

Strategies for Effective Eating Development—SEEDS: Design of an Obesity Prevention Program to Promote Healthy Food Preferences and Eating Self-Regulation in Children From Low-Income Families

Sheryl O. Hughes, PhD¹; Thomas G. Power, PhD²; Ashley Beck, PhD²; Drew Betz, MS²; Shirley Calodich, MPH, RD²; L. Suzanne Goodell, PhD, RD³; Laura G. Hill, PhD²; Rachael Hill, MA²; J. Andrea Jaramillo, BS¹; Susan L. Johnson, PhD⁴; Jane Lanigan, PhD²; Adair Lawrence, MS²; AnaMaria Diaz Martinez, MEd²; Merrianeeta Nesbitt⁵; Irene Overath, MACEd, CFLE²; Louise Parker, PhD²; Sarah Ullrich-French, PhD⁶

ABSTRACT

Objective: To develop a scientifically based childhood obesity prevention program supporting child eating self-regulation and taste preferences. This article describes the research methods for the *Strategies for Effective Eating Development* program. A logic model is provided that depicts a visual presentation of the activities that will be used to guide the development of the prevention program.

Design: Randomized, controlled prevention program, pretest, posttest, 6 months, and 12 months.

Setting: Two sites: Houston, TX and Pasco, WA. Each trial will last 7 weeks with 8–10 mother–child dyads in each arm (prevention and control).

Participants: Recruitment at *Head Start* districts (Texas; n = 160) and Inspire Child Development Center including *Early Childhood Education* and *Head Start* (Washington; n = 160). Sixteen trials with 16–20 parent–child dyads per trial will provide adequate power to detect moderate effects.

Intervention: Multicomponent family-based prevention program incorporating a dialogue approach to adult learning and self-determination theory.

Main Outcome Measures: Child assessments will include observed taste preferences, caloric compensation, and eating in the absence of hunger. Parent assessments will include parent-reported feeding, feeding emotions, acculturation, child eating behaviors, child food preferences, and child dietary intake. Heights and weights will be measured for parent and child.

Analysis: A multilevel growth modeling analysis will be employed to consider the nested nature of the data: time points (level 1) within families (level 2) within trials (level 3).

Key Words: childhood obesity, prevention program, family-based, child eating self-regulation, food preferences (*J Nutr Educ Behav.* 2016;48:405–418.)

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¹US Department of Agriculture/Agricultural Research Service Children's Nutrition Research Center, Department of Pediatrics, Baylor College of Medicine, Houston, TX

²Department of Human Development, Washington State University, Pullman, WA

³Department of Food, Bioprocessing, and Nutritional Sciences, North Carolina State University, Raleigh, NC

⁴Department of Pediatrics, Section of Nutrition, University of Colorado School of Medicine, Aurora, CO

⁵Office of the Provost, Washington State University, Pullman, WA

⁶Department of Educational Leadership, Sport Studies, and Educational/Counseling Psychology, Washington State University, Pullman, WA

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Address for correspondence: Sheryl O. Hughes, PhD, Children's Nutrition Research Center, Baylor College of Medicine, 1100 Bates Ave, Houston, TX 77030-2600; Phone: (713) 798-7017; Fax: (713) 798-0307; E-mail: shughes@bcm.edu

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INTRODUCTION

Childhood overweight and obesity have increased significantly in the past 3 decades.¹ Rates of overweight in the US have more than doubled in younger children; more than 26% of preschool-aged children are currently overweight or obese.² Obese children are at an increased risk for poor socio-emotional development and problematic medical conditions.³ During the first 5 years of life, an increase in weight velocity from 2 to 5 years is the strongest predictor of obesity in early adulthood.⁴ Childhood obesity rates are particularly high in low-income, minority populations.² Targeting young

children and their families from high-risk groups may help to curb the obesity epidemic.

Programs developed to prevent childhood obesity in school-aged children have had moderate success and limited long-term impact.⁵⁻⁷ This may be due to the age of the child because the first 5 years are important in the development of child eating behaviors⁸ or owing to the lack of inclusion of parents and other family members. The current study will develop and evaluate a novel approach to obesity prevention that will incorporate the family and focus on the self-regulation of eating in young children. The primary goal of the study will be to encourage and assist parents in recognizing and supporting their children to pay attention to their internal cues of fullness and satiety.

Experimental studies with preschoolers can inform childhood obesity prevention efforts at an early age. Studies have shown that preschoolers possess the ability to regulate energy intake during meals^{9,10} and across successive meals over 24 hours¹¹ by starting and stopping eating in response to internal cues of hunger and fullness. Although intake at meals was considerably variable, total daily energy intake was tightly regulated.^{11,12} Older children showed poorer compensation compared with younger children; thus, children may lose this ability as they grow older.^{13,14} Individual differences in this ability have been linked to feeding behaviors. For example, mothers who reported higher control in feeding had children who showed a lessened ability to self-regulate their eating.¹⁵ Feeding practices such as encouraging eating when the child was not hungry, providing inadequate exposure to novel foods, and serving excessive portion sizes may have deterred children from attending to internal fullness cues. Individual differences in child eating self-regulation have also been linked to child weight.¹⁵⁻¹⁷ Eating in absence of hunger was associated with higher child and adolescent weight,¹⁸⁻²¹ and poor satiety responsiveness was associated with greater weight status among children aged 3–11 years.²²⁻²⁴ Children with poorer eating self-regulation are at greater risk for childhood obesity.

