

Childhood Obesity Research Demonstration (CORD): The Cross-Site Overview and Opportunities for Interventions Addressing Obesity Community-Wide

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Abstract

Background: This is the first of a set of articles in this issue on the Childhood Obesity Research Demonstration (CORD) project and provides an overview of the multisite approach and community-wide interventions. Innovative multisetting, multilevel approaches that integrate primary healthcare and public health interventions to improve outcomes for children with obesity need to be evaluated. The CORD project aims to improve BMI and obesity-related behaviors among underserved 2- to 12-year-old children by utilizing these approaches.

Methods: The CORD consortium, structure, model terminology and key components, and common measures were solidified in year 1 of the CORD project. Demonstration sites applied the CORD model across communities in years 2 and 3. Evaluation plans for year 4 include site-specific analyses as well as cross-site impact, process, and sustainability evaluations.

Results: The CORD approach resulted in commonalities and differences in participant, intervention, comparison, and outcome elements across sites. Products are to include analytic results as well as cost assessment, lessons learned, tools, and materials.

Discussion: Foreseen opportunities and challenges arise from the similarities and unique aspects across sites. Communities adapted interventions to fit their local context and build on strengths, but, in turn, this flexibility makes cross-site evaluation challenging.

Conclusion: The CORD project represents an evidence-based approach that integrates primary care and public health strategies and evaluates multisetting multilevel interventions, thus adding to the limited research in this field. CORD products will be disseminated to a variety of stakeholders to aid the understanding, prevention, and management of childhood obesity.

Introduction

Currently, childhood obesity affects 16.9% of children ages 2–19 years old in the United States.¹ Children with obesity are more likely to develop dyslipidemia, type 2 diabetes, fatty liver disease, asthma, and suffer from depression and stigmatization.^{2–5} Childhood obesity is also associated with increased school absenteeism and poorer school performance.^{6,7}

The health behavior of children is influenced by factors in multiple environments, including the home, early care and education (ECE), school, community, and healthcare settings. Addressing childhood obesity therefore requires prevention

and treatment interventions across settings, programs, and systems.^{8–10} However, few interventions address more than one setting.^{11,12} The Childhood Obesity Research Demonstration (CORD) project, a multifaceted prevention and management effort with three phases spanning 4 years, seeks to fill this research gap. This article outlines the CORD project development and structure, describes the CORD model along with an overview of the interventions and evaluation, provides a comparison of commonalities and differences across the three demonstration sites, and discusses opportunities and challenges to the approach.

A primary goal of CORD is to evaluate a multisetting, multilevel approach that integrates primary care and public

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health strategies to improve underserved children's health behaviors and ultimately reduce childhood obesity.

Methods

Development

The CORD project was authorized through the Children's Health Insurance Program (CHIP) Reauthorization Act in 2009; funding was appropriated by the Affordable Care Act in 2010. CHIP is a low-cost health insurance program for children of working families with limited income.¹⁸ These children often have higher rates of obesity and less access to care¹⁹; thus, CORD was to implement and evaluate obesity prevention efforts to improve the health of children ages 2–12 years, who are enrolled in or eligible for CHIP.

CORD grantees were funded through a 4-year cooperative agreement beginning in October 2011. A planning phase took place in year 1, followed by intervention phases in years 2 and 3, and an analysis and evaluation phase in year 4.^{20,21}

A CORD consortium was developed that consists of stakeholders across sectors and settings that allowed for shared learning, experiences, and resources. CORD is overseen by the CDC by a team approach that included contributions from the CORD lead, scientific advisor, evaluator, and project officer.²² The three CORD demonstration sites include the University of Texas Health Science Center, Houston (TX-CORD); San Diego State University (CA-CORD); and the Massachusetts State Department of Health (MA-CORD). The three CORD demonstration sites, in turn, partnered with state and local agencies, community coalitions, ECE centers, school districts, and primary care organizations. An overview of the CORD demonstration sites is provided in Table 1.^{23–27} A fourth grantee, the University of Houston, serves as the evaluation and coordinating center (EC-CORD) and provides data warehousing, supports site-specific evaluations, and leads the cross-site evaluation, including a cost analysis. A federal partner steering committee also contributes guidance to the CORD project and includes representatives from the National Institutes of Health, Centers for Medicare and Medicaid Services, Agency for Healthcare Research and Quality, Health Resources and Services Administration, and Administration for Children and Families.

