families of older children (>5 y to 12 y). Referral rates varied widely among the 12 primary care practices, and referral rates were not associated with EHR modifications.

Implications for Public Health
Engagement and recruitment strategies for enrolling families in primary care practice in weight management programs should be strengthened. Further study of factors associated with referral and enrollment, better systems for EHR tools, and data on provider and office adherence to study protocols should be examined. EHRs can track referral and enrollment to capture outcomes of recruitment efforts.

Introduction

Obesity is a prevalent chronic condition in childhood with lifelong health consequences. Effective weight management programs for children must be behavior-based, comprehensive, and of moderate to high intensity to improve weight status in the immediate and intermediate term (1). However, such programs cannot improve obesity at a population level unless they are broadly disseminated and adopted, especially by those who are at greatest risk, which include Hispanic and black children (2), and because poverty is often associated with childhood obesity (3), children of limited financial means.

Development of effective dissemination and implementation strategies requires focus on the process of recruitment and engagement and the outcomes from those efforts (4). Primary care practices are important sites for weight management promotion because 75% of children aged 18 years or younger see primary care providers each year (5). Assessment of body mass index (BMI) and subsequent intervention to address the condition is recommended care, either in the provider's office or by referral to an adjunct obesity management program. Methods through which patients in primary care practices are placed in weight management programs should be studied.

Limited studies have assessed recruitment and enrollment in childhood weight management programs through primary care practices. One systematic review of clinical trials of obesity interventions that targeted low-income or minority children presented limited recruitment and retention information from among the 38 studies reviewed that reported any recruitment information, including strategies, setting, duration, barriers, and effects (6). Four studies recruited participants from primary health care practices (though not exclusively), and 2 of these reported rates of enrollment after referral of 62.5% in an adolescent study and 22.2% in a preschool study (6–10). In a child weight management program in a multispecialty health care practice, 41% of patients referred to a weight management program attended an initial presentation (9). A few studies (10,11) compared rates of enrollment relative to potentially eligible patients, not only those who were physician-referred. One study of adolescents evaluated several strategies to refer patients, one of which bypassed the medical provider by sending letters to patients deemed qualifying from electronic health record (EHR) data; that study found that approximately 9% of patients with obesity enrolled (12). This rate was similar to one from a German study of a low-intensity telephone-based obesity intervention targeting patients with obesity (13). Because studies in the area of recruitment and retention in childhood obesity studies are limited, data about recruitment strategies and associated factors, especially in low-income populations, are needed to inform future programs. Reasons that patients or families reported for not enrolling in weight management programs and for program drop-out included inconvenient locations or time of programs and also lack of perceived need (13–15). Barriers that providers reported included low self-efficacy, perceived need for counseling and communication support, lack of reimbursement, and time constraints (16, 17).

The Texas Childhood Obesity Research Demonstration (TX CORD) study presented an opportunity to develop and evaluate recruitment strategies for weight management programs offered to a large population of a Medicaid-eligible, diverse sample of children seen in TX CORD primary care practices. This study describes the TX CORD recruitment strategy and study findings, taking advantage of the unusual availability of demographic and anthropometric information on a large but defined cohort of eligible participants.

Purpose and Objectives

The TX CORD study was a multilevel, multisystem intervention to address childhood overweight and obesity in children aged 2 to 12 years from racially/ethnically diverse, low-income catchment areas in Houston, Texas, and Austin, Texas (18,19). The study examined recruitment to a 12-month randomized controlled trial (RCT) that was embedded in the population-level, systems-based intervention. Twelve Houston and Austin primary care practices received training and materials to optimize identification and care of all patients with overweight and obesity. For the RCT, patients aged 2 to 12 years from these practices with a BMI at or above the 85th percentile were recruited to a study that compared a community-based program, which used both "Mind, Exercise, Nutrition . . . Do It! (MEND) and an adapted Coordinated Approach to Child Health (MEND–CATCH) program, with a health care–based program that used the materials provided to the practices (Next Steps) (18). Participants were stratified into 3 age groups: 2 to 5 years, 6 to 8 years, and 9 to 12 years. The objectives of this study were to describe and evaluate the strategies used in primary care practices to recruit families of children with overweight or obesity into weight management programs.

Twelve partner primary care practices in Houston and Austin participated in the trial. The Houston practices were part of a large hospital organization with a single EHR system. Five Houston practices were selected because they were located in the TX CORD catchment area. Three of these were designated medical

homes aimed at providing care to Medicaid and CHIP (Children's Health Insurance Program)–eligible children, and the other two had 30% to 50% of patients covered by Medicaid or CHIP. The 7 partner practices in the Austin catchment area were federally qualified health centers and nonprofit safety-net primary care clinics. The Austin practices were members of 3 different health care organizations and used 3 different EHR systems.

All offices had 2 to 5 full-time equivalent pediatric providers, and some had social workers on staff. Their patients were generally low-income and nonwhite. Catchment areas included Hispanic and black neighborhoods (Houston) or mostly Hispanic neighborhoods (Austin). Study recruitment was limited to health care practices to ensure that children in weight management programs had a source of health care to identify and manage any physical or mental comorbidities. Partner sites were able to provide appropriately de-identified data from their EHRs to describe their clinic population.