Experimental studies have shown how children come to prefer novel

foods. When exposing young children to novel foods, an effect of the exposure amount on choice and liking was shown.^{25,26} It took 8 to ≥ 15 exposures for children to learn to prefer novel foods,²⁵ with results being replicated in a social marketing study²⁷ and more naturalistic settings.²⁸ Exposing children to novel foods may increase willingness to consume foods such as vegetables; however, most parents stop serving new foods to children considerably short of the 8–15 recommended exposures.^{27,29}

Experimental studies on portion sizes have implications for childhood obesity. Children seen in varying conditions of entrée portion size and energy content ate 34% more calories at a single meal when served a larger, more energy-dense portion.³⁰ When serving children 3 main entrees and a snack over a 24-hour period, total energy intake was 140 kcal (12%) greater in the large portion condition (double the reference size) relative to the reference condition.³¹ In an observational study in a naturalistic setting, the average kilocalories of food mothers served their preschool children for dinner (median, 565 kcal) was greater than the average kilocalories of food mothers themselves consumed during the same meal (median, 547 kcal).³² The amount served to the child was significantly associated with the amount consumed ($r = .88$). Large portions typically served to young children may contribute to childhood obesity.

Routines and structure have been associated with better child outcomes; thus home eating routines may be important in creating family structure that supports healthful child eating.^{33,34} Preschool children experiencing 3 common household routines which included family dinners had a 40% lower prevalence of obesity.³⁵ Unconscious drivers of food choice and intake were also prevalent in the larger environment (food advertising, billboards, and food arrangement in the grocery store), which may encourage food choices without reasoned awareness of the long-term impact on childhood obesity.³⁶

Numerous programs have been developed, mostly in the school setting, to prevent obesity in children, some of which have had moderate success.^{6,7} However, they may be of limited effectiveness for the following reasons: (1) Interventions during the school years

do not address child eating patterns developed early in life; (2) interventions that do not involve parents or families limit the sustainability of behavior change; and (3) interventions that focus only on nutrition education and physical activity neglect important parental feeding behaviors that can reduce the likelihood of childhood obesity (eg, encouraging preferences for healthful foods, facilitating self-regulation of energy intake, serving appropriate child-sized portions, establishing mealtime routines, and addressing food cues in the larger environment). Although researchers have begun to develop, evaluate, and disseminate family-based obesity prevention programs,^{5,37,38} few comprehensive obesity prevention programs exist that focus on the role parents have in developing children's food preferences, food selection, and self-regulation of energy intake. In addition, even fewer programs exist for preschoolers designed specifically to address the needs of low-income, minority families.⁸

The *Strategies for Effective Eating Development* (SEEDS) prevention program will add to the field by focusing on the role parents have in the development of child food preferences, food selection, and self-regulation of energy intake—known risk factors for childhood obesity in low-income families with preschoolers. To the authors' knowledge, currently no prevention program to date addresses these issues in low-income families. SEEDS will incorporate a dialogue approach to adult learning³⁹ and a well-known theoretical approach for behavior change: self-determination theory.⁴⁰ The child curriculum will focus specifically on developing food preferences and encouraging self-regulation of energy intake. These same issues will be targeted in the parent curriculum along with other parenting behaviors associated with child weight status (serving appropriate child-sized portions, establishing mealtime routines, and addressing food cues in the environment). Fostering behavior change by delivering similar content to parents and children is expected to increase program impact.

Although SEEDS will be developed for use with all low-income families, the first efficacy study will target low-income Hispanic individuals because:

(1) Hispanic people are at a high risk for childhood obesity, and (2) a homogeneous sample will help to understand the impact better in a single group before applying the program to additional groups. The study objectives will be to:

1. Develop a scientifically based, culturally relevant, 7-week, family-based obesity prevention program focused on supporting child eating self-regulation and exploration of novel foods; and
2. Test program efficacy by conducting a randomized controlled trial among Hispanic families with preschoolers at 2 separate locations. Children in the prevention program are expected to increase eating self-regulation and increase fruit and vegetable intake and variety, and parents will increase responsive feeding behaviors.

METHODS

Study Design

The SEEDS study will use a randomized controlled trial design to measure program efficacy. The study will be conducted at 2 sites: a large urban city (Houston, TX) and a smaller agricultural community (Pasco, WA). Each trial will include a prevention arm and a control arm lasting for 7 weeks; each arm will include 8–10 parent–child dyads. The prevention arm will receive the program curriculum consisting of a parent component with 7 lessons, a child component with 7 lessons, and a family component in which the parent and child come together for a meal with each of the 7 lessons. The control arm will receive no curriculum. Eight trials will be implemented at each of the 2 sites, yielding a total of 16 trials across the study. Identical assessments will be obtained for participants in the prevention arm and the control arm. Assessments will be administered 4 times: 2–3 weeks before the program, 2–3 weeks after the program, and at 6 and 12 months after the program. This study was approved by the Institutional Review Boards at Baylor College of Medicine and Washington State University.

Participant recruitment. The SEEDS study will target families known to be at high risk for child obesity rates:

low-income Hispanic parents and their preschool children. In Houston, TX, families will be recruited from *Head Start* districts in Harris County. In Pasco, WA, families will be recruited from the Inspire Child Development Center, a network of interrelated programs including the *Early Childhood Education and Assistance Program* and *Head Start*. These comprehensive preschool programs provide free services and support to low-income families, with the goal of ensuring that all children enter kindergarten ready to succeed. By recruiting and implementing in both states, a diverse group of Hispanic families will participate in the program evaluation, including families from agricultural communities and urban settings.

Research staff members will work closely with the child development centers regarding recruitment procedures. Recruitment activities will be conducted during registration of children at the centers, parent meetings, and drop-off and pickup times. Specifically, research staff will explain the goal of the study to interested parents, and parents will complete informed consent procedures if they choose to participate in the study. The parent who is primarily involved in feeding the preschool child will be designated the target parent.

Determination of sample size. The sample size was determined using G*Power 3.1.1⁴¹ (Germany, 2007) considering 3 levels of clustering in the data: Repeated measures (level 1) will be clustered within parent–child dyads (level 2) and parent–child dyads will be clustered within trials (level 3). Assuming a sample of 16–20 parent–child dyads for each trial (16 trials in total), a medium intra-class correlation of 0.15,⁴² a moderate correlation of 0.5 across time (4 measurement occasions), and an α of .05, there will be adequate power (80%) in the proposed analyses to detect a moderate effect size ($f = 0.25$) for all main effects and interactions.

