

Incorporating Primary and Secondary Prevention Approaches To Address Childhood Obesity Prevention and Treatment in a Low-Income, Ethnically Diverse Population: Study Design and Demographic Data from the Texas Childhood Obesity Research Demonstration (TX CORD) Study

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Abstract

Background: There is consensus that development and evaluation of a systems-oriented approach for child obesity prevention and treatment that includes both primary and secondary prevention efforts is needed. This article describes the study design and baseline data from the Texas Childhood Obesity Research Demonstration (TX CORD) project, which addresses child obesity among low-income, ethnically diverse overweight and obese children, ages 2–12 years; a two-tiered systems-oriented approach is hypothesized to reduce BMI z-scores, compared to primary prevention alone.

Methods: Our study aims are to: (1) implement and evaluate a *primary obesity prevention* program; (2) implement and evaluate efficacy of a 12-month family-centered *secondary obesity prevention* program embedded within primary prevention; and (3) quantify the incremental cost-effectiveness of the secondary prevention program. Baseline demographic and behavioral data for the primary prevention community areas are presented.

Results: Baseline data from preschool centers, elementary schools, and clinics indicate that most demographic variables are similar between intervention and comparison communities. Most families are low income (\leq \$25,000) and Hispanic/Latino (73.3–83.8%). The majority of parents were born outside of the United States. Child obesity rates exceed national values, ranging from 19.0% in preschool to 35.2% in fifth-grade children. Most parents report that their children consume sugary beverages, have a television in the bedroom, and do not consume adequate amounts of fruits and vegetables.

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Conclusions: Interventions to address childhood obesity are warranted in low-income, ethnically diverse communities. Integrating primary and secondary approaches is anticipated to provide sufficient exposure that will lead to significant decreases in childhood obesity.

Introduction

Because of its high prevalence, adverse metabolic effects, ethnic and socioeconomic (SES) disparities, and costs, addressing childhood obesity is a national public health imperative. Recent data from the United States estimate that 22.8% of children 2–5 years of age and 34.2% of children 6–11 years are overweight or obese,¹ with prevalence rates highest among black and Latino children. Childhood obesity is associated with metabolic and endocrine disorders that lead to early development of type 2 diabetes, cardiovascular disease, hypertension, and nonalcoholic fatty liver disease.^{2,3} Annually, obesity accounts for roughly 9% of all medical expenditures, and this cost may increase as today's obese youth enter adulthood.⁴

Recent systematic reviews indicate that behavior changes and weight loss among obese children are possible^{5,6}; however, reported weight losses were modest and the maintenance of effects was rarely measured. Moreover, the generalizability and reproducibility of the findings are unclear because of small sample sizes, nonstandardized outcome measures, inadequate inclusion of low-income minority children, and limited program accessibility.

Recognizing the complexity of childhood obesity, there is a consensus that development and evaluation of a systems-oriented approach for child obesity prevention and treatment is needed.⁷ A systems approach would simultaneously address the drivers of obesity at the individual, family, healthcare, community, organizational, and societal levels through primary prevention and secondary prevention efforts.

The goal of the Texas Childhood Obesity Research Demonstration (TX CORD) study is to implement and evaluate an integrated, systems-oriented model that incorporates primary and secondary prevention efforts at multiple sectors (primary healthcare clinics [PHCs], early care and education [ECE] centers, elementary schools, and community organizations) and multiple levels (child, family, community, and environment/policy). Our specific study aims are threefold: (1) to implement and evaluate a *primary obesity prevention* program in low-income, ethnically diverse catchment areas in Austin and Houston; (2) to implement and evaluate the efficacy of a systems-based, 12-month, family-centered *secondary obesity prevention* program embedded within the primary prevention program; and (3) to quantify the incremental cost-effectiveness of the 12-month family-based secondary prevention program, relative to primary prevention alone, for child obesity. The primary hypothesis for the TX CORD project is that integrating primary and secondary prevention approaches for child obesity will significantly reduce BMI *z*-scores in low-income, ethnically diverse overweight and obese children,

ages 2–12 years, compared to *primary prevention alone*. The aim of this article is to present the study design and description of the TX CORD project and include baseline data from the primary prevention communities.

Methods

Main Trial Study Aims and Study Design

The TX CORD project consists of two study designs: (1) a quasi-experimental pre- and post-test community trial comparing primary prevention programs in intervention and comparison catchment areas⁸ and (2) a randomized, controlled trial (RCT) comparing two secondary prevention child obesity programs nested within the primary prevention catchment area (Fig. 1). In the primary prevention intervention, baseline and 2-year follow-up data on the prevalence of overweight/obesity, risk factors, and the utilization of healthcare services and community programs are collected in the intervention and demographically matched comparison catchment areas ($n = 1614$ children ages 2–12 years/measurement year).

In the secondary prevention RCT, overweight/obese children ($n = 576$), ages 2–12 years, and their families are recruited and randomly assigned to either the 12-month secondary prevention program (Intervention 1) or the primary prevention program alone (comparison, Intervention 2), stratified by age subgroups (2–5, 6–8, and 9–12 years). Outcomes include BMI *z*-score, obesity-related behaviors, and quality of life. We will employ activity-based costing methods to quantify the incremental cost of delivering the secondary prevention program, relative to the primary prevention intervention program alone.

Intervention Overview and Description

Overarching Theoretical Framework

Primary prevention is defined as a public health effort targeting the entire population to prevent the development (incidence) of, or to decrease, the prevalence of obesity.⁵ In contrast, *secondary prevention*⁶ focuses on weight reduction among overweight and obese children to prevent long-term disease progression and development of comorbidities. The TX CORD systems-based approach coordinates intervention strategies along a continuum of prevention/treatment services. In our proposed model, the obesity chronic care model⁹ is operationalized within a framework of the social ecological model¹⁰ and social cognitive theory¹¹ that were used for the design of both the primary and secondary prevention programs. Using this approach, obesity is framed as a complex systems problem for which food and physical activity (PA) behaviors and