Intervention Approach

TX CORD intervention

The TX CORD study implemented primary obesity prevention strategies at schools and early childhood education centers within the catchment areas in Houston and Austin. The TX CORD secondary obesity prevention study (aimed at children with BMI ≥85th percentile) was a 2-arm RCT that compared a community intervention and a health care intervention that took place within the primary prevention catchment areas. The interventions were 12 months. Five cohorts were enrolled from September 2012 through January 2014, and the last cohort ended in January 2015. Participants in both arms had data on height and weight, fitness level, dietary intake, and psychosocial factors measured at baseline, 3 months, and 12 months. Children and parents who were randomized to the community intervention arm first participated in a 3-month intensive program, MEND/CATCH, which was held at a YMCA facility in the catchment area. Families of preschool children (aged 2–5 y) attended weekly 90-minute sessions that focused on healthy food identification, parent–child games for physical activity, and parenting skills. Children aged 6 to 12 years and their parents attended twice-weekly sessions that consisted of 1 hour of nutrition and behavior change lessons and 1 hour of physical activity for the children while parents had further facilitator-led group discussion. During months 4 through 12, all age groups had monthly family review sessions, with cooking classes and narrative role models, and children aged 6 to 12 years transitioned to twice-weekly YMCA youth sports (20).

Children and parents randomized to the comparison health care intervention arm were asked to discuss weight and healthy lifestyle with the provider during clinic visits by using Next Steps counseling material and a self-paced workbook for parents and children (21). Providers were encouraged to use the Next Steps material with any clinical patient; therefore, the use of Next Steps was not limited to RCT participants. Rather, families enrolled in the RCT and randomized to this arm received usual care that had been optimized for the practices with the training and Next Steps material. Visit frequency was determined by the provider and family together and was influenced by Texas Medicaid policy, which does not reimburse for visits to primary care providers solely to treat obesity.

Engagement process and recruitment strategies

Figure 1 presents the proposed framework of the TX CORD intervention. Resources and activities were guided by the perspectives of practices, and the referral process addressed the needs of both patients and practices. The framework consisted of defined resources, activities, and projected outputs and short- and long-term outcomes.

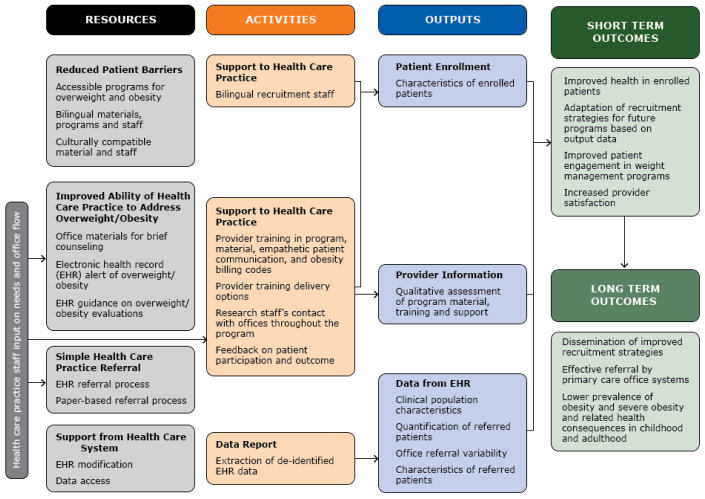

Figure 1. Framework to optimize recruitment of patients for the Texas Childhood Obesity Research Demonstration (TX CORD) study, Texas, 2012–2014.

For the convenience of patients, the programs in the community arm of the RCT were scheduled for early evenings or Saturday mornings at YMCAs in catchment areas. To engage Spanish-

speaking families, all program materials for both intervention arms of the RCT were in Spanish and English so that bilingual staff could guide families through the recruitment and consent process. Program material, which contained information such as food choices and meal routines, was culturally appropriate for participants. Team members who taught the community program at the YMCA were Hispanic and black.

The research staff met with providers and their staff members at each primary care practice to discuss the proposed study and to elicit concerns as the study protocol was developed and finalized. Providers identified time constraints and difficulty changing patient and family behaviors as challenges in addressing obesity. Obesity counseling competed with other anticipatory guidance during annual well-child examinations, and the cost of follow-up visits to address obesity alone was not covered under Medicaid or CHIP. Providers and their staff members wanted to ensure that clinical encounters were reimbursable and to preserve work flow when they provided weight counseling or made study referrals, and they had limited time for training. Materials and processes were finalized to respond to these concerns.

EHRs were modified to support obesity discussion and to increase referral to the study. On the basis of work done in a previous study (22), an alert was adapted for use in the EHR encounter when a patient aged 2 to 12 years had a BMI at or above the 85th percentile. The alert suggested, but did not require, use of a set of obesity-related diagnosis codes, laboratory orders, referrals, and education materials (ie, Next Steps). This EHR set included a process to indicate family permission to be contacted about the study. This approach was proposed by staff members of provider practices to minimize study-referral paperwork. However, all practices also had paper referral forms for faxing recruitment information. Regardless of referral method, providers and their staff members were asked to introduce the study only briefly; members of the research staff then called interested families to explain the study and to determine qualification.

Next Steps counseling materials were adapted to help providers introduce obesity and obesity prevention strategies to patient families. Such materials served as an engagement tool in study recruitment but were also resources for the health care arm of the RCT. Next Steps materials presented a list of healthy lifestyle themes displayed on a poster and in a desktop flip chart with simple graphics and counseling tips (21) Parents and providers identified 1 or 2 themes of greatest interest and relevance for the family to use in brief counseling during an office visit. By being visible in the examination room, the poster could also cue families to initiate a conversation about lifestyle even if the provider did not.

A 2-hour training was developed for providers that included orientation to the study, EHR modifications, and the Next Steps materials. It also included Texas Medicaid coding rules for the diagnosis of obesity and a brief introduction to motivational interviewing, with a goal of facilitating discussion with families about overweight and obesity and encouraging families to initiate change.

Engagement implementation

Although the EHR modifications were planned for all offices, the Austin health care systems underwent several major administrative changes, which delayed EHR modifications until the study was completed. Therefore, Austin offices had no EHR flag for overweight or EHR support for obesity care, and study referral in Austin was exclusively via paper and fax.