The Childhood Obesity Research Demonstration Project Model

A common CORD model was used across all demonstration sites. It consisted of interventions in multiple settings that incorporate all levels of the socioecological model^{9,13} to improve behaviors and prevent obesity. Evidence-based interventions for obesity prevention were implemented in each setting that a child encounters, from ECE or schools to their community, healthcare setting, home, and family. The CORD model built on existing state and community efforts to support children's healthy eating, active living, and obesity prevention. Using a

collective impact approach focused on integrating primary care and public health, CORD combines changes in preventive care at clinical provider visits with coordinated changes across select ECEs, schools, and community settings. Settings were linked by integrators such as community health workers (CHWs) and community coalitions or community advisory groups. CHWs served in roles of individual- and systems-level coordinated care, providing education and counseling to children and families, helping to link families to resources in their communities, and facilitating community-wide healthy eating and active living.

Interventions were designed for both systems-level (*e.g.*, practices and physical environments of ECE settings) and individual-level change (*e.g.*, changes in child and family behavioral risk factors and BMI). By implementing policy, system, and environmental (PSE) supports in addition to individual-based programs, CORD intends to enhance behavior change and population-level obesity prevention efforts.^{10,14–17} The CORD demonstration sites focused on strategies to improve children's health behaviors by involving the children, parents, and other family members and the communities in which they live. PSE changes were incorporated in ECEs, schools, and healthcare centers, and the hope is that benefits from CORD-initiated interventions may continue after the project evaluation period.

Common terminology was developed for the CORD project and built into the CORD model to help with consistent approaches. The term primary care includes all services delivered and PSE changes made in the healthcare setting. Public health is defined as all services and changes in the ECE, school, and community settings. CHWs deliver services and support system change in both primary care and public health. Primary care services are further defined by a tiered approach.²⁸ Primary care plus indicates additional services provided (*e.g.*, intense programs patients are referred to that are based in community centers, Healthy Weight referral clinics, or delivered in family visits) above those provided in a primary care clinic for children who are overweight or obese. Also of note, as a result of ongoing efforts to improve children's health, every community has some degree of obesity prevention efforts occurring at baseline; as such, the comparison groups are termed “no CORD intervention” owing to the fact that the public health and primary care taxonomy here describes the CORD-funded multisetting, multilevel intervention efforts above baseline common practice.

Evaluation Plans

The CORD project outcomes are similar across sites and include information for site-specific and cross-site evaluations.^{23,25,27,29} Each demonstration site proposed methods to assess outcomes within their site. In addition to site-specific evaluation, EC-CORD led development of several types of cross-site evaluation plans, including impact, process, and sustainability. The CORD sites and CDC developed common measures and tools during the year 1

Table 1. Overview of CORD Demonstration Sites^{23–27}

CORD project	TX-CORD	CA-CORD	MA-CORD
Program name	<ul style="list-style-type: none"> • Texas CORD 	<ul style="list-style-type: none"> • Our Choice, <i>Nuestra Opción</i> 	<ul style="list-style-type: none"> • Mass in Motion Kids
Cooperative agreement funded institutions	<ul style="list-style-type: none"> • The University of Texas Health Science Center at Houston 	<ul style="list-style-type: none"> • San Diego State University 	<ul style="list-style-type: none"> • Massachusetts State Department of Public Health
Brief description ^a	<ul style="list-style-type: none"> • The Texas CORD project in Austin and Houston, Texas, works within defined high-needs catchment areas of both cities to integrate primary care systems, local YMCAs, ECE centers and public schools to deliver prevention. • Primary prevention interventions are delivered in the community over a 2-year time period. • The TX-CORD intervention site has a secondary prevention randomized trial (only children with BMI >85th percentile) embedded within the community approach. It compares an enhanced primary care approach to an intensive 1-year behavioral modification program in the YMCAs. 	<ul style="list-style-type: none"> • The Our Choice/<i>Nuestra Opción</i> project in Brawley, El Centro, and Calexico, California, represents a newly formed collaborative comprising a research institute, a federally qualified health center (Clinicas), a county public health department, ECE centers, public schools, local recreation departments and agencies, and restaurants. • This study implements varying combinations of intervention activities across two cities to compare the relative effects of an integrated primary care and public health, primary care alone, and public health alone approaches to a control condition located in the third city. 	<ul style="list-style-type: none"> • The Mass in Motion Kids project in Fitchburg and New Bedford, Massachusetts, builds on an existing state department of public health program, Mass in Motion, by enhancing systems and practices of primary care services in federally qualified healthcare centers, WIC facilities, ECE centers, public schools and associated afterschool programs, and community-specific media activities. • A subset of the children with BMI >85th percentile in the MA-CORD intervention group will receive an enhanced primary care approach in a healthy weight clinic.
Community demographics	<ul style="list-style-type: none"> • >50% students in catchment areas on assisted lunch program • 19% of preschoolers and 35% of fifth graders are obese • Largely recent immigrant parents from Mexico and other Latin American countries 	<ul style="list-style-type: none"> • 23% of children below poverty line • 47% of children in county overweight or obese • Immigrant populations from Mexico 	<ul style="list-style-type: none"> • 24–27% of children below poverty line in intervention cities • ~40% of children overweight or obese in intervention cities • Immigrant populations from Portugal and West Africa
Inclusion criteria	<ul style="list-style-type: none"> • Child, ages 2–12 years • BMI ≥85th percentile for randomized trial 	<ul style="list-style-type: none"> • Child, ages 2–11 at baseline • No BMI criteria for sample 	<ul style="list-style-type: none"> • Child, ages 2–12 years • BMI ≥85th percentile for healthy weight clinic
CHW component	<ul style="list-style-type: none"> • CHWs are based in the community setting and their role includes that of counselors at community organizations and assisting in delivery of packaged wellness programs for secondary prevention. 	<ul style="list-style-type: none"> • CHWs are based in the healthcare setting and their roles include conducting a family wellness program, serving as part of an obesity care team, and serving on various committees for policy and system changes. 	<ul style="list-style-type: none"> • CHWs are based in the healthcare setting and they serve as wellness navigators with educational and community involvement roles.