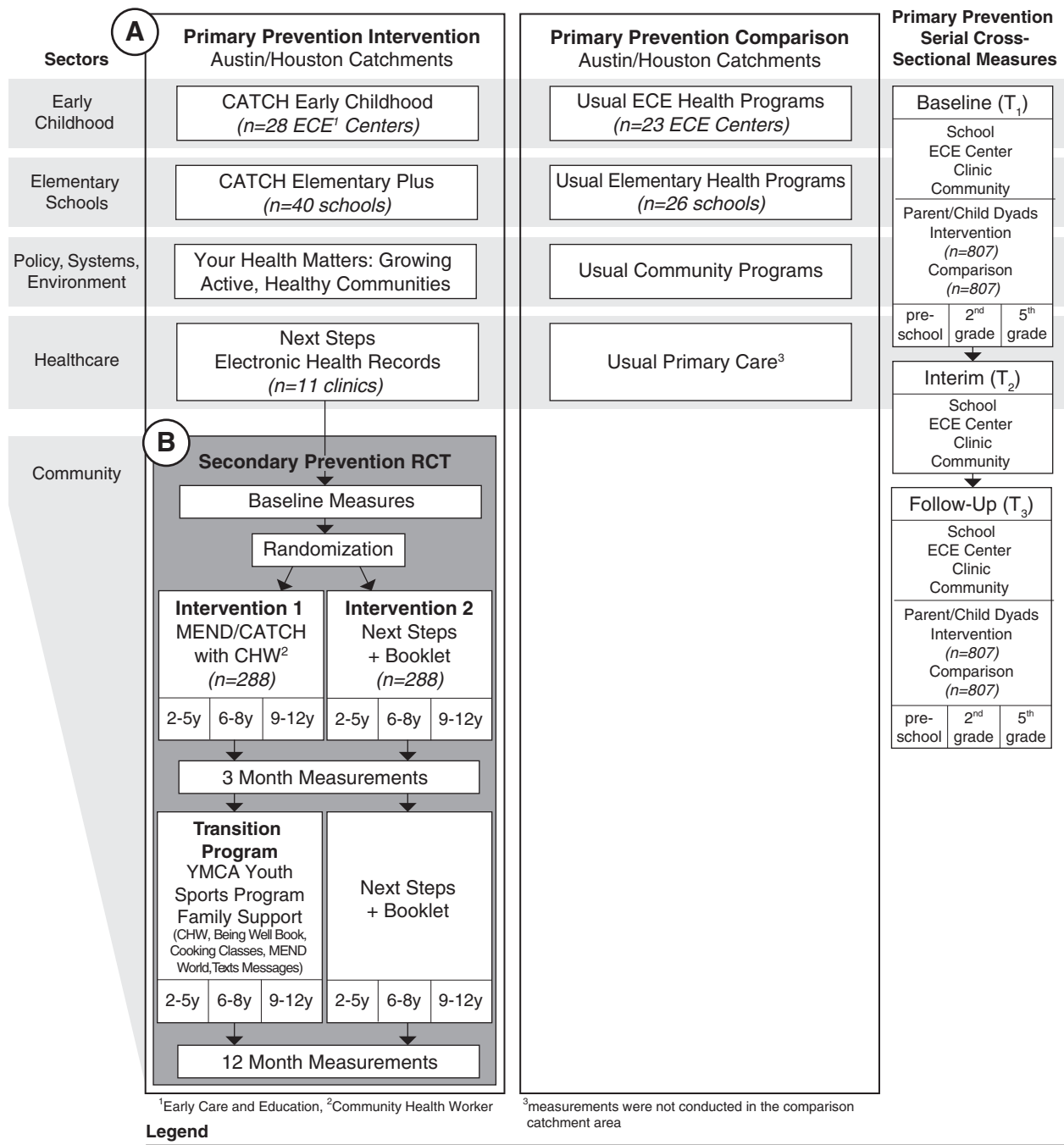


Figure 1. Study design for the Texas Childhood Obesity Research Demonstration (TX CORD) project. CATCH, Coordinated Approach to Child Health; ECE, early care and education; RCT, randomized, controlled trial; CHW, community health worker.

psychosocial factors are not determined solely by individual choice, but are enabled or constrained by contextual factors, including environmental factors and policy.¹²

The TX CORD study design is shown in Figure 1. This model includes secondary prevention programs (intensive, behaviorally based programs with nutrition education, PA classes, parental support, and community

health worker [CHW] support) embedded in a defined catchment area with primary prevention efforts (built environment/policy, healthcare, school and ECE programs) described in Table 1.

Primary prevention is operationalized in healthcare clinics in which obesity risk assessment, counseling, and systems for referral are in place for all children, regardless of income level

Table 1. Overview of TX CORD Intervention Components

Component	Description
Primary prevention intervention	
CATCH Early Childhood	<ul style="list-style-type: none"> ● Implemented in all Head Start centers and school Head Start prekindergartens in the intervention catchment areas/communities ● Center staff attend half-day CATCH training in year 1 in Austin and Houston and optional half-day booster in year 2 ● Program curricula and materials ● CATCH Early Childhood Coordination Toolkit used in year 2 ● Limited technical support throughout the year ● Encourage stronger center nutrition and activity policies
CATCH Elementary Plus School Program	<ul style="list-style-type: none"> ● Implemented in elementary schools in the intervention catchment areas/communities ● School staff (primarily PE teachers) attended a half-day CATCH training in year 1 in Austin and Houston ● CATCH Coordination Toolkit that lays out a year-round agenda for all components ● Uses CATCH curricula and PE equipment already at schools ● Limited technical support: <ul style="list-style-type: none"> ○ Staff ○ E-mail and online support ● CATCH committees to coordinate school wellness activities¹ ● Text messages emphasizing CATCH concepts and linking families to resources, health fairs, and so on—families could opt in to receive messages <ul style="list-style-type: none"> ○ Once per week ○ English or Spanish ○ Year 2 only
Your Health Matters: Growing Healthy, Active Communities training	<ul style="list-style-type: none"> ● Full-day training sessions conducted in Houston and Austin ● Attendees included CHWs, teachers, parents, physicians, and other stakeholders ● Designed to teach stakeholders about advocacy and the implementation of environmental changes for healthy eating and active living at local, state, and national levels
Healthcare (Next Steps)	<ul style="list-style-type: none"> ● Next Steps implemented in partner healthcare offices in Houston and Austin intervention catchment areas/communities ● Training for physicians and other office staff ● Limited technical support ● Key elements: <ul style="list-style-type: none"> ○ BMI screening <ul style="list-style-type: none"> ■ Decision supports to integrate guidelines for the appropriate clinical screening, evaluation, and treatment into day-to-day practice (e.g., Texas Pediatric Society Obesity Toolkit and American Academy of Pediatrics guidelines) ○ Next Steps brief counseling materials <ul style="list-style-type: none"> ■ Facilitates the clinical intervention ■ Supporting educational materials for families ○ EHR to identify at-risk children, provide treatment prompts, and aggregate data <ul style="list-style-type: none"> ■ Obesity Smart Set incorporated into EHR
Secondary prevention RCT	
Intervention 1	
MEND 2–5	<ul style="list-style-type: none"> ● 10 weekly 90-minute sessions relating to general nutrition, PA, and behaviors for children ages 2–5, including: <ul style="list-style-type: none"> ○ 30 minutes of guided active play ○ 15 minutes of healthy snack time evidence-based, exposure-based technique to promote acceptance and increased intake of fruit and vegetables² ○ 45 minutes where children participate in creative play activities while parents attend an interactive education and skill development session based on group-based parent training principles³
MEND 6–8 and 9–12	<ul style="list-style-type: none"> ● 10-week, bi-weekly 2-hour sessions for children ages 6–8 and 9–12 (separate sessions for each age group). Sessions include: <ul style="list-style-type: none"> ○ 1 hour of behavioral and nutrition sessions for parents and children together to improve self-esteem and address behavior change, as well as provide interactive group-based fun activities and discussions about family-friendly nutrition guidelines, practical skills, and demonstrations. ○ 1 hour of exercise sessions that use fun activities and group play based on CATCH activities to build strength and fitness (see description in next section) ○ 1 hour of parent group discussion sessions to address behavior changes, based on group-based parent training principles⁴ ● All family MEND resources provided in English and Spanish ● Based on evidence-based MEND 7–13 program

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Table 1. Overview of TX CORD Intervention Components *continued*

Component	Description
CATCH structured PAs	<ul style="list-style-type: none"> ● Follows initial 10-week MEND program, conducted separately for children ages 6–8 and 9–12 ● Held 2×/week for 1 hour/session ● Adapted from the PE component of the CATCH Kids' Club activities and led by YMCA PA leaders ● Activities modified to address needs of obese children, to increase moderate-to-vigorous PA, while emphasizing the social and enjoyable aspect of the program, and maintaining safety and following established guiding exercise training principles of progression, specificity, and exercise training ● Exercise program aims for a moderate intensity level equivalent to 60–70% of maximal heart rate for the majority of the 60 minutes. ● As children progress, they will be directed to participate in YMCA youth sports or other community sports or exercise programs for a more sustainable model.
CHW	<ul style="list-style-type: none"> ● Liaison between program components and family resource person ● 4 CHWs drawn from cadres in Houston and Austin ● Will work with 144 families over 2 years in each site ● Roles: outreach, recruitment, delivery of intervention components (i.e., MEND sessions, cooking classes, and tracking of families) ● Trained in MEND, CATCH, motivational interviewing, nutrition, and PA
Transition program	<ul style="list-style-type: none"> ● Children enrolled in YMCA sports programs (e.g., basketball, soccer, ballet, swimming) for 9 months ● Monthly family support sessions facilitated by program leaders, including: <ul style="list-style-type: none"> ○ Book club format using <i>A Year of Being Well</i> book, which has role model stories of low-income families using CDC obesity prevention behaviors and found to be feasible and decrease obesity-related behaviors ○ MEND review materials ○ Cooking classes based on <i>The Happy Kitchen/La Cocina Alegre™</i> <ul style="list-style-type: none"> ■ Theory-based cooking classes that teach families to choose and prepare healthy meals and snacks ■ Taught by CHWs and MEND theory leaders ■ Materials are available in English and Spanish ■ Participants receive cookbook and groceries at the end of the lesson to take home. ○ MEND World online/print materials <ul style="list-style-type: none"> ■ Follows initial 10-week MEND program ■ Both online and hard copy ■ Self-directed learning and activities ○ CATCH activities for children during support sessions (e.g., active play and games) ○ <i>En Vivo</i> comic books to decrease screen time
Text messages	<ul style="list-style-type: none"> ● Text messages for families once per week in English or Spanish through cell phones <ul style="list-style-type: none"> ○ Reinforce MEND, CATCH concepts ○ Link families to resources in the community and health-related events ● Use of social media (Facebook) when families transition out of program
Intervention 2	
Next Steps plus booklet	<ul style="list-style-type: none"> ● Next Steps brief counseling materials <ul style="list-style-type: none"> ○ Facilitates the clinical intervention ○ Supporting educational materials for families ● Next Steps booklet with games, goal setting, and other activities that parents and children work on together in a self-directed manner ● Follow-up visits to physician as necessary (maximum of approximately two per 3-month period)