Logic Model

The logic model for this study provides an explicit and visual statement of the activities that will bring about change and the expected results (Figure 1). Acting as a road map, the logic model shows the steps to be

taken to reach the outcomes and how the activities are linked to the results of the program. In addition, each component of the logic model allows for an evaluation to take place. Specifically, the logic model includes 3 core components: inputs, outputs (activities and participation), and outcomes (short, medium, and long term); it is a pictorial model of individuals and organizations that will provide input during different stages (inputs), the framework for how the prevention program will be developed (outputs), and final results (outcomes).

Hypotheses

As shown in Figure 2, it is predicted that mothers who participate in the SEEDS intervention (ie, through the parent and family sessions) will show more authoritative feeding styles, less directive feeding practices, and more positive emotions during feeding. These changes in feeding practices, as hypothesized by self-determination theory, will in turn yield greater child self-regulation of intake, child willingness to try new foods, and child preferences for fruits and vegetables. These same child outcomes will be influenced directly by children's participation in the child sessions. Finally, these changes in child eating practices will result in reduced child body mass index (BMI) at the follow-up time points.

Program Description

Strategies for Effective Eating Development will be a family-based, culturally relevant obesity prevention research program designed to promote healthful food preferences and self-regulation of eating in low-income families with preschoolers. Learning will be based on a dialogue approach to adult learning³⁹ and behavioral change will be based on self-determination theory.⁴⁰ The dialogue approach³⁹ is consistent with principles of self-determination theory that will facilitate deep learning of the program content. The dialogue approach is based on the following learning objectives: anchoring the content within the learner's experience, adding new information, inviting the learner to apply the new content to his or her own situation, and asking the learner to decide how or what information he or she will take away and use

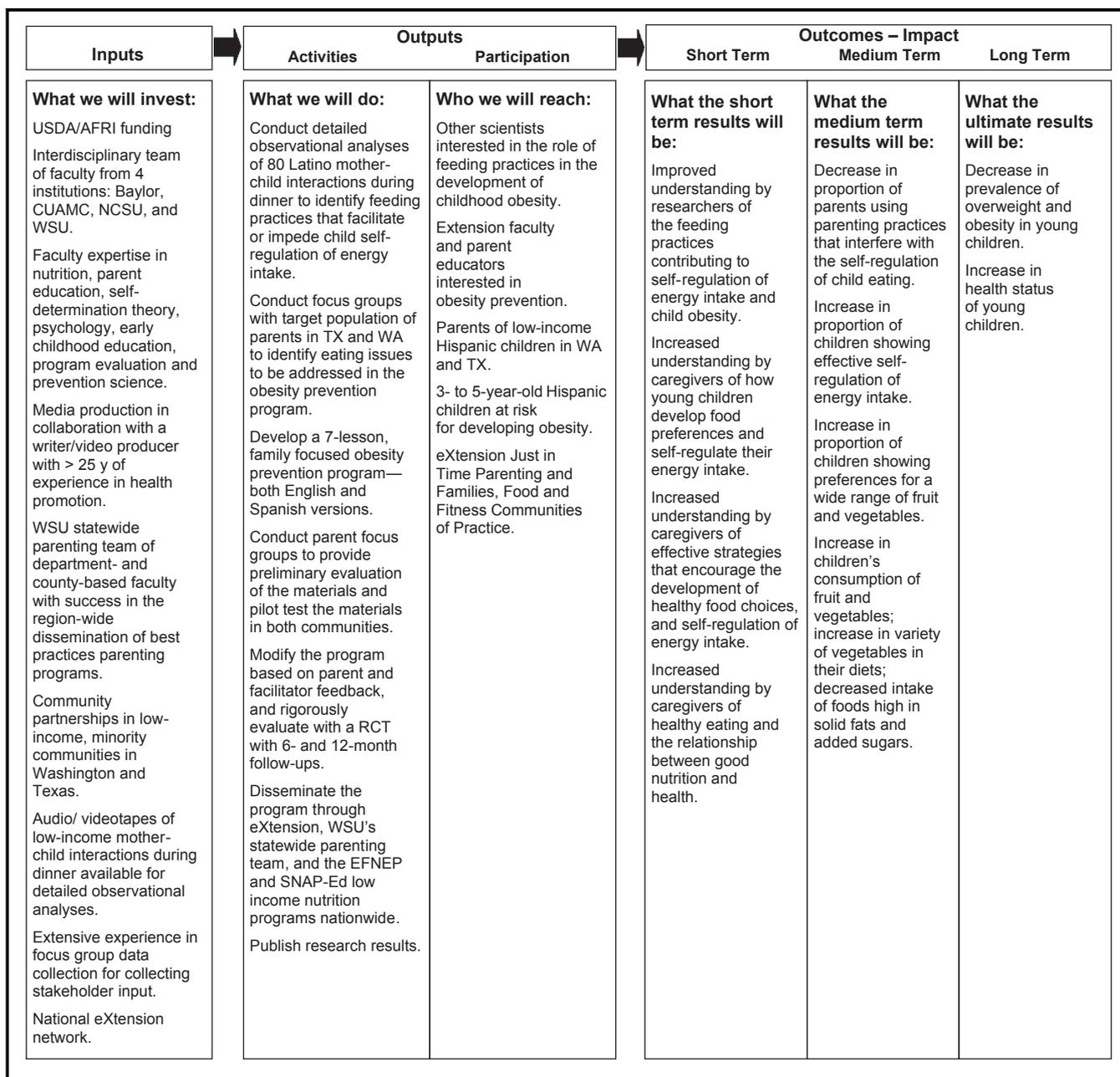


Figure 1. The logic model includes 3 core components: inputs, outputs (activities and participation), and outcomes (short, medium, and long term). CUAMC indicates University of Colorado Anschutz Medical Campus; EFNEP, Expanded Food and Nutrition Education Program; NCSU, North Carolina State University; RCT, randomized controlled trial; SNAP-Ed, Supplemental Nutrition Assistance Program Education; TX, Texas; USDA/AFRI, United States Department of Agriculture/Agriculture and Food Research Initiative; WA, Washington; WSU, Washington State University.