^aInterventions promote healthy eating, active living, and obesity prevention and control by using multisetting, multilevel approaches that address policy, system, and environment changes as well as individual and family counseling and behavior change.

CORD, the Childhood Obesity Research Demonstration (CORD) project; CHW, community health worker; ECE, early care and education; WIC, Special Supplemental Nutrition Program for Women, Infants, and Children.

planning phase to facilitate analysis of these outcomes across sites.

The impact evaluation was developed to examine the following research question: Does the CORD model of bridging primary care and public health with multisetting, multilevel interventions linked by CHWs affect children's behaviors, their BMI, and other measures? The main outcomes are assessment of BMI and behaviors, including increasing fruit, vegetable, and water consumption; increasing physical activity; decreasing sugary drinks and energy-dense foods; decreasing screen time; and increas-

ing quality sleep. Additional common outcomes include satisfaction with care, quality of life, and parenting skills. A set of 35 common measures will be used for the impact evaluation and allow for a uniform way to assess child/family sociodemographic characteristics and common outcomes of CORD. The questions come from validated instruments. Common PSE tools are also used in 103 schools, 90 ECEs, 17 healthcare settings, and in the communities. The PSE measures come from instruments such as the Nutrition and Physical Activity Self-Assessment for Child Care Tool³⁰ used in the ECE setting and the Wilder

Table 2. A Comparison of Characteristics From the Three CORD Demonstration Sites²³⁻²⁷