The planning and training of practice staff members were conducted during spring and summer 2012. Providers (pediatricians, nurse practitioners, and social workers) received a 2-hour training in one of several different formats: in person, by live webinar, or by recorded webinar. Active recruitment and study enrollment began within weeks of the training. Briefly, providers identified eligible patients (eg, children with a BMI ≥85th percentile), assisted by the EHR alert. Providers used Next Steps materials and EHR support to address obesity and referred patients for recruitment.

Once interested families were referred, research staff members telephoned them to explain the study, assess eligibility, and offer an enrollment visit for consent, assent, measurement, and randomization. Three to 5 contact attempts were made. Outcome, including parents' reasons for not enrolling in the study, were tracked. Because recruitment of children aged 2 to 5 years was difficult, a secondary recruitment process was initiated in which offices generated lists of recent encounters with eligible children aged 2 to 5 years (with a BMI ≥85th percentile). These families were then contacted by telephone from the practice, given a brief description of the program, and asked if research staff members could contact them.

Once enrolled, patients in the health care arm received the intervention self-paced booklet and encouragement to schedule additional provider visits, and the patients enrolled in the community program participated in the MEND/CATCH program described. Participants in the 12-month study were recruited and enrolled in 5 waves from September 2012 through January 2014.

To support practices, research staff members visited each practice every 2 or 3 months to remind the staff of the study, answer questions, and replace missing material. In addition, practices received information about outcomes for referred patients and also height, weight, and BMI measures at 3 and 12 months of those who participated in both the community and the health care arms of the study.

Evaluation Methods

To understand the characteristics of the large but circumscribed patient population designated for recruitment, we used EHR data provided by the 12 partner offices to examine the demographic and anthropometric characteristics of all children aged 2 to 12 years seen during recruitment (September 2012 through January 2014). The following de-identified information was included: age; sex; race/ethnicity (Hispanic, non-Hispanic black, non-Hispanic white, and other); insurance type (Medicaid, CHIP, commercial or other, which included Tricare, Medical Access Program in Travis County, and unknown); and weight and height, which were used to calculate BMI and BMI percentile and to categorize children as overweight (BMI 85th to <95th percentile), obese (95th to <99th percentile), or severely obese (≥99th percentile). When patients had multiple encounters, the variables associated with the first well-child visit during the recruitment period were used. For patients without well-child visits, the first urgent encounter in which weight and height were measured was used, and when no height was obtained at any encounter, nonanthropometric variables from the first urgent visit were used. Differences between Houston and Austin cohort characteristics were examined. Prevalence of overweight and obesity was compared with NHANES (National Health and Nutrition Examination Survey) 2011–2012 data by age and race/ethnicity (2).

From these office data, the eligible population was defined as children with a BMI at or above the 85th percentile, and their demographic characteristics were examined. The referred patients were the families of the eligible children who agreed to be contacted by our research staff. Children's data were limited to age, sex, weight, and height, and some measures were missing or were from parent report rather than provider report. The enrolled patients were families who consented to the study, and their children's data came from baseline research evaluations, including measured weight and height and parent-reported race/ethnicity and insurance type. The demographic and anthropometric characteristics of the 3 groups (eligible population, referred patients, and enrolled patients) were compared to examine characteristics of children who were likely to progress to referral and enrollment.

By using the study database as well as information from the calls from our research staff to referred families, the outcomes of referred families were categorized into 1) enrollment into the study; 2) ineligibility because a medical or psychological condition made the community program unsuitable for the child; 3) ineligibility because of research criteria, which limited enrollment to one child per family and to domicile within 5 miles of the catchment area borders; 4) lack of transportation to the community program; or 5) lack of interest, which included families who actively declined and those who did not respond to multiple telephone calls. These outcomes were examined by age group. A questionnaire completed by provider practices at the end of the study provided perspective on study training and participation. To examine variation in office engagement implementation strategies, the proportions of patients referred and enrolled were examined by office, and association between availability of EHR tools and patient referral and enrollment was tested.

We used χ^2 tests, univariate linear regression, and univariate logistic regression — for categorical, continuous, and binary variables, respectively — to evaluate the practice cohort, testing within age groups for differences between sites and by BMI status. The χ^2 test was used to test differences in reasons for nonenrollment. A multivariable logistic regression model was used to calculate odds of enrollment of office patients with a BMI at or above the 85th percentile relative to nonenrollment within each age group and of referred patients relative to nonenrollment for each age group. The variables included in the multivariable logistic regression models were mutually adjusted for one another.

Institutional review boards for human subject research for The University of Texas Health Science Center, Baylor College of Medicine, and Seton Health Care Family approved the protocol.

Results

Health care office patient population in Houston and Austin

Patients aged 2 to 12 years seen in the 12 participating primary care practices during the recruitment period were approximately 60% Hispanic patients and 20% non-Hispanic black patients across ages and sites. Approximately 70% of the patients were insured by Medicaid or CHIP. Table 1 presents the characteristics divided by age group and site. The proportion of patients with overweight or obesity (BMI ≥85th percentile) and obesity (BMI ≥95th percentile) in each racial/ethnic category and age group were similar to the national prevalence rates of NHANES 2011–2012 (**Figure 2**) (2). Houston practices had more patients than Austin practices, a higher percentage of non-Hispanic black patients, and a higher percentage of patients with commercial in-

surance. Although the distribution of BMI categories was different between the 2 sites in the 6-to-8 years age group and in the 9-to-12 years group, the proportions of children with obesity or severe obesity did not differ by site. The ages differed between sites, but the means were within 3 months of each other.