CATCH, Coordinated Approach to Child Health; CHW, community health worker; EHR, electronic health record; MEND, Mind Exercise Nutrition Do it!; PA, physical activity; PE, physical education; TX CORD, the Texas Childhood Obesity Research Demonstration project.

or insurance status. Primary prevention encompasses ECE- and school-based programs, which emphasize and support healthy eating and PA, together with other community-level programs. Enhancing opportunities and policies for healthy eating and PA create supportive environments in the community, with messages that reinforce and complement the behavioral targets of the interventions.

Secondary prevention programs (Fig. 1) include more-intensive interventions that focus on overweight or obese

children and their families, and include targeted goals to improve dietary intake and increase PA through integrated healthcare/public health efforts. These interventions are implemented in small groups or one on one, with emphasis on increasing food and PA-related skills and self-efficacy. Families are monitored and connected to the healthcare system through CHW. The intervention system delivers information to families, as well as to healthcare providers, to provide feedback and a safety net for adverse or

unexpected consequences. This bidirectional link with the child's medical home provides an immediate link to further medical care, if required.

TX CORD Intervention Program Components

The TX CORD program components are shown in Figure 1 and Table 1 and are briefly described below. All TX CORD components have been previously implemented and evaluated in low-income and diverse populations in various settings, and several of the programs have been widely disseminated. The use of previously evaluated programs in a packaged form for dissemination, as well as the focus on system-level changes, indicates that TX CORD program elements are generalizable to similar low-income, diverse populations.

Primary Prevention Program Components

Primary prevention consists of evidence-based obesity prevention program components that are implemented in preschools, elementary schools, community settings, and healthcare clinics, including: (1) Coordinated Approach To Child Health (CATCH) Early Childhood (CEC) in ECE centers; (2) CATCH in elementary schools; (3) Your Health Matters: Growing Healthy, Active Communities, a health promotion, systems, and environmental change training program; and (4) a TX CORD-modified Next Steps program with themed-based visits, and brief counseling program for healthcare providers.

Early Care and Education Centers and Schools

The CEC program is a developmentally appropriate obesity prevention program for preschool children and the ECE setting. CEC includes a classroom curriculum with nutrition and garden-based lesson plans, extension activities, and curriculum connectors, an activity box with corresponding equipment to promote PA indoors and outdoors in a preschool setting, parent tip sheets complementing the preschool activities, and a coordination kit with themes to coordinate CEC activities across the classrooms and preschool. Implementation of the program has been found to be feasible and acceptable in Head Start and other ECE settings.^{13,14}

The CATCH Elementary School (grades K–5) program is a coordinated school health program based on the CDC eight-component model¹⁵ for diet and PA behaviors. Core components of CATCH include: Child Nutrition Services; physical education (PE); classroom curricula; family outreach; school environment; and a coordination guide. CATCH has been found to be culturally relevant and appropriate, and results have been robust in low-income, Hispanic/Latino populations.^{16,17} Based on the accumulating evidence, it appears that school programs, such as CATCH, can be effective for obesity prevention, but need community or supportive efforts to produce long-term changes.^{16,17}

Community

The community components of TX CORD include an environmental policy change training, an advisory committee, and meetings to enhance coordination with existing CDC-funded community initiatives. A health promotion, systems and environmental policy change training program, Your Health Matters: Growing Healthy, Active Communities, is implemented to train grassroots organizers in environmental efforts that can lead to changes in the food and/or PA environment. Three trainings sessions are planned, in Houston in English, and in Austin in English and Spanish, with a capacity of 30–40 participants per session. Efforts are made to recruit CHWs, teachers, parents, and other community leaders who would benefit from an introduction to the role of the environment in promoting healthy living. Environmental changes emphasized in the training are consistent with the behavioral targets in the TX CORD intervention. TX CORD investigators convene an advisory committee as well, with community leaders from Austin and Houston, as well as representatives from existing state coalitions, such as Live Smart Texas¹⁸; this committee reviews and advises TX CORD on program implementation. TX CORD investigators also coordinate efforts with current funded community transformation grants in both Austin and Houston, using quarterly update meetings with program stakeholders.

Healthcare Clinics

Healthcare providers play a seminal role in children's health, although a majority feel ill equipped to address childhood obesity in their clinics.¹⁹ For TX CORD, the healthcare intervention consists of training and counseling around three main components: (1) BMI screening; (2) Next Steps theme-based childhood obesity counseling; and (3) electronic health record (EHR) changes to support childhood obesity clinical visits.

Where available, the EHR automatically displays an alert when a patient's BMI is ≥ 85 th percentile.²⁰ The optional Obesity Evaluation and Intervention Guide provides prompts for the patient history and physical, and the provider has easy access to a set of diagnosis codes, laboratory tests, and referrals common in management of overweight and obesity. In addition, a list of community resources that support healthy lifestyles, such as community recreation centers, farmers markets, and nutrition websites, is embedded in the patient information section of the electronic record or available in hard copy. When EHRs are not available, providers rely on training, Next Steps materials, and cues to actions (*e.g.*, Next Steps posters) for screening.

The original Next Steps consisted of materials to support brief counseling for weight management in the primary healthcare office.²¹ TX CORD has culturally adapted Next Steps materials for low-income, urban, black, and Latino children in both English and Spanish versions. A wall

poster with a menu of healthy lifestyle topics, such as the My Plate guide or appropriate screen time behaviors, serves as a cue to action to encourage parents and providers to focus on key behavioral messages. The provider uses a laminated flip chart to briefly review key concepts for the topic, show simple graphics, and help set behavior change goals. One or more topics can be covered during an office visit, depending on available time. An activity book compliments the theme-based visits and allows children and families to remember and work on the healthy themes at home through goal setting, monitoring calendars, and other behaviorally based activities to reinforce the concepts for each topic.

Secondary Prevention Program Components

The 12-month secondary prevention program (Intervention 1) for overweight and obese children and their families entails: (1) a 3-month intensive phase, which includes the Mind Exercise Nutrition Do it! (MEND) programs for preschool (ages 2–5) and school-aged (ages 6–12) children coupled with adapted CATCH activities, and (2) a 9-month transition program, which includes monthly family sessions with cooking classes, a book club, CATCH activities, YMCA youth sports, and other community-level activities (Table 1; Fig. 1). CHWs serve as program liaisons and assist in delivering all intervention group sessions as well as tracking families and their healthcare expenditures throughout the year-long period. In addition, CHWs provide support to families by serving as a resource to answer questions or concerns by the families, checking monthly on participation in sports teams, and referring families to other community resources.