Data/design elements	Commonalities across sites	Differences between sites
Participants		
Population characteristics	<ul style="list-style-type: none"> • High proportion low income, CHIP eligible • High rates of obesity • 2- to 12-year-old children 	<ul style="list-style-type: none"> • Race/ethnic composition • Geographic location
Participants inclusion criteria	<ul style="list-style-type: none"> • All sites have children \geq85th percentile of BMI as part of the sample 	<ul style="list-style-type: none"> • BMI percentile cutoff for sample inclusion varies
Participant sampling	<ul style="list-style-type: none"> • Intervention and comparison participants are drawn from populations with similar sociodemographic characteristics 	<ul style="list-style-type: none"> • Recruitment occurs in different settings (community and/or clinic recruitment).
Interventions		
Intervention framework	<ul style="list-style-type: none"> • Multisetting, multilevel interventions: All include interventions in ECE, schools, healthcare, and the community targeting individual and family behavior change as well as PSE changes • Cross-setting linkages (e.g., CHW, coalitions) 	<ul style="list-style-type: none"> • Specific interventions differ by site
Strategies	<ul style="list-style-type: none"> • Increase fruit and vegetable consumption, water intake, and physical activity and improve sleep • Decrease fatty foods, sugar drink intake, and screen time 	<ul style="list-style-type: none"> • Specific strategies to accomplish overarching strategic goals differ by site
Consortium	<ul style="list-style-type: none"> • Partners composed of public health department, academic center, and partnerships across settings and sectors 	<ul style="list-style-type: none"> • Sites have various additional partners
CHW	<ul style="list-style-type: none"> • Integrate across settings • Overarching activities similar 	<ul style="list-style-type: none"> • Primary setting base (e.g., clinic, community) • Specific tasks (e.g., counseling, case management)
Capacity	<ul style="list-style-type: none"> • All are designed to take evidence-based interventions and build on community capacity. • All allow for additional supports to be leveraged by the CORD intervention 	<ul style="list-style-type: none"> • Capacities differ by community • Additional supports leveraged differ by community (e.g., awards of additional grants)
Comparisons		
Catchment areas	<ul style="list-style-type: none"> • All sites selected a comparison community with similar sociodemographic characteristics, but were not supported with CORD multisetting, multilevel interventions 	<ul style="list-style-type: none"> • Catchment community geographical boundaries vary <ul style="list-style-type: none"> ◦ Comparison area within the same city as intervention area ◦ Comparison city within the same county as intervention city ◦ Comparison city within the same state as intervention city
Groups	<ul style="list-style-type: none"> • All sites include groups of full CORD intervention components (public health and primary care plus) 	<ul style="list-style-type: none"> • Sites also include one or two comparison groups of partial intervention components (public health and primary care; public health; primary care plus)
Outcomes		
Data type, cohort	<ul style="list-style-type: none"> • Longitudinal outcome data are gathered on parents and children in primary intervention groups 	<ul style="list-style-type: none"> • A mix of longitudinal, cross-sectional data are collected in comparison groups
Design	<ul style="list-style-type: none"> • Quasi-experimental 	<ul style="list-style-type: none"> • Some subgroups are matched or randomized
Timing	<ul style="list-style-type: none"> • Two years of intervention activities • All include clinical data collected at 0 and 12 months 	<ul style="list-style-type: none"> • Intensity differs at different points in the interventions • Sites have additional measurement time points from data derived in clinical and public health settings

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Table 2. A Comparison of Characteristics From the Three CORD Demonstration Sites^{23–27}
continued

Data/design elements	Commonalities across sites	Differences between sites
Measures	<ul style="list-style-type: none"> ● Common outcome measures for individuals <ul style="list-style-type: none"> ○ Assessments <ul style="list-style-type: none"> ■ Weight-related changes: height, weight, BMI ■ Sociodemographics ○ Behaviors <ul style="list-style-type: none"> ■ Fruit and vegetable consumption ■ Sugary beverage consumption ■ Water consumption ■ Physical activity ■ Screen time ■ Sleep time ○ Quality of life ○ Parenting strategies ○ Satisfaction with healthcare ● Common outcome tools for populations <ul style="list-style-type: none"> ○ PSE-level measures in all settings 	<ul style="list-style-type: none"> ● Site-specific measures assess elements unique to each site and provide additional insights on interventions.
CORD products	<ul style="list-style-type: none"> ● Cross-site evaluations including impact, process, sustainability, cost, and success stories 	<ul style="list-style-type: none"> ● Site-specific evaluations, toolkits, and materials

CORD, the Childhood Obesity Research Demonstration (CORD) project; CHIP, Children's Health Insurance Program; CHW, community health worker; ECE, early care and education; PSE, policy, systems, and environment.

Collaboration Factors Inventory Survey³¹ for community coalitions. In instances where different assessment tools are used across sites (*e.g.*, a community has invested in an existing tool), then common activities or constructs that are key to the CORD model (as described above) are measured to capture similar content.

The process evaluation defines the reach of intervention activities, describes program training and education materials, and documents PSE changes. The approach captures dose delivered and fidelity at two levels: demonstration site investigators to providers (*e.g.*, healthcare providers, ECE providers, and teachers) and providers to families. Process data are obtained, for example, from administrative data and surveys, CHW iPad quantitative data collection applications, and qualitative interviews.

The third type of cross-site evaluation focuses on sustainability. This assesses the potential for continuation of intervention activities and benefits past the project's completion. It documents the institutionalization and standardizing of new practices in each setting and describes what will be needed to maintain community capacity to continue these efforts. This evaluation also includes identifying components needed to replicate the CORD model in other communities.

Results

Commonalities and Differences

The CORD project will describe three demonstration experiences applying the CORD model with common key components for obesity prevention and management. It will be evaluated using common measures, tools, and terminology.