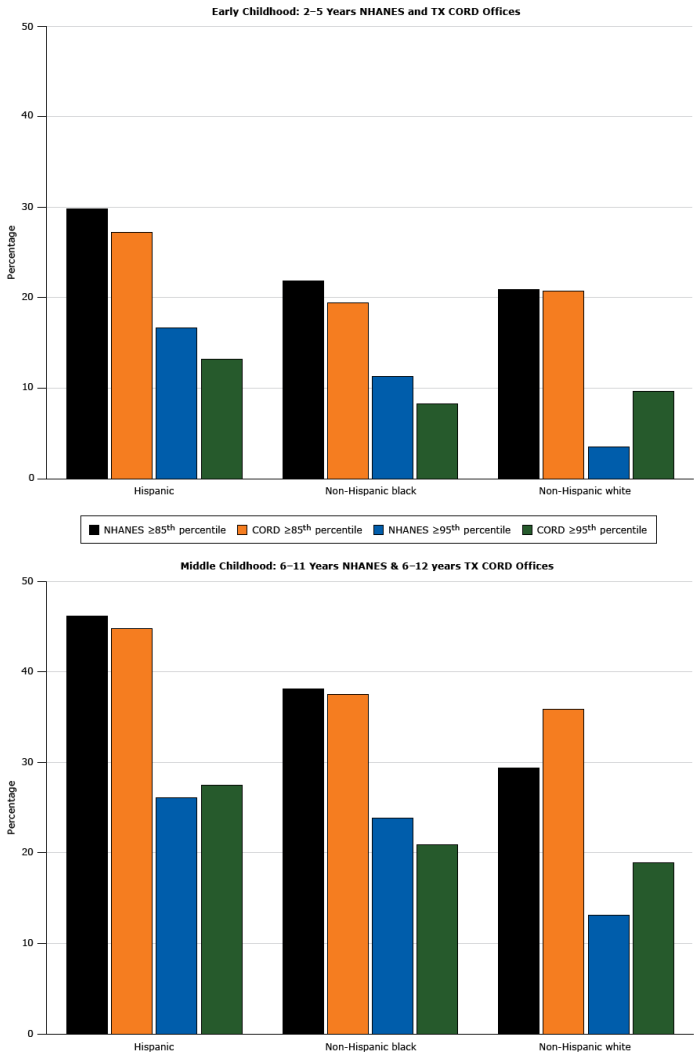

Figure 2. Prevalence of overweight and obesity among patients with a body mass index at or above the 85th percentile (N = 7,845) seen in Texas Childhood Obesity Research Demonstration (TX CORD) study practices, by racial/ethnic groups. Data are from NHANES 2011–2012 (2) and from participating TX CORD practices, 2012–2014. Abbreviations: NHANES, National Health and Nutrition Examination Survey.

When the data were examined by healthy weight (BMI <85th percentile) versus overweight/obesity (≥85th percentile) in each age group (Table 2), those with overweight or obesity more often were Hispanic and had Medicaid or CHIP rather than commercial insurance.

Characteristics of eligible population, referred patients and enrolled patients

Of the 7,845 children with overweight or obesity seen in the TX CORD practices (Table 2), 2,030 (25.9%) were referred to the study, and 549 (27.0%) of those referred were enrolled (Table 3). Referral rates were lowest in the 9-to-12 year age group (22.7%), although the 28.7% referral rate among the 2 to 5 year age group reflects additional recruitment efforts implemented in this group because of low enrollment. Once referred, 32% of families with children aged 6-to-12 years enrolled, in contrast to 19.5% of those with children aged 2 to 5 years. Compared with the eligible population, the referred patients had more severe obesity, as assessed by both mean BMI and BMI category distribution. Severe obesity was present in 40% of age 2-to-5 years referrals, 36% of age 6-to-8 years referrals, and 26% of age 9-to-12 years referrals. Austin practices were smaller, making up 31% (aged 2–5 y), 32% (6–8 y), and 36% (9–12 y) of patients with BMI at or above the 85th percentile in the practices, yet the Austin practices accounted for larger proportions of the referred groups (38%, 38%, and 40%, respectively) and even larger proportions of the enrolled groups (52%, 54%, and 45%, respectively) than Houston offices. These data indicate higher referral and enrollment rates of their high BMI patients despite lacking the EHR referral tool. The enrolled patients had approximately the same levels of obesity as the referred groups. Although data on race/ethnicity and insurance were unavailable for referred patients, the proportion of non-Hispanic white patients was much lower among the enrolled than among the eligible population, and Medicaid enrollment was higher for enrolled patients than for the eligible population in the middle and youngest age groups.

Multivariate analyses of variables associated with enrollment were performed for both the eligible population with BMI at or above the 85th percentile and the referred cohort. Enrollment for the eligible population was associated with more severe obesity, being from Austin, and being Hispanic or non-Hispanic black (Table 4). Sex and insurance categories were not associated with enrollment in any age group. For the referred cohort, higher BMI was not significantly associated with enrollment (Table 5). Significant predictors varied with age group; higher mean age within the age 2-to-5 years group, being from Austin within the age 9-to-12 years group, and both higher mean age and being from Austin within the age 6-to-8 years group (Table 5). The 3 patient age groups had different outcomes after referral (Figure 3). The age 2-to-5 years

group had the highest proportion not interested and the lowest enrollment rate. The age 9-to-12 years group had the lowest proportion not interested and the highest proportion not meeting research criteria compared with the other age groups.

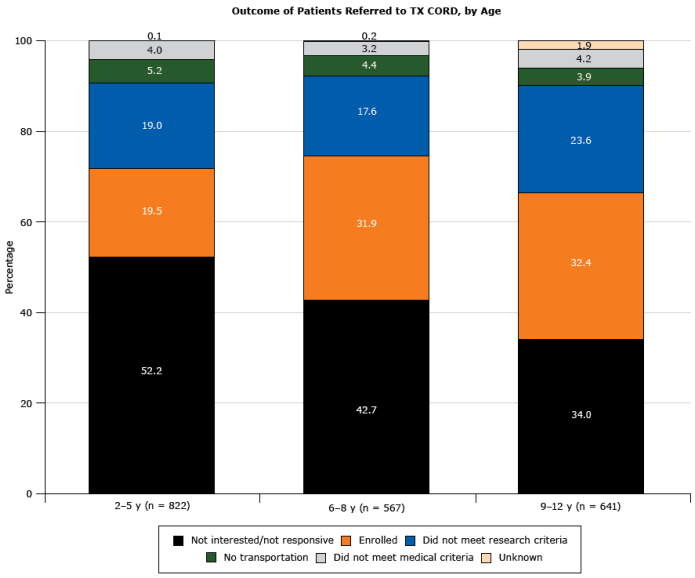

Figure 3. Outcome of patients with a body mass index at or above the 85th percentile (N = 2,030) referred to the Texas Childhood Obesity Research Demonstration (TX CORD) study. Among patients referred to the study, eligibility and interest varied by age group.