in the future.³⁹ Behavioral change in self-determination theory is guided by the idea that the key to understanding self-regulation of human behavior is through examining environmental processes that nurture (vs impede) self-determined behavior.⁴⁰ The focus will be on developing intrinsic motivation and integrating extrinsically motivated behaviors into autonomous, self-regulated behavior. Evidence demon-

strates that intrinsic motivation is promoted by providing choices, acknowledging feelings, and providing opportunities for self-direction; self-determined motivation is discouraged by expected tangible rewards, threats, demands, pressured evaluations, and imposed goals.^{40,43}

Self-determination theory is supported by research on food preferences and the self-regulation of energy

intake. External pressure to engage children in healthful eating patterns often has the opposite effect. Excessive pressure from adults to consume healthful foods (eg, using food as a reward, forcing children to clean their plates, pressuring children to eat certain foods) can lead to a decreased preference for healthful foods and interfere with the process of self-regulation involving sensitivity to internal fullness and

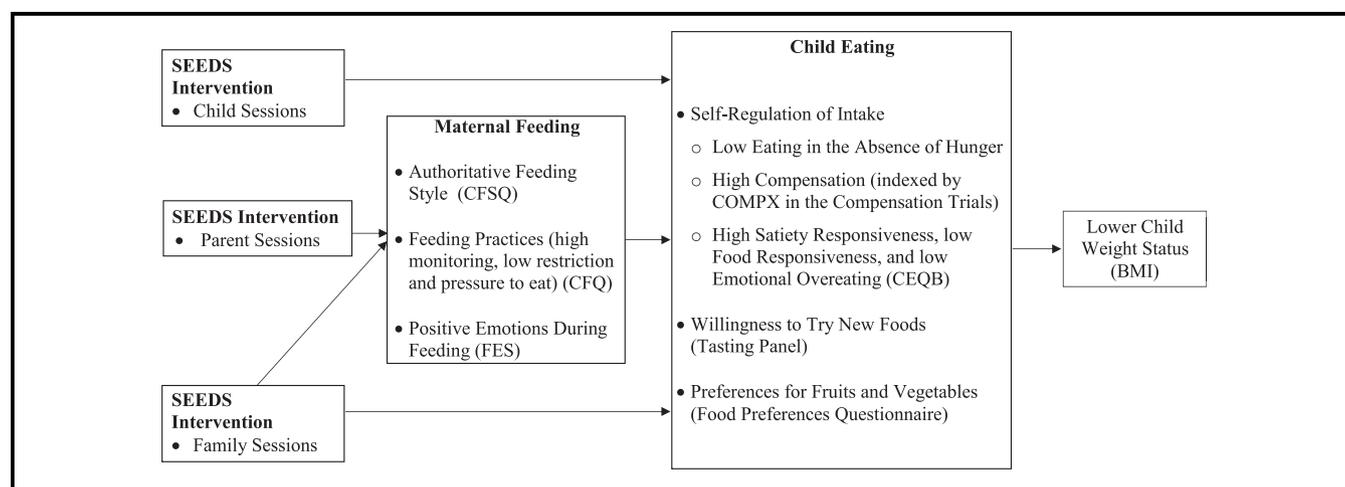


Figure 2. Conceptual model. BMI indicates body mass index; SEEDS, *Strategies for Effective Eating Development*.

hunger cues.^{44,45} Successful feeding behaviors involve low levels of external pressure, such as: (1) serving a variety of foods and allowing the child to decide how much to eat; (2) modeling consumption of healthful foods; (3) involving the child in shopping for and preparing healthful foods; and (4) offering the child choices within a set of healthful foods.⁴⁴

Coding of audio/videotapes of 80 families during dinnertime will provide a better understanding of how maternal responses to child eating may override children's internal fullness and hunger cues, thereby interfering with the effective self-regulation of energy intake.⁴⁶ Further information regarding this observational method can be found elsewhere.⁴⁷ Focus groups with *Head Start* families will provide information regarding how mothers decide when their child is full (determining fullness), how mothers decide how much to place on the child's plate (portion sizes), and perceptions of the child not eating enough vs eating too much. Both of these endeavors will be used to inform curriculum development.

Curriculum will be developed to include parent, child, and family components for use in a 7-week program. The format of the SEEDS program is modeled on a 7-week family-focused prevention program that has been highly successful; it has been offered in many US states and internationally in many countries.⁴⁸ One family-focused prevention study showed high retention rates with a 7-week program.⁴⁹ Modules will be developed by an interdisciplinary team from psychology, parent

education, extension, nutrition, and early childhood development. The team will divide into smaller groups to develop individual lessons and then rejoin into the larger group to discuss and rework the lessons.

The parent component will be composed of group experiential activities along with video-based instruction portraying common family scenarios. Twelve videos will be developed specifically to be interspersed throughout the lessons. Parents will view common scenarios, questions will be portrayed on the screen to facilitate parent discussion, and strategies will be provided to guide parents in managing similar situations at home. Individual goal setting will be incorporated with guided opportunities to apply program content. The 7 parent lessons will include: Introduction, Trying New Foods (how children develop preferences), Internal Cues of Hunger and Fullness (how children decide when they have had enough to eat, and how parents know when their child has had enough to eat), Portion Size (how parents decide on appropriate portions for preschoolers), Structure of the Environment (outside influences), Structure of the Home Environment (structure of the home meal), and Review (responsive feeding). [Table 1](#) provides a more detailed description of the parent lessons.

The child component will involve a series of activities focused on exploring and trying new foods and identifying internal cues of hunger and fullness (similar to the content in the parent lessons). The 7 child lessons will include

book reading, child-centered play, and routines based on early childhood education.⁵⁰ Colorful dolls with detachable stomachs will be used throughout the lessons to help children identify and describe their own cues of hunger and fullness. Novel foods will be introduced each week and children will be encouraged to explore these foods during the child lessons.