Although the CORD model is the same in all three demonstration sites, it is not a fixed protocol. As such, demonstration sites contain differences in participants, interventions, comparison groups, and outcomes (Table 2). For example, participants are demographically diverse across the sites and participants were recruited from either the clinic or community or both. The individualized interventions vary in specified tasks for CHWs, specific strategies and approach to the overarching cross-site obesity prevention and management goals, and comparison groups also vary by demonstration site. For the geographical recruitment areas, MA-CORD has two intervention cities and a comparison city within the same state. In CA-CORD, a comparison city is within the same county, and in TX-CORD, the comparison groups are closest geographically with comparison catchment areas within the same cities. The intervention groups include communities receiving the full CORD intervention (public health and primary care plus), and comparison groups are those with partial intervention components (public health and primary care, public health, or primary care plus) and those receiving no CORD intervention. Some site-specific differences exist in study design (*e.g.*, experimental design in the TX-CORD secondary prevention group), data type (*e.g.*, longitudinal data in the four CA-CORD comparison groups), and measures (*e.g.*, MA-CORD collects additional Special Supplemental Nutrition Program for Women, Infants, and Children [WIC] data), and timing of data collection. These variations in addressing the overarching research question provide unique perspectives as a result. More detailed information on the populations, interventions, and evaluation elements is provided in the accompanying articles in this supplement.^{23–27,29}

The resulting series of CORD products will have a common cross-site evaluation, detailed different site-specific findings, and a set of recommendations and lessons learned. Other items include collection of success stories by a standard form, consistent cross-site collection of detailed cost information (*e.g.*, training providers, delivering interventions in each setting, and supply of equipment), and a number of products created by demonstration sites, such as posters, booklets, toolkits, and educational handouts. If CORD interventions are found to be effective, the findings could be translated into practice and packaged as program and PSE changes to be implemented and adapted by other communities and brought to scale.

Discussion

CORD is a research demonstration project that offers unique opportunities. First, in light of the paucity of findings on obesity changes in communities targeting more than two settings across levels of the socioecological model, CORD represents an opportunity to test an integrated model of primary care and public health interventions in three demonstration sites and enhance understanding in this scientific field. This model also includes both primary prevention approaches to benefit all children and secondary treatment intervention components. This approach allows for evaluation of the integrated strategy for reduction of adiposity among overweight and obese children through treatment interventions embedded within beneficial community supports. For healthy weight children, the primary prevention strategies aim to prevent the onset of obesity.

CORD research provides the opportunity to assess three approaches to including CHWs in the team for coordinated obesity prevention and treatment. They served in varying roles, including as patient navigators of the health system, health educators (*e.g.*, teaching cooking classes and parenting practices), counselors, and trainers.

As another distinctive element of this project, the design of CORD includes a set of complementary interventions adapted to the unique needs of each CORD community with ongoing feedback from community advisory groups. This flexibility allows interventions to build on local capacity (*i.e.*, community based) and may be useful for decreasing implementation costs and improving sustainability of the intervention.

CORD allowed the opportunity for preplanning to refine the CORD model and a set of specific common measures to be captured by each demonstration site. This allowed for more similarities in measures and design elements among the sites. This may aid our understanding of key components of the model.

Finally, the CORD project offers the opportunity for sharing products, such as tools that have potential to advance best-practice team approaches and study evaluations. Products also include CORD materials that can inform programs, policies, systems, and environments supportive of children, families, providers, and communities.

Conversely, many of the same CORD characteristics that lead to opportunities also bring challenges. One of CORD's greatest challenges arises from allowing for flexibility in design given that differences across the demonstration sites are expected to create some difficulties in the cross-site evaluation. Also, though external validity arising from evaluations of natural environments is higher, this is achieved at the trade-off of lower internal validity given that unmeasured confounders may not be randomly distributed. In addition, challenges are faced owing to the complexity of the CORD intervention to address a multifactorial chronic disease. Evaluating such complex interventions can require thinking beyond conventional trials.³² CORD interventions, though complex in examining coordinated, community-wide, multisetting, multilevel interventions with linkages across sectors, hope to add insights on solutions for obesity prevention and management. The CORD project may not lead to generalizable results to all US communities based on limiting the project to three sites. For example, the data may be less generalizable to Native American communities.

Conclusion

In summary, CORD has a common model of integrated primary care and public health with multisetting, multilevel interventions linked by CHWs. A consortium of experts, institutions, and agencies are working together to deliver individualized interventions that build on community capacity and community advisor input in order to improve care and obesity-related outcomes for high-risk children. The project has a set of common measures, terminology, and a cross-site evaluation plan. The products from the CORD evaluations will be disseminated to a variety of stakeholders.

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