The individual primary care practices varied considerably in referral and enrollment rates (Figure 4). Referral rates ranged from 8.5% to 66.8%. Enrollment ranged from 1.9% to 25.7% of the eligible population, and 17% to 50% of the referred population. Referral rates did not differ by availability of EHR referral tools.

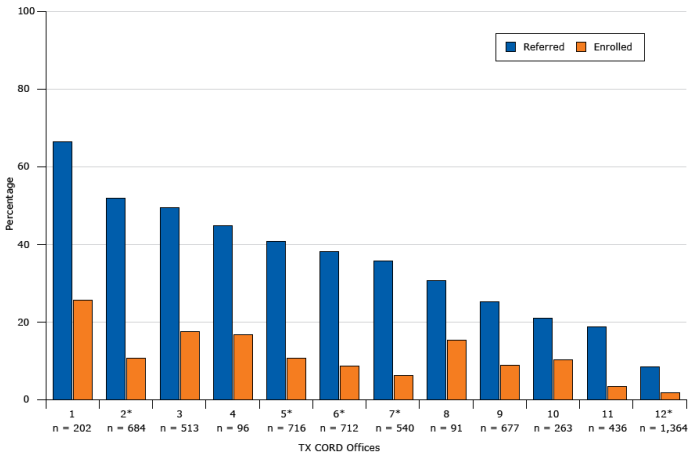

Figure 4. Percentage of patients in 12 primary care practices with a body mass index at or above the 85th percentile referred (N = 2,030) and enrolled (N = 549) in the Texas Childhood Obesity Demonstration (TX CORD) study, by primary care practice. Asterisks indicate that electronic health records for that office were modified to include a referral process for overweight or obesity. Numbers in parentheses are the total number of eligible patients in each practice. (A tabular version of this figure is also available.]

The training and participation questionnaire, completed by 34 providers, offered 5 response options ranging from strongly agree to strongly disagree. Based on responses of agree or strongly agree, 50% reported that training provided adequate information, and 56% found the required time commitment acceptable. As a result of training and materials, 62% reported they were more likely to start a conversation about obesity as part of a patient encounter, and 65% felt more comfortable discussing obesity with families.

Implications for Public Health

Primary health care practices are well positioned to identify children with overweight or obesity and address the problem through screening, counseling, and referral to a program, potentially improving dissemination and adoption of behavior-based weight management programs. The TX CORD RCT focused on primary health care practices for engagement and recruitment of diverse and low-income children at high risk for obesity to weight management programs. The implementation process had family-centered strategies with convenient time and location of programs and with program and recruitment elements that were welcoming to a predominantly Hispanic population. The process also had office-centered strategies, adding support to health care practices for recognizing and discussing unhealthy weight with patients and simple ways to refer them to support programs, including changes made to EHRs in 5 of the 12 offices. Because program participation was available only to those children in specific health care

practices and because all the practices could provide limited, deidentified information from the EHR, this study had the capability of examining the pattern of referral and enrollment among a defined cohort.

In our study, recruitment began with an office visit that included screening and brief counseling for children who had overweight and obesity. The next step after screening was referral, and the final step was enrollment. Referral status reflects the activity of both the provider, who discussed the child's weight and proposed referral, and of the family, which accepted referral. Thus, the recruitment strategies targeting family and primary care practice are relevant. Enrollment status after referral reflects a family decision based on perceived severity and individual circumstances, so office recruitment strategies may be less influential.

Approximately one quarter of the eligible population (patients aged 2 to 12 years with BMI ≥85th percentile seen in the health care offices) were referred. Referred patients were characterized by high body weight: about 40% of referred patients had severe obesity. Although the program targeted all patients at or above the 85th percentile, the pattern is consistent with experiences of hospital-based tertiary care weight management programs, in which most the patients are in the highest BMI category (21). Parent recognition of overweight and obesity increases with obesity severity (22), and, although not measured in this study, provider concern likely increases as well. Both factors could contribute to this referral pattern in TX CORD. Engagement of children with milder obesity is important and may lead to more success from the intervention (23). Although an important family-level engagement strategy was cultural compatibility with Hispanic families, we examined the effect only on enrolled families because referred families did not report race or ethnicity.

The high variation in referral rates across practices was unexpected. Training, support, and materials, with the exception of the EHR changes, were the same for all 12 offices. Providers reported moderate endorsement of the adequacy of training for the study and of the acceptability of the time commitment. Overall, providers agreed that the TX CORD experience led to more frequent discussion of obesity and more comfort with discussion. The EHR alert for BMI at or above the 85th percentile was designed to ensure provider recognition, but practices with the alert did not have higher referral rates, a finding that suggests that the EHR alert might need further development (eg, optimizing its location within the encounter template, ensuring a provider response). Austin practices as a group referred a higher percentage of eligible patients than Houston practices, but range of referrals rates in Austin offices (19% to 67%) and Houston offices (9% to 52%) were both wide. This variation may reflect differences in procedures among individual providers, given that the 12 participating practices had a low number of providers, but data on individual providers were not available. It is possible that providers needed more robust cues to action for referral. We did not audit providers or observe patient encounters, so future studies might consider more objective data on implementation of referral processes. The variation found in this study suggests that improvement is possible at the practice level, and exploration of office culture, office processes, and provider behavior may lead to interventions that support higher and more consistent referral rates across practices.