The family component will provide parents and children with an opportunity to share the concepts learned in individual lessons with each other. A meal will be provided for the parents and children at the beginning of each lesson; staff members will be included in the meals to encourage continued bonding with program participants.

The overall approach of the SEEDS program will be to create a culturally relevant intervention based on several core values including *familismo*, *respeto*, *educación*, and *simpatía*. With these values in mind, several practical steps will be taken in the delivery of the intervention. Bilingual interventionists will ensure that intervention delivery is consistent with Hispanic cultural values. Despite many within-group differences,⁵¹ Hispanic cultures promote the value of collectivism, which emphasizes the importance of the group before the individual.⁵² *Familismo* is a core value that includes the commitment to support family members and reliance on family for help.⁵² To respect *familismo* value, an emphasis is put on family health, not individual health. *Respeto* (ie, respect) is another core value that will be implemented throughout the program.^{53,54} Research

Table 1. Description of Parent Lessons to Be Developed

Lessons	Content	Learning Objectives	Anchor	Add	Apply	Away
1: Introduction	<ol style="list-style-type: none"> 1. Getting acquainted 2. Introduce SEEDS program and food goals for child 3. Set goal for new family food experience 		Parents will discuss things they are trying to achieve when feeding their children	Play Videos 1 and 2. These videos will cover the introduction and goals of the SEEDS program.	Activity about identifying family meal-time scenarios. Parents will select a photo that is similar to a meal in their own home	Parents will discuss things to try at home. Staff will distribute SEEDS magnets
2: Trying New Foods	<ol style="list-style-type: none"> 1. Child may taste food 8–12 times before accepting 2. Exploring can help child become familiar and accept new food 3. Preparing food in different ways may help with liking 	<ol style="list-style-type: none"> 1. The number of times to introduce new foods to children 2. Better understand the process children undergo to learn to like new foods 3. Strategies for creating a family plan for new food experiences 4. How to introduce a new food at home 	Play Video 3 (<i>What's That?</i>). Discuss children's reactions to trying new foods	Play Video 4 (<i>How Many Times Does it Take?</i>) and Video 5 (<i>Introducing New Foods</i>). Parents will discuss exposure to new foods and the number of times it takes for acceptance. Parents will discuss how introducing new foods can be a struggle	Parents will brainstorm ways to introduce new foods. Will use a flip chart with headings of Strategies (on 1 page) and Possible Solutions (on another). Tasting activity for parents (hummus and garbanzo beans)	Staff will distribute Things to Try at Home cards. Parents will be encouraged to try new foods at home
3: Internal Cues of Hunger and Fullness	<ol style="list-style-type: none"> 1. Children can learn to recognize hunger and fullness cues 2. Children can respond to cues and communicate this to parents 3. Adults and children have different roles at meals 	<ol style="list-style-type: none"> 1. Better understand feelings of hunger and fullness 2. To pay attention to internal cues and how this facilitates healthy eating 3. What causes children to ignore or follow their own cues 4. Parent and child roles at mealtimes 5. What makes it hard for parents to trust child cues 	Parents will discuss hunger and fullness cues. Parents will describe how it felt when they waited longer than usual to eat, when they ate more than usual, and when they ate the appropriate amount	Play Video 6 (<i>Listening to our Cues</i>) and have parents discuss scenarios from video. Play Video 7 (<i>Parent and Child Roles</i>) and have parents discuss roles during eating episodes	Activity with statements describing different mealtime roles. Parent will identify whose role it is (parent or child)	Staff will distribute tool developed for children to let their parents know they are full. Staff will remind parents that the child's role is to decide if and how much to eat, and suggest talking to their child about fullness cues at home. Staff will distribute card (handout) on parent and child roles at mealtimes

4: Portion Sizes	<ol style="list-style-type: none"> 1. Children's stomachs are about the size of their fists 2. As a guide, child portions are about 1 tablespoon/y of the child's life 	<ol style="list-style-type: none"> 1. Appropriate portion sizes for preschoolers 2. Experience measuring and comparing portion sizes for adults and children 3. Strategies to help children self-serve 4. How to set up portion size goals for the home 	<p>Parents will discuss what they think about or consider when deciding how much food to be placed on their child's plate. Staff will write responses on a flip chart</p>	<p>Play Video 8 (<i>Child Portions</i>). Parents will discuss how much children actually need to eat</p>	<p>Activity for parents to practice serving child-sized portions using measuring spoons and cups and normal-size serving spoons on standard and child-sized plates</p> <p>Compare a child-sized snack bag with an appropriate child-size serving (age 3–5 y)</p>	<p>Staff will distribute handout related to portion sizes. Staff will distribute a child-size cup, a tablespoon, and a one-quarter measuring cup for each parent to use to serve the child or allow the child to serve himself or herself at home. Encourage parents to be aware and practice appropriate portion sizes during mealtimes</p>
5: Structure of the Environment (Outside Influences)	<ol style="list-style-type: none"> 1. Plan shopping trips 2. Grocery and convenience stores are arranged to increase spending on specific kinds of foods, healthy and unhealthy 3. The freshest and healthiest foods are usually in the outside grocery store aisles 4. Grocery stores intentionally market/advertise to children. Food is placed on shelves at the right height to catch the child's eye 5. Tempting treats are places near the cash register to catch attention when waiting in line 	<ol style="list-style-type: none"> 1. Awareness of cues in the environment that influence eating 2. Strategies to deal with environmental cues to eat when away from home 	<p>Parents will discuss messages and cues in the environment when walking or driving down the street. Parents will discuss some of the cues that are tempting when hungry</p>	<p>Play Video 9 (<i>Cues to Eat: On the Street</i>). Parents will discuss what they saw in the video, such as cues to eat, foods, and quantity being encouraged</p>	<p>Play Video 10 (<i>Grocery Store and Drive-Through Scenes</i>). Discussion questions to be embedded in the video after each scenario. Video will be paused at these places so parents can discuss</p>	<p>Staff will distribute handout on planning, arrangement of items in grocery stores, and marketing to children. Staff will distribute handout related to eating better on a budget</p>