Intensive phase (3 month). The MEND 2–5 and 6–12 programs for preschool- and school-aged children have been developed and evaluated over the past decade.^{22,23} MEND programs are multicomponent interventions including behavioral, nutrition, and PA sessions designed to treat and prevent childhood obesity.²³ The TX CORD MEND programs include the following core components: (1) behaviorally based sessions for children and their families; (2) a PA curriculum adapted using CATCH materials²⁴; (3) group discussion sessions with parents; (4) feedback reports to primary healthcare providers and parents on child progress; and (5) additional resources for families (MEND World). MEND was adapted for the United States using focus group data and interviews and extensively field tested in diverse, low-income populations in Texas. Initial pilot data show acceptability and encouraging effects on BMI and changes in obesity-related behaviors.²⁵

Transition program (9 month). The remaining 9 months of the secondary prevention (Intervention 1) include monthly 90-minute postprogram sessions that parents and children attend together. These sessions include a brief review of the MEND concepts, role model stories from the

Being Well book,²⁶ and cooking lessons adapted from *The Happy Kitchen/La Cocina Alegre*^{TM27} for parents, while children participate in activities that include CATCH games,²⁴ comic books from *En Vivo* (an intervention to decrease television viewing)²⁸ and MEND World activities. Children also enroll in YMCA sports teams or programs to encourage PA and gradually transition them into existing community programs to encourage maintenance of program effects. Weekly text messages to parents enrolled in the secondary prevention program are also used to increase both the reach and reinforcement of the behavioral objectives of the intervention.

CHWs provide interconnections and coordination between healthcare and community sectors. The CHWs receive training in childhood obesity and provide health information, strategies, and resources for families in a culturally sensitive manner. CHWs assist in presenting all MEND and transition sessions and serve as liaisons for program components.

The 12-month secondary prevention program (Intervention 2) for overweight and obese children and their families is centered in the healthcare setting and entails (1) BMI screening, (2) Next Steps, and (3) EHR changes to support childhood obesity clinical visits, as previously described.

In TX CORD, the primary prevention programs are implemented in parallel with the secondary prevention programs in the same geographic catchment area (Fig. 1). Families enrolled in the secondary prevention program may be exposed to the primary prevention efforts in clinics, schools, ECE centers, and in the community; analyses will determine how many of the families are exposed to both interventions (primary and secondary).

Evaluation

Determination of Primary Prevention

Intervention Areas

Catchment areas in Austin and Houston were determined using geographical information systems data and are based on an index specific to this study, which includes variables such as income and racial/ethnic composition.⁸ Further details about the method, as well as the geographic distribution of the catchment areas, are provided elsewhere.⁸

Primary Prevention Recruitment and Data Collection

Representative schools and ECE centers in the intervention and comparison catchment areas are invited to participate in the TX CORD project. Human subjects approval is obtained in each school district (Austin and Houston) and from Head Start centers; after approval, individual schools/centers are recruited to participate. Informed consent is obtained from school and healthcare personnel before assessment. Informed active consent of

parents of Head Start/preschool children ages 2–5 years as well as second- and fifth-grade students is obtained before measurement. All school children are required to complete either verbal (second grade for BMI measures) or written (fifth grade for BMI and survey) assent. The institutional review boards at The University of Texas Health Science Center–Houston and Baylor College of Medicine approved all protocols and procedures.

School and ECE surveys are completed by the school principal, center manager, or designee; teacher surveys are distributed to teachers of preschool children ages 2–5 years as well as second- and fifth-grade teachers. These age categories correspond to the three stratified age groups for the secondary prevention. Clinic surveys are distributed to participating clinics; all personnel involved in assessment of overweight/obese children are asked to participate. Clinic scans are completed by the clinic managers; vending machine audits are also conducted by trained staff. At ECE centers and schools, parents of preschool and second-grade students complete a survey, as do fifth-grade parents and children.

A final sample size of 1614 child-parent dyads ($n=807$ intervention and 807 control), with 538 children at each grade level (preschool, second grade, and fifth grade), is determined to provide adequate power.

Primary Prevention Measures

An overview of the measurements and time periods for evaluation are outlined in Table 2.

Parent and child surveys. Measures for primary prevention parent and child surveys are developed from previous survey instruments, including the School Physical Activity and Nutrition (SPAN) survey (Table 2).^{29–31} Other questionnaire items include CORD common measures.³² All measurement instruments are translated into Spanish and pilot tested for cultural competence.

Child height and weight. Trained staff use standard equipment (digital scale and stadiometer) and calibration procedures to measure body weight to the nearest 0.1 kg and height and waist circumference to the nearest 1 mm as described by the National Center for Health Statistics. BMI (weight [kg] ÷ stature [m]²) z-score for age and sex is computed using the 2000 CDC reference.³³

School, early care and education, and teacher surveys. School, ECE center, and teacher surveys are developed using questionnaire items from previous studies,^{34,35} the Nutrition and Physical Activity Self-Assessment for Child Care assessment tool,³⁶ the Yale Rudd Center survey,³⁷ and other items developed specifically for this study.

Clinic and clinician surveys. Clinic staff surveys are adapted from Polacsek and colleagues,³⁸ as well as the common CORD measures.³²

Community-level assessments. To assess coalition strength, the Wilder survey³⁹ is administered to the advisory committee, as well as program stakeholders. In addition to the Wilder survey, community-level assessments were conducted using the Community-Based Surveillance of Supports for Healthy Eating/Active Living, a CDC-developed tool.⁴⁰

Secondary Prevention Recruitment

Overweight/obese children (total, $n=576$), ages 2–12 years, are recruited from participating clinics within TX CORD intervention catchment areas in Austin and Houston and randomly assigned to either Intervention 1 (secondary prevention program) or Intervention 2 (comparison), in stratified age groups (2–5, 6–8, and 9–12 years). Recruitment includes a variety of methods, depending on the clinic: flags in EHR; referral sheets from physicians; and calls to eligible families from the clinic to ask about participation in the study. Inclusion criteria are: (1) 2–12 years of age and (2) $\geq 85^{\text{th}}$ percentile for BMI.⁴¹ Exclusion criteria include: (1) complications of obesity that would interfere with participation (*e.g.*, severe respiratory insufficiency or orthopedic problems); (2) underlying obesity-related conditions, such as systemic steroid use or endocrine abnormalities; (3) severe psychological problems; (4) severe obesity ($> 99.5^{\text{th}}$ BMI percentile); and (5) participation in an obesity treatment program within the past year. Informed active consent is obtained from at least one parent or guardian and assent is obtained from the child, with children ages 6–12 years providing written assent and children less than 6 years providing verbal assent.

Secondary Prevention Measures

Physiological measures, anthropometrics: children. Trained staff use standard equipment (digital scale, stadiometer, and metal tape) and calibration procedures to measure body weight, as described above. Fat-free mass and fat mass are measured by bioelectrical impedance analysis (Body Composition Analyzer/Scale, model TBF-410 GS; Tanita Corp., Arlington Heights, IL).

Parents. Weight, height, and body composition are measured using the same procedures, and obesity status is categorized using cut-off points for overweight (BMI > 25) and obesity (BMI > 30).^{41,42}

Fitness. Resting systolic and diastolic blood pressure as well as mean arterial pressure and heart rate are measured using an automated DINAMAP Vital Signs Monitor (8100T; Critikon, Inc., Tampa, FL). Aerobic fitness is determined by a standardized, validated, and height-adjusted step test.⁴³

Diet and physical activity. The Block Kids 2004 Hispanic Food Frequency Questionnaire (NutritionQuest, Berkeley, CA) is used to determine usual dietary intake. Free-living

Table 2. Overview of TX CORD Outcome and Process Measures and Time Frame

Primary prevention intervention (2-year intervention)	Baseline		2 years postbaseline
Community (catchment-wide) measures (n=1614)			
Assessment of programs and policy	X		X
School-based survey: programs, policies related to nutrition and PA; health education programs	X		X
School teachers survey	X		X
Parent survey for preschool, second-grade, and fifth-grade parents			X
Child survey (fifth grade): diet and PA	X		X
Fitnessgram® (for elementary and middle schools); height and weight for children in day care and under age 8 (not covered by Fitnessgram)	X		X
ECE survey	X		X
ECE teacher survey	X		X
Clinic survey	X		X
Clinician survey; vending machine audit	X		X
Wilder Survey for TX CORD Advisory Committee	X		X
BRFSS Data (for adult obesity and related behaviors)	X		X
Community assessment data: shared from TDSHS projects	X		
Community assessment	X		X
Secondary prevention intervention (1-year intervention)			
Child measures (n=576)			
	Baseline	3 months	12 Months
Physiological			
Anthropometrics: height, weight, BMI, fat mass, waist circumference	X	X	X
Cardiovascular health: blood pressure, resting HR	X	X	X
Fitness			
Height-adjusted step test	X	X	X
Activity: ActiGraph (7 days)	X	X	X
SPAN survey: PA	X	X	X
Diet			
Block Kids 2004 Hispanic FFQ SPAN: diet	X X	X X	X X
Psychosocial health			
ChEAT, body esteem, Peds quality of life	X	X	X
Parent measures (n=576)			
Sociodemographics (child and parent)			
Age, race/ethnicity, SES, acculturation, nativity, education, health literacy	X	X	X
Physiological			
Height, weight, BMI fat mass	X	X	X
Psychosocial health			
Strengths and Difficulties Questionnaire, Short-form Health Survey (SF-12), Peds Quality of Life; Sizing Them Up, Child Growth, Child Feeding Questionnaire, Parenting Questionnaire (TOPSE)	X	X	X
Beneficiary satisfaction with community and healthcare services	X	X	X