Enrollment, a family-level decision potentially influenced by interactions between provider and patient during the office visit, differed by race/ethnicity and age group. Hispanic patients, even after controlling for city and weight status, had a higher likelihood of enrollment. There have not been large studies of Hispanic children in weight management programs, and the culturally welcoming approaches that the study took with this group were effective. The proportion of enrolled patients was lower among children aged 2 to 5 years (20%) than among those aged 6 to 12 years (above 30%), although we used additional strategies to increase referral rates in this preschool group in response to low enrollment. The referral outcome data demonstrate the low interest and low response rate in the age 2 to 5 years group. Reasons could include less parental concern about weight in this age group (22) and more difficulty with logistics of attending the program. We did not see the expected association of higher enrollment with more severe obesity in the multivariate analysis of referred patients. Although high BMI increased likelihood of referral, decision to enroll may have been influenced by ability to participate in programs rather than by concern about obesity. Another explanation may be that social desirability led some families to accept referral from a concerned provider and then decline enrollment (actively or passively) because of low concern or other barriers. Future studies can note active refusal, but when programs cannot reach families, passive refusal cannot be distinguished from logistical challenges in low-income populations, such as cellular telephone inactivation.

Strengths of the study were the ability through use of EHR data to describe the large cohort of children with high BMI who were targeted for recruitment but did not enroll, and the implementation of the study in active, nonacademic practices. A limitation was the RCT structure, which could have influenced referral and enrollment. The referred group lacked race/ethnicity and insurance information, and lacked confirmation of the parent-reported weights and heights. In addition, recorded reasons for nonenrollment did not distinguish between active refusal and lack of response to contact efforts.

In conclusion, this study used a defined and well-characterized population of children at high risk for obesity and examined program recruitment and enrollment by using engagement and recruitment strategies that incorporated screening and brief counseling in primary care. The study successfully enrolled Hispanic families, but engagement of young children and children with less severe obesity was low. Providers reported increased obesity discussion during encounters as a result of the study, but referral varied widely by office. This variation suggests that low-referring offices could modify practices to increase attention to overweight and obesity among children, and focused study of high- and low-referring practices would be the next step in in developing interventions to address childhood obesity. Such interventions should include examination of EHR tools in actual clinical practice and further qualitative work to optimize their use.

Acknowledgments

This research was supported by the Centers for Disease Control and Prevention (award no. U18DP003377). The authors thank Anne Adolph, Marlon Armstrong, and Theresa Wilson for their assistance with database management and Allison Marshall for assistance with formatting.

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Tables

Table 1. Characteristics of Patients Aged 2 to 12 Years Seen in Primary Care Practices Participating in the Texas Childhood Obesity Research Demonstration Study (TX CORD), by Age Group and by Site, 2012–2014

Characteristic[a]	2–5 Years			6–8 Years			9–12 Years		
	Houston, n = 9,448	Austin, n = 3,707	*P* Value[b]	Houston, n = 4,707	Austin, n = 2,030	*P* Value[b]	Houston, n = 4,666	Austin, n = 2,202	*P* Value[b]
Age, mean (SD), y	3.6 (1.2)	3.5 (1.1)	0.007	7.3 (0.9)	7.1 (0.9)	<.001	10.8 (1.2)	10.9 (1.3)	.22
Sex									
Female	4,691 (49.7)	1,856 (50.1)	.67	2,288 (48.6)	993 (48.9)	.84	2,261 (48.5)	1,099 (49.9)	.26
Male	4,757 (50.3)	1,851 (49.9)		2,416 (51.4)	1,037 (51.1)		2,405 (51.5)	1,103 (50.1)	
Race/ethnicity									
Hispanic	5,229 (57.8)	2,369 (66.6)	<.001	2,622 (58.9)	1,267 (65.3)	<.001	2,540 (56.8)	1,670 (79.1)	<.001
Non-Hispanic black	2,374 (26.3)	232 (6.5)		1,177 (26.4)	149 (7.7)		1,314 (29.4)	147 (7.0)	
Non-Hispanic white/other	1,436 (15.9)	954 (26.8)		656 (14.7)	523 (27.0)		616 (13.8)	293 (13.9)	
Insurance									
Medicaid	5,472 (59.0)	3,212 (86.8)	<.001	2,514 (54.8)	1,537 (75.9)	<.001	2,308 (51.3)	1,319 (60.1)	<.001
CHIP	640 (6.9)	246 (6.6)		615 (13.4)	248 (12.2)		635 (14.1)	288 (13.1)	
Commercial	3,104 (33.5)	156 (4.2)		1,438 (31.3)	74 (3.7)		1,533 (34.1)	150 (6.8)	
Other	62 (0.7)	86 (2.3)		20 (0.4)	166 (8.2)		20 (0.4)	438 (20.0)	
BMI percentile, mean (SD)	55.2 (31.6)	54.4 (32.3)	.20	67.1 (29.0)	63.3 (31.2)	<.001	70.1 (29.4)	70.6 (29.5)	.52
BMI percentile category									
<5th	627 (7.5)	310 (8.5)	.28	105 (2.7)	93 (4.7)	.001	100 (2.5)	66 (3.0)	<.001
5th to <85th	5,733 (68.8)	2,465 (67.4)		2,350 (59.9)	1,210 (60.6)		2,068 (51.8)	1,102 (50.7)	
85th to <95th	1,048 (12.6)	460 (12.6)		604 (15.4)	292 (14.6)		734 (18.4)	418 (19.2)	
95th to <99th	533 (6.4)	255 (7.0)		587 (15.0)	279 (14.0)		823 (20.6)	499 (23.0)	
≥99th	392 (4.7)	168 (4.6)		275 (7.0)	123 (6.2)		267 (6.7)	88 (4.0)	

Abbreviations: BMI, body mass index; CHIP, Children's Health Insurance Program; SD, standard deviation.