(continued)

Table 1. Continued

Lessons	Content	Learning Objectives	Anchor	Add	Apply	Away
6: Structure of the Home Environment	<ol style="list-style-type: none"> 1. Mealtime routines help children learn about the world and feel secure. Mealtime routines can help a child eat better 2. Meals for young children should last 15–20 minutes 	<ol style="list-style-type: none"> 1. How to set up healthy eating routines at home 2. Strategies for creating routines that work in the family 	Children learn about the world from patterns and repetition which help them understand their place in the world and in the family. Discuss some daily routines and eating routines in the families of participants	Play Video #11 (Mealtime Routines). Video will be paused after mealtime scenarios and questions will appear on the screen. Parents will discuss mealtime scenarios and their importance for young children.	Parents will divide into groups of 3 and brainstorm solutions to difficulties in establishing home routines	Staff will distribute handouts about how to establish mealtime routines in homes. Staff will distribute handout regarding strategies for being a healthy role model for children
7: Review	<ol style="list-style-type: none"> 1. Review of 7 lessons 	<ol style="list-style-type: none"> 1. Successes and challenges in achieving program content 2. Review of responsive feeding 3. Graduation 	Play Video 12 (Let's Review). SEEDS program and strategies and barriers to implementing what was learned	Parents will discuss what was learned in the SEEDS program and strategies and barriers to implementing what was learned	Staff will dismiss parents for graduation	

SEEDS indicates *Strategies for Effective Eating Development*.

staff will convey information without disagreeing or challenging parents, but rather by fostering and encouraging discussions. Research staff will provide information and allow parents the autonomy to decide how this information is used within the family environment. Providing the family with information is consistent with the value of *educación* (ie, education),^{53,55} which means more than the simple transmission of knowledge. Research staff will open dialogues among the parents and foster an environment of applying the lessons and strategies to the home environment. Another value to be promoted is *simpatía*, or positive interactions among the parents and research staff,⁵² such as research staff joining the families during the meal at the beginning of the lessons and allowing all parents to express their concerns and ideas during the discussions. In addition, family nutrition will be emphasized rather than nutrition for the individual. Research staff with expertise in Hispanic culture will assist parents with categorizing traditional foods, creating guidelines for reasonable serving sizes of traditional foods, and offering suggestions for ways to cook traditional foods healthfully.

Training for Program Facilitation Staff

Bilingual staff members will be hired to fill parent and child facilitation positions. To ensure that facilitators have the knowledge and background to optimize behavior change integrated into the program, a degree in psychology or education will be required for parent facilitators and training or experience in early childhood education will be required for child facilitators. Staff hired for these positions will attend a 2-day intensive training session guided by the investigators who are developing the program. Hired staff will study the training manual to familiarize themselves with the program content. They will practice delivering lessons during the training session and will be guided to maximize participant engagement and involvement using parenting education principles. Once the trials begin, investigators will debrief the staff after each lesson by answering questions and providing feedback.

Data Collection

Data will be collected from preschool children and their parents at the child development centers where the trials will be implemented in Houston, TX and Pasco, WA. Assessment data will be collected before the trial begins (pre-assessment), after the 7-week program ends (post-assessment), and at 6 and 12 months after the program (follow-up). Assessments will occur over a 2- to 3-week period. For each assessment day, 8 staff will assist in data collection.

Training for Assessment Staff

A separate set of bilingual staff that will be blinded to the conditions

(prevention and control) will be hired and trained to conduct assessments. An undergraduate or masters-level degree in psychology or nutrition (or similar degree) will be required. To ensure consistency in training, all assessment staff will attend a single intensive training session.

Assessment Methods

Assessments will be completed with the parent and the child. Parents will report on demographics including age, ethnicity, education, and employment status for descriptive information. Child assessments will include 2 eating self-regulation measures (caloric compensation and Eating in the Absence of Hunger

and an observational measure of taste preference. Parents will report on feeding, feeding emotions, and their child's eating behaviors and child food preferences. Acculturation information will be obtained from the parents. Height and weight will be measured for the parent and child. [Table 2](#) describes outcome variables from each assessment.

Child eating self-regulation observations.

Self-regulation of energy intake—Children will participate in compensation trials to assess their self-regulation of energy intake according to the method developed by Johnson and Birch.¹⁵ On day 1, each child will consume a high-energy or low-

Table 2. Assessments and Variables to Be Derived for Analysis From Assessments

Construct	Assessment Tool	Type of Administration	Target	Variables to Be Derived
Sensitivity to cues of hunger and fullness	Caloric compensation trial (Johnson and Birch, 1994) ¹⁵	Observation	Child	Self-regulation of energy intake (sensitivity to energy content of foods eaten)
Eating beyond satiation	Eating in the Absence of Hunger (Fisher and Birch, 1999) ¹⁸	Observation	Child	Total number of calories eaten in absence of hunger
Taste preference	Food tasting protocol (Sullivan and Birch, 1990) ⁵⁸	Observation	Child	Willingness to try new foods
Feeding practices	Child Feeding Questionnaire (Birch et al, 2001) ⁵⁹	Self-report	Parent	Restriction; monitoring; pressure to eat; promotion of autonomy; offering new foods; structure in feeding; promoting internal control of eating
Feeding styles	Caregiver's Feeding Styles Questionnaire (Hughes et al, 2005) ⁶³	Self-report	Parent	Authoritative, authoritarian, indulgent, uninvolved feeding styles; parent- and child-centered feeding
Feeding emotions	Feeding Emotions Scale (Frankel et al, 2015) ⁶⁶	Self-report	Parent	Positive and negative parent emotions during feeding
Child eating behaviors	Child Eating Behavior Questionnaire (Wardle et al, 2001) ⁶⁷	Parent report	Child	Satiety responsiveness; food responsiveness; enjoyment of food
Food preferences	Food Preferences Questionnaire (Skinner et al, 2002) ²⁹	Parent report	Child	Child fruit and vegetable preference
Food intake	Block Kids Food Screener (Block and Naughton, 1990) ⁶⁸	Parent report	Child	Child intake by food group (number of servings; caloric intake)
Acculturation	Bidimensional Acculturation Scale (BAS) (Marin et al, 1996) ⁷¹	Self-report	Parent	Parent acculturation into US culture
Anthropometrics	Height and weight	Observation	Parent; child	Body mass index, weight categories of normal, overweight, obese