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Table 2. Overview of TX CORD Outcome and Process Measures and Time Frame *continued*

Intervention programs and policy measures			
Program satisfaction, healthcare utilization	X	X	X
Program costs	X	X	X
CHW survey	X		X
Both primary and secondary			
Process evaluation measures	Baseline	1 year	2 year
Dose (MEND, CATCH, postprogram sessions, school, ECE, clinic data)	X	X	X
Fidelity (MEND, postprogram sessions, school, ECE, clinic data)	X	X	X
Acceptability/feasibility (exit interview, school, ECE, clinic)	X	X	X
Systems-level measures	Baseline	1 year	3 year
Systems-level interviews		X	X

BRFSS, Behavioral Risk Factor Surveillance System; chEAT, Children's Eating Attitude Test; ECE, early care and education; FFQ, food frequency questionnaire; HR, heart rate; MEND, Mind Exercise Nutrition Do It!; PA, physical activity; SES, socioeconomic status; SF-12, Short-form Health Survey; SPAN, School Physical Activity and Nutrition; TDSHS, Texas Department of State Health Services; TOPSE, a Tool to measure Parenting Self-Efficacy; TX CORD, the Texas Childhood Obesity Research Demonstration project.

PA is recorded for 7 consecutive days using a triaxial accelerometer (ActiGraph GT3X+; ActiGraph, Pensacola, FL). Awake time and sleep times are identified, and awake time is categorized into sedentary, light, moderate, and vigorous PA levels.⁴⁴ Further data analysis and cut points for accelerometer data are conducted using methods from Pate and colleagues and Trost and colleagues 2002.^{45,46} Items adapted from the SPAN survey²⁹ ascertain the children's food preferences, eating patterns, and physical activities.

Psychosocial health: children. The Children's Eating Attitude Test (ChEAT) is used to assess the level of disordered eating attitudes.⁴⁷ The Body Esteem Scale (Mendelson) assesses children's cognitive and affective evaluations of the appearance of their body.⁴⁸ Peds Quality of Life (Varni)^{49–51} is used to measure quality of life across four discrete domains of function: physical health; emotional health; social health; and school functioning.

Parents. The Strengths and Difficulties Questionnaire, a brief behavioral screening questionnaire that asks parents to rate the frequency with which their child exhibits a range of behaviors associated with emotional distress in four areas (emotional, inactivity/hyperactivity, conduct, and peer relationships) is used.⁵² The Tool to Measure Parenting Self-Efficacy ascertains parenting styles and practices.⁵³ Peds Quality of Life, a parent-rated 23-item measure of health-related quality of life in children,^{49–51} and Sizing Them Up (Modi), an obesity-specific quality-of-life measure of children,⁵⁴ are used. The Short-Form Health Survey (SF-12), a brief 12-item

measure assesses parents' physical and mental health.⁵⁵ Health literacy is determined using The Newest Vital Sign assessment tool.⁵⁶

Secondary Prevention Data Collection

The 12-month intervention was designed with an adequate sample size ($n = 576$) to provide sufficient statistical power to determine the effect of the intervention on the primary (BMI z-score) and secondary (body composition, dietary practices, PA, fitness, quality of life, and psychological state) outcomes. Measurement periods were scheduled at baseline, 3 months (at the end of the intensive phase of the program), and 12 months (at the end of the program; Table 2).

Cost-effectiveness. To quantify the incremental cost-effectiveness of the 12-month secondary prevention intervention, relative to the primary prevention alone, activity-based costing methods will be used. Further information about the approach will be included in subsequent publications.

Process evaluation. Process evaluation covers dose, fidelity, and acceptability/feasibility of the TX CORD primary and secondary prevention components. Dose is measured using items such as number of face-to-face sessions attended by parent and child and number of exercise sessions attended. Fidelity is assessed by checklists for each lesson, assessing critical elements of the programs that were taught and completed by participants. Acceptability/feasibility is measured through interviews and program utilization surveys with children, parents, staff, and stakeholders.

Sustainability: scalability and institutionalization. Sustainability of TX CORD core components is evaluated by conducting structured interviews with selected program administrators and implementers at schools, ECE centers, primary care clinics, and YMCAs. Sustainability, also known as institutionalization, is often cited as the culminating goal following the successful demonstration of program efficacy.^{57–60}

Data and Analysis

To provide further information on the population targeted in the TX CORD communities, data from the primary prevention community populations at baseline are presented. Data relevant to the secondary prevention, as well as the primary prevention follow-up, will be presented in future analyses. For each study population (with the exception of healthcare clinics, which were in the intervention catchment only), significant differences between those catchment areas were assessed using parametric or nonparametric tests, as appropriate, and accounting for nonindependencies, as necessary, using the SAS mixed procedure with robust standard errors (SAS Institute Inc., Cary, NC). Specifically, this procedure was used to adjust for the clustering of teachers within centers and schools, as well as of parents and children within schools.

Results

Descriptive information is presented separately for (1) ECE centers and teachers (Table 3), (2) elementary schools and teachers (Table 4), (3) primary care clinics and clinicians (Table 5), and (4) children and their parents (Table 6). Participation rates varied by sector (school, ECE center, and clinic), with 100% of selected ECE centers and clinics participating and 92% of selected elementary schools participating. Family participation ranged from 32% of elementary school families to 50% of ECE center families; 96% of the study sample-size goals for parent-child dyads were met across all age groups.

Early Care and Education Center and Teacher Intervention-Comparison Differences

There were few significant differences in nutrition and PA training and policies between ECE centers and teachers from the intervention versus the comparison catchment areas. ECE centers from the comparison catchment reported more teacher training in PA, relative to those from the intervention catchment. A higher percentage of early education teachers in the comparison catchment reported being trained to implement the CATCH Early Childhood program as well as currently teaching the CATCH Early Childhood program (Table 3).

Elementary School and Elementary Teacher Intervention-Comparison Differences

There were few significant differences in student population and teacher background/training between elementary schools in the intervention versus the comparison catchment areas. A higher percentage of elementary teachers in the intervention catchment were Hispanic/Latino, whereas a higher percentage of teachers in the comparison area were black. Likewise, a higher percentage of elementary teachers in the intervention catchment were bilingual, relative to those in the comparison catchment. Finally, a higher percentage of elementary teachers in the intervention catchment reported being trained to implement CATCH (Table 4).

Clinic and Clinician

The staff at the 11 clinics in the intervention catchment areas in Austin and Houston were predominantly female and racially/ethnically diverse, especially among the non-provider staff. Providers reported previous training in nutrition, PA, or child obesity for 10 hours or less, and nonprovider staff reported 5 hours or less. Approximately half of the clinics plotted weight and height at every encounter. Only two clinics had policies prohibiting food-related rewards. Most of the clinics had no vending machines (Table 5).

Primary Prevention Preschool Intervention-Comparison Differences

There were no differences in household characteristics between preschool families in the intervention and comparison catchment areas. Parents of preschool children in the comparison catchment reported slightly higher education levels, relative to those from the intervention catchment, and were also more likely to report that their child had a regular bedtime (Table 6). The overall prevalence of child obesity was 19.0%, well above current rates reported by the National Health and Nutrition Examination Survey.¹

Primary Prevention Second-Grade Intervention-Comparison Differences

There were no differences in any household or parent characteristics between second-grade sample respondents in the intervention or comparison catchment areas. Parents of second-grade children in the comparison catchment reported higher consumption of punch, sports drinks, and so on, and lower consumption of water among their children, relative to those from the intervention catchment (Table 6). Prevalence of obesity was 28.3% among all second-grade children.