[a] Values are n (%) unless otherwise indicated. Denominators vary because the number of participants who responded to individual questions varied.

[b] *P* Values calculated by univariate linear regression tests, univariate logistic regression tests, and χ^2 tests for continuous, binary, and categorical variables, respectively.

Table 2. Characteristics of Patients Aged 2 to 12 Years Seen in Primary Care Practices Participating in the Texas Childhood Obesity Research Demonstration Study, by Age Group and BMI Status[a], 2012–2014

Characteristic[b]	Office								
	2-5 Years			6-8 Years			9-12 Years		
	<85, n = 9,135	≥85, n = 2,856	*P*[c] Value	<85, n = 3,758	≥85, n = 2,160	*P*[c] Value	<85, n = 3,335	≥85, n = 2,829	*P*[c] Value
Age y, mean (SD)	3.5 (1.21)	3.9 (1.18)	<.001	7.2 (0.90)	7.4 (0.91)	<.001	10.8 (1.21)	10.9 (1.2)	.05
Sex									
Female	4,554 (49.9)	1,384 (48.5)	.12	1,869 (49.7)	1,027 (47.5)	.11	1,692 (50.7)	1354 (47.9)	.03
Male	4,581 (50.2)	1,472 (51.5)		1,889 (50.3)	1,133 (52.5)		1,643 (49.3)	1,475 (52.1)	
Race/ethnicity									
Hispanic	5,097 (58.3)	1,902 (68.9)	<.001	2,086 (58.6)	1,376 (66.3)	<.001	1,942 (61.0)	1,896 (69.4)	<.001
Non-Hispanic black	1,889 (21.6)	455 (16.5)		760 (21.4)	377 (18.2)		757 (23.8)	532 (19.5)	
Non-Hispanic white/other	1,756 (20.1)	402 (14.6)		713 (20.0)	321 (15.5)		484 (15.2)	304 (11.1)	
Insurance									
Medicaid	5,848 (67.6)	1,927 (72.0)	<.001	2,228 (62.8)	1,339 (66.2)	.006	1,728 (55.8)	1,489 (57.1)	<.001
CHIP	622 (7.2)	201 (7.5)		475 (13.4)	284 (14.0)		413 (13.3)	421 (16.1)	
Commercial	2,070 (23.9)	513 (19.2)		722 (20.3)	346 (17.1)		713 (23.0)	490 (18.8)	
Other	105 (1.2)	34 (1.3)		123 (3.5)	54 (2.7)		244 (7.9)	208 (8.0)	

Abbreviations: BMI, body mass index; CHIP, Children's Health Insurance Program; SD, standard deviation.
[a] Healthy weight (<85th percentile) versus overweight or obese (≥85th percentile).
[b] Values are n (%) unless otherwise indicated.
[c] *P* values calculated by univariate linear regression tests, univariate logistic regression tests, and χ^2 tests for continuous, binary, and categorical variables, respectively.

Table 3. Sociodemographic and Anthropometric Characteristics of Patients With Overweight or Obesity (BMI ≥85th Percentile) Seen in Primary Care Practices Participating in the Texas Childhood Obesity Research Demonstration (TX CORD) Study, by Age Group[a], 2012–2014

Characteristic	2–5 Years			6–8 Years			9–12 Years		
	Total[a] (n = 2,856)	Referred (n = 822), 28.7	Enrolled (n = 160), 19.5	Total[a] (n = 2,160)	Referred[a] (n = 567), 26.3	Enrolled (n = 181), 31.9	Total[a] (n = 2,829)	Referred (n = 641), 22.7	Enrolled (n = 208), 32.4
Site, n (%)									
Houston	1,973 (69.1)	508 (61.8)	83 (51.9)	1,466 (67.9)	352 (62.1)	97 (53.6)	1,824 (64.5)	385 (60.1)	93 (44.7)
Austin	883 (30.9)	314 (38.2)	77 (48.1)	694 (32.1)	215 (37.9)	84 (46.4)	1,005 (35.5)	256 (39.9)	115 (55.3)
Age, mean (SD), y	3.9 (1.18)	3.9 (1.04)	4.3 (1.02)	7.4 (0.91)	7.2 (0.88)	7.5 (0.85)	10.9 (1.2)	10.4 (1.05)	10.5 (1.04)
Sex, n (%)									
Female	1,384 (48.5)	426 (52.0)	84 (52.5)	1,027 (47.5)	281 (49.8)	84 (46.4)	1,354 (47.9)	291 (45.8)	104 (50.0)
Male	1,472 (51.5)	394 (48.0)	76 (47.5)	1,133 (52.5)	283 (50.2)	97 (53.6)	1,475 (52.1)	345 (54.2)	104 (50.0)
Race/ethnicity, n (%)									
Hispanic	1,902 (68.9)	NA	141 (88.1)	1,376 (66.3)	NA	153 (84.5)	1,896 (69.4)	NA	179 (86.1)
Non-Hispanic black	455 (16.5)		16 (10.0)	377 (18.2)		27 (14.9)	532 (19.5)		25 (12.0)
Non-Hispanic white/ other	402 (14.6)		3 (1.9)	321 (15.5)		1 (0.6)	304 (11.1)		4 (1.9)
Insurance, n (%)									
Medicaid	1,927 (72.0)	NA	120 (82.2)	1,339 (66.2)	NA	116 (73.0)	1,489 (57.1)	NA	106 (58.2)
CHIP	201 (7.5)		12 (8.2)	284 (14.0)		24 (15.1)	421 (16.1)		38 (20.9)
Commercial	513 (19.2)		12 (8.2)	346 (17.1)		17 (10.7)	490 (18.8)		20 (11.0)
Other	34 (1.3)		2 (1.3)	54 (2.7)		2 (1.3)	208 (8.0)		18 (9.9)
BMI percentile, mean (SD)	93.9 (4.7)	96.5 (3.8)	97.0 (3.8)	94.9 (4.4)	97.0 (3.2)	97.3 (3.0)	95.0 (4.0)	97.0 (2.8)	97.3 (2.6)
BMI percentile category									
85th to <95th	1,508 (52.8)	127 (25.6)	37 (23.1)	896 (41.5)	98 (19.4)	35 (19.3)	1,152 (40.7)	99 (16.8)	29 (13.9)
95th to ≤99th	788 (27.6)	170 (34.2)	49 (30.6)	865 (40.1)	223 (44.2)	80 (44.2)	1,322 (46.7)	339 (57.4)	129 (62.0)
≥99th	561 (19.6)	200 (40.2)	74 (46.3)	399 (18.5)	184 (36.4)	66 (36.5)	355 (12.6)	153 (25.9)	50 (24.1)