energy drink as a first course or preload. Thirty minutes later, each child will self-select a variety of foods and eat ad libitum (consume until no longer hungry). On day 2, each child will receive the alternate version of the preload, and consume a self-selected meal. Food intake will be measured by pre-weighing and post-weighing all foods. Energy intake of foods will be calculated using manufacturers' information, as is standard practice in this field.^{14,15} The index of child self-regulation, or Compensation Index, is derived from the extent to which each child adjusts his or her ad libitum intake. Children who are sensitive to the energy density of the drink will compensate by eating less at the meal after consuming a high-energy drink. The Compensation Index is a stable indicator of child self-regulation¹⁵ and has been used successfully in an intervention to improve young children's self-regulation of energy intake.⁵⁶

Eating in the Absence of Hunger—

Eating beyond satiation will be measured for each child using a task developed by Fisher and Birch.⁵⁷ Before the task, each child will be provided with a complete meal based on 44% of the daily food requirements for a 4- to 5-year-old child. Both sweet and savory snacks and age-appropriate toys will be offered to each child. Children will be left with the food and toys for 10 minutes and told they can eat whatever they want and play with whatever toys they like. Snacks remaining after the 10-minute period will be measured and kilocalories ingested will be determined. Scores on this task will reflect the total number of kilocalories eaten in the absence of hunger for each child.

Child taste preference observation.

A food-tasting protocol will be administered to each child to assess his or her liking for foods and willingness to try new foods. In this protocol based on a procedure developed by Sullivan and Birch,⁵⁸ each child will be asked to taste 5 familiar and 4 novel foods in a self-selected order. The foods will represent a variety of food groups including foods to which children may have a neophobic response.

Observers will record whether each child tastes the food or refuses it, along with exploration of the foods (smelling, licking, or spitting).

Parent feeding and emotions.

Child Feeding Questionnaire— The Child Feeding Questionnaire (CFQ) is a parent-report measure of feeding attitudes and practices.⁵⁹ The CFQ has 4 attitude scales and 3 feeding practice scales. The latter will be used to measure parents' feeding practices (restriction, monitoring, and pressure to eat). Twenty additional items developed by Kaar and colleagues⁶⁰ measure the promotion of autonomy, offering new foods, structure in feeding, and promoting internal control of eating. Confirmatory factor analyses show this measure to be valid and reliable for use with Hispanic parents.⁶¹ Predictive validity of the CFQ has been demonstrated across multiple studies.⁶²

Caregiver's Feeding Styles Questionnaire—

The Caregiver's Feeding Styles Questionnaire is a parent-report questionnaire developed by Hughes and colleagues⁶³ to measure feeding styles of low-income parents. Parents indicate on 5-point scales how often they use 7 child-centered (eg, reasoning, complimenting) and 12 parent-centered (eg, demands, threats) feeding directives. Scores are derived on 2 parenting dimensions (demandingness and responsiveness) and parents are classified into 4 feeding styles (authoritarian, authoritative, indulgent, and uninvolved). Indulgent feeding on the Caregiver's Feeding Styles Questionnaire was associated with child obesity in 3 samples.⁶³⁻⁶⁵ Evidence of test-retest reliability, internal consistency, convergent, and predictive validity has been demonstrated.⁶³

Feeding Emotions Scale—

The Feeding Emotions Scale is a brief instrument consisting of 20 items that measure different feelings and emotions parents have while feeding their child.⁶⁶ Confirmatory factor analysis supported a 2-factor model with independent subscales of positive and negative affect. Convergent validity was demonstrated by associations with a measure of general adult emo-

tions.⁶⁶ Predictive validity was demonstrated by showing mean differences in affect across parent feeding styles.⁶⁶ Scores indicate positive and negative parent affect during feeding episodes with the child.

Parent report of child eating behaviors.

The Child Eating Behavior Questionnaire is a parent report measure assessing 8 dimensions of eating in young children.⁶⁷ Validity and reliability have been demonstrated.⁶⁷ Three of the 8 subscales measure parents' report of child eating self-regulation (food responsiveness, enjoyment of food, and satiety responsiveness). To the authors' knowledge, this is the only parent-report measure of satiety responsiveness in young children (responsiveness to fullness cues).

Parent report of child food preferences and intake.

Food Preferences Questionnaire—

The food preference questionnaire used for this study was adapted from Skinner and colleagues.²⁹ This parent-report measure includes 112 food and drink items regarding children's preferences using 3 categories: never tried, tried and like it, or tried and did not like it. Similar measures have been used successfully by the Food and Drug Administration in the Total Diet Study.²⁹

Block Kids Food Screener—

The Block Kids Food Screener is a food frequency questionnaire designed to measure parents' report of child intake (aged 2–17 years). This screener assesses child intake by food group consumed in the past 7 days (number of servings and caloric intake).^{68,69}

Acculturation.