Primary Prevention Fifth-Grade Intervention-Comparison Differences

A higher percentage of fifth-grade families in the intervention catchment reported receiving SNAP benefits.

Table 3. TX CORD Baseline Early Care and Education Centers and Center Teachers: Intervention and Comparison Catchment Differences

Early care and education centers	Total n (%) (n=23)	Intervention n (%) (n=11)	Comparison n (%) (n=12)
Economically disadvantaged (%)	23 (100.0)	11 (100.0)	12 (100.0)
Nutrition education			
Teacher training			
Rarely or never	1 (4.4)	1 (9.1)	0 (0.0)
Less than once a year	1 (4.4)	0 (0.0)	1 (8.7)
Once a year	8 (34.8)	3 (27.3)	5 (41.7)
Twice a year or more	13 (56.5)	6 (54.6)	7 (58.3)
Parent workshops			
Rarely or never	1 (4.4)	1 (9.1)	0 (0.0)
1–5 times per year	2 (8.7)	0 (0.0)	2 (16.7)
6 times per year	5 (21.7)	1 (9.1)	4 (33.3)
At least monthly	15 (65.2)	9 (81.8)	6 (50.0)
Physical activity education			
Teacher training			
Rarely or never	2 (8.7)	2 (18.2)	0 (0.0) ^{***1}
Less than once a year	1 (4.4)	1 (9.1)	0 (0.0)
Once a year	8 (34.8)	6 (54.6)	2 (16.7)
Twice a year or more	12 (52.2)	2 (18.2)	10 (83.3)
Parent workshops			
Rarely or never	4 (17.4)	4 (36.4)	0 (0.0)
1–5 times per year	2 (8.7)	0 (0.0)	2 (16.7)
6 times per year	6 (26.1)	2 (18.2)	4 (33.3)
At least monthly	11 (47.8)	5 (45.5)	6 (50.0)
Written policy on nutrition			
Does not exist	2 (9.1)	1 (8.3)	1 (10.0)
Exists informally	0 (0.0)	0 (0.0)	0 (0.0)
Written, but not always followed by staff	1 (4.6)	1 (8.3)	0 (0.0)
Written and followed by staff	19 (86.3)	10 (83.3)	9 (90.0)
Written policy on physical activity			
Does not exist	4 (18.2)	2 (16.7)	2 (20.0)
Exists informally	1 (4.6)	0 (0.0)	1 (10.0)
Written, but not always followed by staff	2 (9.1)	2 (16.7)	0 (0.0)
Written and followed by staff	15 (68.1)	8 (66.7)	7 (70.0)
Type of early child education center			
Head Start	23 (100.0)	11 (100.0)	12 (100.0)
State-funded preschool	0 (0.0)	0 (0.0)	0 (0.0)
Age of children at center			
Early preschool: age 3 years	14 (60.9)	5 (45.5)	9 (75.0)
4–5 years	20 (86.7)	8 (72.7)	12 (100.0)
Early education teachers	Total mean (SD) or % (n=113)	Intervention mean (SD) or % (n=49)	Comparison mean (SD) or % (n=63)
Age in years (mean, SE)	42.5 (1.1)	42.5 (1.7)	42.4 (1.4)
Female (%)	96.3	95.9	96.7
Race/ethnicity			
Hispanic/Latino (%)	44.1	44.0	44.1
African American (%)	48.6	48.0	49.2
Bilingual (%)	53.2	59.2	48.3
Current job title:			
Teacher (n, %)	59 (52.2)	22 (44.0)	37 (58.7)

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Table 3. TX CORD Baseline Early Care and Education Centers and Center Teachers: Intervention and Comparison Catchment Differences *continued*

Early education teachers	Total mean (SD) or % (n=113)	Intervention mean (SD) or % (n=49)	Comparison mean (SD) or % (n=63)
Years of teaching			
1 year or less	8.8	8.2	9.5
2–5 years	30.4	40.8	22.2
6–10 years	17.0	8.2	23.8
> 10 years	43.8	42.8	44.5
Years working at the center (%)			
1 year or less	33.3	29.2	36.5
2–5 years	45.0	50.0	42.9
6–10 years	9.9	12.5	7.9
> 10 years	10.8	8.3	12.7
Trained to implement CATCH Early Childhood (%)	19.8	6.1	31.6 ^{*2}
Currently teaching CATCH Early Childhood (%)	21.4	6.1	35.2 ^{*3}
Number of health lessons taught yearly (mean, SE)	7.2 (0.2)	7.3 (0.3)	7.2 (0.4)
40–50	20.0	20.0	20.9
50–60	10.0	20.0	5.8
> 60	6.2	7.5	4.7

Childcare center ID has been taken into account as a random effect.

* $p < 0.05$; ** $p < 0.01$.

^{*1} $p < 0.01$ between intervention (I)=2 (18.2) and comparison (C)=0 (0.0).

^{*2} $p < 0.05$ between I=6.1 and C=31.6.

^{*3} $p < 0.05$ between 6.1 and C=35.2.

CATCH, Coordinated Approach to Child Health; SD, standard deviation; SE, standard error; TX CORD, the Texas Childhood Obesity Research Demonstration project.

There were no differences between fifth-grade parent respondents in the catchment areas. Parents in the comparison catchment reported higher consumption of punch, sports drinks, and so on, as well as higher total sugar-sweetened beverage consumption among their fifth-grade children, relative to those from the intervention catchment (Table 6). Prevalence of obesity was 35.2% among all fifth-grade children.

Baseline data from the TX CORD primary prevention settings (ECE centers, elementary schools, and clinics), as well as the initial parent and child data indicate, that our intervention catchment area is similar to the comparison catchment area in most relevant demographic and behavioral variables. Families in the study area are extremely low income, with most parents reporting an annual household income of \leq \$25,000 and many families receiving multiple government assistance programs (Table 6). The population is also predominantly Hispanic/Latino (73.3–83.8%) and African American (13.5–22.7%). A majority of parents were born outside of the United States, with approximately 44–55% speaking Spanish primarily.

A high prevalence of overweight and obesity (\geq 85th BMI percentile) also is documented in our population, with the rates increasing from preschool to second grade to fifth grade (36.5%, 45.6%, and 56.7%, respectively; Table 6). In general, parent-reported child dietary and PA behaviors show approximately 2.5–3.0 servings per day of fruits and vegetables, 1.2–1.5 servings per day of sugary beverages, and \geq 60 minutes per day of moderate-to-vigorous PA on 4–5 days per week. Parents reported 68.3%, 65.1%, and 63.6% of preschool, second-grade, and fifth-grade children, respectively, have a television (TV) in their bedrooms.

Discussion

The composition of the population in the primary prevention catchment areas suggests many barriers in the implementation of intervention programs for child obesity and overweight, including the necessity of bilingual materials for all programs, and cultural issues that might influence food patterns and PA,⁶¹ as well as problems inherent with diet and PA in low-income populations, such

Table 4. TX CORD Baseline Elementary Schools and Elementary Teachers: Intervention and Comparison Catchment Differences

Elementary schools	Total mean (SD) or % (n=16) ^a	Intervention mean (SD) or % (n=9)	Comparison mean (SD) or % (n=7)
Total enrollment ^b	707.0 (249.6)	807.0 (262.5)	577 (171.1)
Percent economically disadvantaged students ^b	96.1 (1.7)	96.9 (0.8)	95.1 (2.1)
Student racial/ethnic composition ^b			
Hispanic/Latino	84.2	86.4	80.2
African American	11.8	10.0	14.9
Other	4.0	3.6	4.9
Coordinated school health program			
CATCH	75.0	88.9	57.1
Other ^c	12.5	11.1	14.3
None	12.5	0.0	28.6
Coordinated school health program Committee or team	68.8	77.8	57.1
Campus improvement plan with diet/PA	81.3	88.9	71.4
Number of nutrition activities and policies	11.5 (2.5)	11.1 (1.9)	12.0 (3.2)

^aThe original *n* in school survey is 24. After excluded eight pre-K schools, 16 schools are included in the analysis.