Abbreviations: BMI, body mass index; CHIP, Children's Health Insurance Program; NA, not applicable; SD, standard deviation.
[a] Total is the number of patients seen in the 12 participating TX CORD practices in each age group with a BMI at or above the 85th percentile. Referred is the number and percentage of patients with a BMI at or above the 85th percentile who were referred to the TX CORD study. Enrolled is number and percentage of patients referred to the study who enrolled.

Table 4. Multivariate Analysis of Characteristics of Enrolled Patients (N = 549) Versus Eligible Patients (N = 7,531)in the Texas Childhood Obesity Research Demonstration (TX CORD) Study, by Age Group[a], 2012–2014

Characteristic	2–5 Years (n = 2,725)		6–8 Years (n = 2,103)		9–12 Years (n = 2,703)	
	OR (95% CI)	*P* Value[b]	OR (95% CI)	*P* Value[b]	OR (95% CI)	*P* Value[b]
Intercept	0	NA	0	NA	0.05 (0.01–0.27)	NA
Site						
Houston						1 [Reference]
Austin	2.61 (1.79–3.80)	<.001	2.89 (2.00–4.17)	<.001	2.86 (2.00–4.10)	<.001
Sex						
Male						1 [Reference]
Female	0.98 (0.69–1.40)	.93	1.54 (1.09–2.16)	0.01	1.06 (0.77–1.44)	.73
Age, y (continuous variable)	1.45 (1.24–1.70)	<.001	1.33 (1.10–1.61)	.004	0.77 (0.68–0.88)	<.001
Child race/ethnicity						
Non-Hispanic white						1 [Reference]
Hispanic	13.08 (4.08–41.89)	<.001	42.92 (5.94–310.12)	<.001	6.51 (2.37–17.86)	<.001
Non-Hispanic black	7.51 (2.08–27.11)	.002	28.72 (3.79–217.79)	.001	3.27 (1.07–10.03)	.04
Insurance						
Medicaid						1 [Reference]
CHIP	1.05 (0.55–1.98)	.88	1.11 (0.69–1.79)	.66	1.20 (0.80–1.79)	.38
Commercial	0.64 (0.34–1.22)	.17	1.09 (0.62–1.93)	.76	1.15 (0.67–1.96)	.61
Other	0.91 (0.20–4.03)	.90	0.33 (0.08–1.45)	.14	0.83 (0.48–1.45)	.51
BMI percentile category						
85th to ≤95th						1 [Reference]
95th to ≤99th	2.28 (1.44–3.62)	<.001	2.07 (1.34–3.20)	.001	3.39 (2.21–5.21)	<.001
>99th	4.91 (3.19–7.55)	<.001	3.95 (2.48–6.28)	<.001	5.12 (3.07–8.53)	<.001

Abbreviations: BMI, body mass index; CI, confidence interval; NA, not applicable; OR, odds ratio.
[a] Odds ratios of enrollment for eligible population (patients with BMI ≥85th percentile).
[b] *P* values calculated by multivariable logistic regression tests.

Table 5. Multivariate Analysis of Characteristics of Enrolled Patients (N = 1,589) Versus Referred Patients (n = 549), Texas Childhood Obesity Research Demonstration (TX CORD) Study, by Age Group[a], 2012–2014

Characteristic	2–5 Years (n = 496)		6–8 Years (n = 504)		9–12 Years (n = 589)	
	OR (95% CI)	*P* Value[b]	OR (95% CI)	*P* Value[b]	OR (95% CI)	*P* Value[b]
Intercept	0.06 (0.02–0.14)	NA	0.01 (0–0.04)	NA	0.07 (0.01–0.43)	NA
Site						
Houston						1 [Reference]
Austin	1.36 (0.92–2.01)	.12	1.69 (1.15–2.48)	.008	2.24 (1.57–3.19)	<.001
Sex						
Male						1 [Reference]
Female	0.85 (0.58–1.26)	.43	1.27 (0.87–1.86)	.21	1.25 (0.88–1.77)	.21
Age, y (continuous variable)	1.64 (1.35–2.00)	<.001	1.74 (1.38–2.19)	<.001	1.13 (0.96–1.33)	.15
BMI percentile category						
85th–95th						1 [Reference]
95th–99th	0.86 (0.51–1.45)	.57	0.80 (0.48–1.35)	.40	1.44 (0.88–2.38)	.15
>99th	1.31 (0.80–2.16)	.28	1.05 (0.62–1.79)	.85	1.29 (0.73–2.26)	.38

Abbreviations: BMI, body mass index; CI, confidence interval; NA, not applicable; OR, odds ratio.
[a] Odds ratios of enrollment for referred patients.
[b] *P* values calculated by multivariable logistic regression tests.