The Bidimensional Acculturation Scale consists of 3 subscales: language use, language proficiency, and electronic media. The Bidimensional Acculturation Scale is considered the best acculturation measure with the greatest validity.⁷⁰ The 3 subscales will be combined to create Hispanic and non-Hispanic domains. Evidence of validity and reliability has been shown in US samples.⁷¹

Anthropometrics. Trained staff following standardized procedures will measure parent and child heights (to the nearest 0.1 cm) and weights (to the nearest 0.1 kg).⁷² Two height and weight measures will be averaged for each parent and child. Age- and gender-specific BMI z scores for each child will be calculated. Children will be classified into underweight (< 5th percentile), healthy weight (5th to < 85th percentile), overweight (85th to < 95th percentile), or obese (\geq 95th percentile) according to Centers for Disease Control and Prevention standards. The BMI scores will be calculated for the parent and will be classified as low and normal weight (BMI < 24.9), overweight (BMI > 25), or obese (BMI > 30).

Program Fidelity

Separate bilingual staff will be hired to conduct process evaluations on the parent and child lessons. For one fourth of the lessons, a trained observer will be present to assess program fidelity through process evaluations. The trained observer will observe the lesson, complete a form that lists all lesson activities and content, and indicate whether all components of the lesson were delivered. Percent coverage scores will be calculated from these forms for each session. These observations will be conducted for the parent, child, and family sessions. Session facilitators will also note any issues that arise during the sessions; these will be examined as part of the process evaluations.

Statistical Plan

Code books will be created for all variables. Any data entered by hand will be entered twice and reviewed to minimize data entry errors. Field and range checks will be conducted. Descriptive statistics including means, SDs, skewness, and kurtosis will be calculated to describe the basic features in the data set. Transformation to normality will be considered as appropriate.

Longitudinal analysis models will allow all available data to be used.⁷³ This strategy will be more efficient because partial information will be

available for participants who drop out. A likelihood ratio test based on pretest and posttest assessment information will determine whether dropouts occurred at random.⁷⁴ Primary comparative analyses will be conducted using intention-to-treat principles emphasizing confidence intervals for between-group comparisons. Regardless of whether the complete prevention program was received, all eligible participants in the prevention group will be included to evaluate the program effects.

Outcome analyses will be conducted using multilevel growth modeling with residual maximum likelihood estimation and a (co)variance matrix approach^{75,76} to account for the nested data structure: time points (level 1) within families (level 2) within trials (level 3). This approach enables program-related effects to be controlled (implementation quality) so that standard errors and therefore program outcomes can be estimated more accurately despite the interdependence of observations within programs. It also allows for an examination of variance within individuals within the same program separately from changes across programs, and variance related to initial values on outcomes measures (eg, starting BMI). Random effects will include time, participant, and program; fixed effects at the individual level will include demographics, acculturation, dosage (program attendance), and starting values on parents' feeding styles and knowledge (and children's BMI for BMI outcome analyses); fixed effects at the program level will include implementation quality indices. To inform the selection of covariates in further analyses, a bivariate analysis will be conducted on independent and dependent variables at baseline.

In addition, dose received will be assessed by employing process evaluation measures during implementation of the prevention program. Simple descriptive statistics will be used (ie, frequencies) employing class attendance records to report the number of classes each participant attends and participants' retention to the prevention program, to describe how activities are received by the participants. All analyses will be conducted using SAS (version 9.4, SAS Institute, Cary, NC, 2013).

DISCUSSION

Although researchers have begun to develop, evaluate, and disseminate family-based obesity prevention programs,^{5,37,38} few comprehensive obesity prevention programs exist that focus on child self-regulation of eating, the exploration of novel foods, and the role parents have in the socialization of these child eating behaviors.⁸ The SEEDS program will be one such prevention program.

Consistent with self-determination theory, parents who encourage the development of healthful eating behaviors most effectively, such as healthful food preferences and eating self-regulation, use child-centered feeding directives, acknowledge children's feelings, and afford children opportunities for self-direction. In contrast, parents who interfere with healthful preferences and self-regulation rely on counterproductive strategies such as tangible rewards, threats, demands, and pressured eating.

Parents in the SEEDS prevention group are expected to (1) use more child-centered and less parent-centered feeding directives, (2) be less likely to show an indulgent and more likely to show an authoritative feeding style, (3) show lower scores on restriction and pressure to eat and higher scores on monitoring, and (4) report higher levels of positive and lower levels of negative feeding emotions. Children in the prevention group are expected to show (1) more willingness to try new foods, and (2) increased self-regulation of energy intake. At the end of the prevention program, both parents and children (especially children) are expected to show greater consumption of fruit and vegetables (including consuming a wider variety of these foods). All effects are expected to continue through the 6- and 12-month assessment periods, although the effect sizes will diminish. Effects on child weight status are not expected at posttest, but decreases in children's BMI percentiles by the 6- and 12-month post-prevention periods for the prevention group are expected, especially for the top 25% of the BMI percentile range. No changes in parent weight status are expected.

Challenges to the program effectiveness will include the researchers'

ability to recruit and maintain program participation. Parents' time demands and work obligations may interfere with program attendance and lack of transportation may limit participation. Parents may have difficulty implementing some of the parenting/feeding practices in their homes owing to limited income and access to healthful foods. Children may not respond positively to changes in parenting and feeding, such as setting appropriate boundaries and limits. Other family members such as spouses may not support attempts to create a healthier home environment. Multiple steps will be taken by program staff to help parents and children implement behavioral changes supported by this prevention effort.

Steps to address these challenges include having study staff complete extensive training and certification before implementing the efficacy trial, having parent facilitators implement numerous brainstorming sessions during the lessons to help families implement and maintain behavioral changes in their own environment, obtaining various forms of contact information from each family, and maintaining contact with families between lessons and assessments to help with retention of the sample. Key strengths include the multidisciplinary approach to program development, the proposed use of self-determination theory to inform behavioral change, the randomized controlled design, the use of observational measures to assess the children, and the potential ability to provide insights into obesity prevention effects in this homogeneous, high-risk population. Ultimately, the SEEDS study will have the potential to help decrease the risk for childhood obesity in Hispanic families and possibly other low-income groups after further formative assessments, program modifications, and summative evaluations are conducted with those groups.

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CONFLICT OF INTEREST

The authors have not stated any conflicts of interest.