^bData for these characteristics were drawn from the Texas Education Agency (TEA, 2013). Texas Education Agency. Reports and data. 2012. Available at www.tea.state.tx.us/index.aspx?id=2147495413&menu_id=680&menu_id2=797&cid=2147483656 Last accessed December 15, 2013.

^cOther program: Fuel Up to Play 60, Wellness Program. Two schools checked both CATCH and District developed own CSHP or Other.

p* < 0.05; *p* < 0.01; ****p* < 0.001.

Elementary teachers	Total mean (SD) or % (n=146) ^a	Intervention mean (SD) or % (n=75)	Comparison mean (SD) or % (n=71)
Age	40.5 (11.5)	41.3 (12.0)	39.7 (10.8)
Female	79.0	76.7	81.4
Teacher racial/ethnic composition			
Hispanic/Latino	47.9	56.2	39.1
African American	21.8	9.6	34.8 ^{*1}
Other	30.1	34.2	26.1
Bilingual speaking	55.9	67.1	44.3 ^{**2}
Current job title			
Classroom teacher	93.8	92.0	95.7
PE teacher	2.8	2.7	2.9
Years of teaching			
Less than 1 year	5.5	6.7	4.3
1–5 years	26.9	22.7	31.4
6–10 years	22.1	25.3	18.6
More than 10 years	45.5	45.3	45.7
Years in current position			
Less than 1 year	21.2	20.0	22.5
1–5 years	46.6	48.0	45.1
6–10 years	13.7	10.7	16.9
More than 10 years	18.5	21.3	15.5

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Table 4. TX CORD Baseline Elementary Schools and Elementary Teachers: Intervention and Comparison Catchment Differences *continued*

Elementary teachers	Total mean (SD) or % (n=146) ^a	Intervention mean (SD) or % (n=75)	Comparison mean (SD) or % (n=71)
Previous nutrition training	71.5	67.6	75.7
Previous PA training	77.4	77.3	77.5
Active schools CATCH committee	77.0	81.4	67.9
Trained to implement CATCH	34.8	48.6	19.1 ^{**3}
Health lessons to teach	4.0 (4.0)	4.3 (4.0)	3.6 (4.0)
Health policies ^b	4.4 (1.7)	4.6 (1.7)	4.2 (1.7)

School ID has been taken into account as a random effect.

^aThirty-four teachers from the 10 pre-K schools have been excluded in the analysis.

^bItems 1–7 under Health Policies section have been combined, with score range 0–7.

* $p < 0.05$; ** $p < 0.01$.

^{*1}In elementary teachers, $p < 0.05$ between intervention (I)=9.6 and comparison (C)=34.8.

^{*2} $p < 0.01$ between I=67.1 and C=44.3.

^{*3} $p < 0.01$ between I=48.6 and C=19.1.

CATCH, Coordinated Approach to Child Health; CSHP, coordinated school health program; ID, identification; ns, not significant; PA, physical activity; PE, physical education; SD, standard deviation; t(df), t-value (degrees of freedom); TEA, Texas Education Agency; TX CORD, the Texas Childhood Obesity Research Demonstration project.

as safety issues in low-income neighborhoods,⁶² lack of availability of healthy foods,⁶³ and TVs in children's bedrooms.^{28,64} In general, obesity-promoting behaviors related to diet and PA are more prevalent in fifth-grade children, compared to preschool children. These behaviors indicate the need for the behavioral interventions emphasized in TX CORD.

ECE centers, all of which are Head Start centers, indicated that opportunities for teacher training, child education, and parent workshops were generally available. These data may reflect recent initiatives to mandate and increase nutrition and PA programs in Head Start programs. As in previous studies,⁶⁵ the ECE teachers were predominantly female and nonwhite, with the majority being bilingual as well. Most had worked at the center for 5 years or less, although it appeared that more of the comparison centers teachers reported being trained in CATCH Early Childhood, compared to the intervention centers, owing to pilot work completed previously in some of the centers in the area. Differences in training status and other factors will be adjusted for in the follow-up analyses.

Participating TX CORD schools have student populations that are predominantly Hispanic/Latino (84.2%), with a smaller proportion of African American students (11.8%). By design, a majority of teachers in the elementary schools had been trained in, and were implementing, CATCH, given that Texas law requires

that all schools have a coordinated school health program.⁶⁶ A large number of nutrition activities and policies were cited by the schools at baseline, also probably reflective of the legislative mandates for coordinated school health.⁶⁷ Elementary school teachers were also predominantly female and reflected the diversity of the intervention population, with a majority being bilingual. More than 70% of teachers reported some type of nutrition or PA training, probably in response to state mandates for implementation of coordinated school health.⁶⁷ Only 36% reported being trained to implement CATCH, which was significantly different between intervention and comparison schools. As in previous studies,^{17,68} most teachers were reporting teaching only a small portion of the CATCH curriculum. To address differences in teacher diversity, racial/ethnic composition will be used as a covariate in follow-up analyses.

Fewer than half of the clinics reported that providers plot child BMI for every visit, although two thirds of the clinics reported calculating BMI. This approach results in missed opportunities to identify early weight increase and offer early intervention. EHRs now automate calculation and plotting of BMI, which streamlines more frequent monitoring of BMI. Only 18.2% of the clinics reported having a policy prohibiting food-related rewards. Previous training in nutrition, PA, and child obesity were low for all staff, but especially nonprovider

Table 5. TX CORD Baseline Primary Care Clinics and Primary Care Clinicians Demographics

Clinics	Mean (SD) or % (N=11)
No. of pediatric patients/week	193 (130.7)
Health care providers	3.5 (1.6)
Presence of a healthy vending machine policy ^a	18.2
Policy prohibiting food-related rewards	18.2
Plot child's weight every visit	50.0
Plot child's height every visit	50.0
Calculate child's BMI every visit	66.7
Plot child's BMI every visit	44.4

^aNine clinics have no vending machines.

Clinicians	MD/DO or NP/PA ^a mean (SD) or % (n=40)	RN, MA, and other ^a Mean (SD) or % (n=95)
Age ^b		
< 30	7.5	36.1
30–40	45.0	32.6
40–50	20.0	20.9
50–60	20.0	5.8
> 60	7.5	4.7
Female	77.5	98.8
Racial/ethnic composition		
Hispanic/Latino	23.1	69.0
African American	18.0	19.1
Other	58.9	11.9
How long employed ^c	6.8 (0.9)	4.5 (0.8)
How many years in medical field ^c	10.4 (1.0)	7.7 (0.8)
Prior training in nutrition ^c	10.2 (1.0)	4.9 (0.8)
Prior training in PA ^c	6.2 (0.9)	3.4 (0.7)
Prior training in child obesity ^c	7.9 (0.8)	2.7 (0.6)

^aThe sample has been stratified into two groups by positions: MD/DO or NP/PA versus RN, MA, and other.

^bOriginal nine age groups have been collapsed into five groups.

^cItems have been treated as continuous variables while assigning the medium value in each category as the continuous value (i.e., 1–5 hours will be counted as 3 hours).

MA, master of arts; MD/DO, doctor of medicine/doctor of osteopathic medicine; NP/PA, nurse practitioner/physician assistant; PA, physical activity; RN, registered nurse; SD, standard deviation; TX CORD, the Texas Childhood Obesity Research Demonstration (TX CORD) project.

staff (e.g., nurses, and so on). Additional training would prepare more office members to give healthy lifestyle messages to families.

Limitations for this baseline assessment include the use of parent self-reported data for child dietary and PA behaviors; potential biases in collecting self-report data from school children, their parents, and the schools; difficulties in recruitment of this population, and cultural and language barriers. Although these data are self-reported, items that had demonstrated validity and reliability in this population were used,^{29–31} and the data collected are similar to that from other surveys.¹⁷ Collection of data from very-low-income, ethnically diverse schools was also a challenge, as previously noted; however, we were able to obtain adequate participation rates across all three age groups (preschool, second-grade, and fifth-grade children). In addition, our study sample had demographics that were very similar to the schools and ECE centers in our study.

Strengths of the assessment include the use of validated survey items, achieving adequate participation rates in a low-income, diverse population, and the ability to collect multiple layers of data from multiple sectors (PHCs, ECE, elementary schools, and community organizations) and multiple levels (child, family, community, and environment/policy).

Conclusions

The TX CORD project includes a focus on both primary and secondary child obesity prevention efforts, a multilevel approach to both measurement and intervention, and the ability to examine the intervention effects by three age groups. It is anticipated that the incorporation of both approaches to child obesity prevention and treatment will result in a more robust intervention, with many “touch points” and sufficient exposure to result in significant changes in outcomes. Incorporating evaluation at each intervention level will also help to determine possible inputs, effects, and barriers of a systems-level approach. The data obtained from the primary prevention sample clearly show that recruitment of a low-income, ethnically diverse participant population is feasible.⁶⁹ In addition, the stratification of the data into developmentally appropriate age groups will allow us to evaluate program outcomes and intervention nuances that can inform future work.

By testing this systems-level model, essential program elements can be elucidated. These primary and secondary prevention programs can expand on current initiatives to provide greater impact through synergy with ongoing environmental and policy efforts. If implemented broadly, such a systems approach has the potential to provide significant and positive outcomes in terms of child health, future adult health, and cost savings for the nation.

Table 6. TX CORD Baseline ECE, Second-Grade, and Fifth-Grade Populations: Household, Parent, and Child Intervention and Comparison Catchment Differences

Household characteristics	ECE total (n=685) M (SD) or %	Second-grade total (n=485) M (SD) or %	Fifth-grade total (n=391) M (SD) or %
Number of people living in the household	4.57 (1.50)	4.95 (1.52)	4.95 (1.64)
Number of children under 18 in the household	2.56 (1.30)	2.87 (1.25)	2.97 (1.43)
Annual household income (%)			
Less than \$10,000	34.1	34.4	33.3
\$10,001–\$15,000	18.8	20.1	20.3
\$15,001–\$20,000	14.3	14.0	12.4
\$20,001–\$25,000	14.0	15.4	11.6
\$25,001–\$35,000	8.6	8.4	13.0
\$35,001–\$50,000	3.1	4.8	6.5
\$50,001–\$75,000	0.9	2.5	1.1
\$75,001 or more	0.1	0.5	1.7
Government assistance received (%)			
WIC	50.5	27.0	25.2
Food stamps (SNAP)	63.3	56.8	55.0 ^{5*}
Free/reduced price school meals	44.5	61.2	61.9
Medicaid or Texas Health Steps	84.1	68.3	67.6
Medicare	18.0	25.7	21.5
CHIP	16.7	28.4	26.2
Parent characteristics			
Age in years	31.2 (6.9)	34.91 (7.51)	36.88 (7.77)
Female (%)	94.5	87.3	87.8
Child's mother (%)	93.2	86.6	87.7
Race/ethnicity (%)			
Hispanic or Latino	73.3	83.8	81.5
Black/African American	22.7	13.5	15.4
Other	4.0	2.7	3.1
Primary language (%)			
Only English	27.4	20.0	23.6
More English than Spanish	11.5	6.0	9.4
Both English and Spanish	15.7	20.0	19.0
More Spanish than English	26.5	25.7	24.1
Only Spanish	18.8	28.4	23.9
Survey language (%)			
English	49.8	35.7	47.3
Spanish	50.2	64.3	52.7
Country of birth (%)			
United States	40.8	31.9	37.5
Mexico	39.8	51.6	47.0
Other country	19.4	16.6	15.4
Married ^a (%)	64.3	70.1	63.4
Employment status (%)			
Currently employed	49.9	42.0	52.3
Currently unemployed	19.1	15.1	17.7
Homemaker	31.0	42.9	30.0
Highest level of education (%)			
None/kindergarten only	1.5 ^{*1}	2.4	1.6
Elementary-middle school	13.0	23.8	29.4
Some high school	19.1	23.6	23.5
High school diploma	36.3	30.8	26.2
Some college or technical school	25.3	15.4	14.0
College diploma	4.8	4.1	5.3
Has healthcare coverage (%)	51.8	54.3	57.5

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Table 6. TX CORD Baseline ECE, Second-Grade, and Fifth-Grade Populations: Household, Parent, and Child Intervention and Comparison Catchment Differences *continued*

Child characteristics			
Age in years	4.25 (.68)	7.61 (.64)	10.65 (0.63)
Female (%)	46.8	57.4	54.2 ^{6*}
Race/ethnicity (%)			
Hispanic or Latino	72.9	81.2	80.8
Black/African American	21.6	14.2	15.3
Other	5.3	4.6	3.8
Primary language at home (%)			
Only English	31.8	23.3	26.7
More English than Spanish	12.5	11.8	16.0
Both English and Spanish	21.5	31.3	44.2
More Spanish than English	23.4	25.7	9.2
Only Spanish	10.8	8.0	3.9
Ate or drank yesterday ^b			
Fruit	1.69 (0.80)	1.44 (0.79)	1.34 (0.89)
Vegetables	1.34 (0.86)	1.09 (0.85)	1.17 (0.84)
100% juice	1.18 (0.93)	0.98 (0.89)	0.98 (0.92)
Punch, sports drinks etc.	0.88 (0.93)	0.90 (0.89) ^{*3}	0.93 (0.94) ^{7*}
Regular soda	0.34 (0.64)	0.36 (0.65)	0.61 (0.71)
Water	2.16 (.90)	2.16 (0.91) ^{*4}	2.22 (0.87)
Total fruits and vegetables ^c	3.02 (1.41)	2.53 (1.38)	2.50 (1.50)
Total sugar-sweetened beverages ^c	1.20 (1.23)	1.24 (1.17)	1.52 (1.32) ^{8*}
Child has a regular bedtime ^d (%)	80.8 ^{*2}	81.9	78.5
Child has a TV in their bedroom (%)	68.3	65.1	63.6
Days child PA for 60 minutes or more ^e	4.96 (2.23)	4.24 (2.36)	4.57 (2.26)
Child BMI			
Measured BMI	16.68 (2.42)	18.63 (3.73)	22.06 (5.36)
BMI-for-age z-score	0.63 (1.17)	0.79 (1.14)	0.96 (1.11)
BMI Percentile Rank	65.83 (28.14)	70.95 (27.62)	74.71 (27.75)
Child Weight Status (%)			
Normal weight (BMI < 85th percentile)	63.4	54.3	43.3
Overweight (BMI 85th to < 95th percentile)	17.5	17.3	21.5
Obese (BMI ≥ 95th percentile)	19.0	28.3	35.2

^aIncludes *Currently Married*, *Married but not currently living together*, and *Living as married*. ^bParent report (0=no; 1=1 time; 2=2 times; 3=3+ times).

^cSum of *Fruit and vegetables*, and *Punch, sports drinks, etc.* and *Regular soda* consumption yesterday, respectively.

^dParent report that child has a regular bedtime *Most of the time* and *Always*.

^eParent report of child physical activity past week (0–7 days).

*¹The comparison group had higher levels of education.

*² $p < 0.05$ between Interaction (I) = 75.3 and Comparison (C) = 84.2.

*³ $p < 0.05$ between I = 0.82 (0.85) and C = 0.99 (0.92).

*⁴ $p < 0.05$ between I = 2.25 (0.89) and C = 2.07 (0.94).

*⁵ $p < 0.05$ between I = 59.5 and C = 49.4.

*⁶ $p < 0.05$ between I = 49.3 and C = 60.2.

*⁷ $p < 0.05$ between I = 0.77 (0.84) and C = 1.12 (1.01).

*⁸ $p < 0.05$ between I = 1.37 (1.19) and C = 1.71 (1.44).

CHIP, Children's Health Insurance Program; ECE, early care and education; ns, not significant; SD, standard deviation; SNAP, Supplemental Nutrition Assistance Program; TX CORD, the Texas Childhood Obesity Research Demonstration (TX CORD) project; WIC, Women, Infants & Children.

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