

# Using Family-Focused Garden, Nutrition, and Physical Activity Programs To Reduce Childhood Obesity: The Texas! Go! Eat! Grow! Pilot Study

Erica C. Spears-Lanoix, MA,<sup>1</sup> E. Lisako J. McKyer, PhD, MPH,<sup>1</sup> Alexandra Evans, PhD, MPH,<sup>2</sup> William Alex McIntosh, PhD,<sup>3</sup> Marcia Ory, PhD, MPH,<sup>4</sup> Lisa Whittlesey, MS,<sup>5</sup> Alice Kirk, MPH,<sup>6</sup> Deanna M. Hoelscher, PhD, LD, RD,<sup>7</sup> and Judith L. Warren, PhD<sup>6</sup>

## Abstract

**Background:** The TEXAS! GROW! EAT! GO! (TGEG) randomized, control trial is a 5-year study to measure the impact of a nutrition and gardening intervention and/or physical activity (PA) intervention on the weight status of third-grade students. This article describes the results of the pilot study to test the feasibility of two interventions and test the measures to be used in the main trial.

**Methods:** The pilot study was conducted in one school with third-grade students and their parents or guardians. The Junior Master Gardner (JMG) and Walk Across Texas (WAT) interventions were implemented over a 5-month period in three third-grade classrooms during spring 2012. The respective interventions focused on improving healthy eating and PA behaviors of children and their families. Baseline and immediate post-test data were collected from students and parents/guardians to measure four child, four parent, and four parent-child interaction behaviors. Process data regarding implementation were also collected from teachers and school administration.

**Results:** Forty-four students and 34 parents or guardians provided both pre- and post-test data. Paired-sample *t*-tests showed statistically significant changes in student knowledge, vegetable preferences, vegetable consumption, and home food availability (all  $p < 0.05$ ). At baseline, participants' weight status categories included 57% obese, 10% overweight, and 31% normal weight. Postintervention, weight status categories included 39% obese, 16% overweight, and normal 45%. Data collected from teachers indicated high levels of implementation fidelity.

**Conclusions:** Implementation of both interventions occurred at a very high fidelity level, which led to positive changes in BMI status, and several dietary and PA behaviors. Although the pilot study indicated feasibility of the two interventions for school implementation, results guided revisions to the TGEG program and its survey instruments.

## Introduction

Over the past 30 years, childhood obesity rates have doubled among children and quadrupled in adolescents.<sup>1-3</sup> Though there is evidence of these rates plateauing in recent years, the widespread decline hoped for has yet to happen.<sup>4-6</sup> Additionally, poorer, publicly

insured black and Hispanic children remain disproportionately represented in overweight and obese statistics.<sup>6-9</sup>

Although causes of obesity are multifactorial and complex, most researchers agree that physical inactivity and poor dietary patterns, including insufficient vegetable consumption, are two behaviors that contribute to the development of overweight and obesity.<sup>10-13</sup> For children, these

<sup>1</sup>Department of Health and Kinesiology, <sup>3</sup>Department of Sociology, <sup>5</sup>Department of Horticultural Sciences, <sup>6</sup>Family and Consumer Sciences, Texas A&M University, College Station, TX.

<sup>2</sup>UTHealth School of Public Health, University of Texas, Houston, TX.

<sup>4</sup>School of Public Health, Texas A&M Health Sciences Center, College Station, TX.

<sup>7</sup>School of Public Health, University of Texas, Austin, TX.

behaviors are greatly influenced by their school and home environments.<sup>14–16</sup> Research has found that as availability and accessibility of fruits and vegetables (F&Vs) in the home increases, F&V consumption increases as well.<sup>17–21</sup> Additionally, because schools serve students of all races and socioeconomic backgrounds, these institutions are viewed as one of the most viable platforms for positively impacting disparity rates and improving childhood overweight and obesity statistics at large.<sup>15,22</sup> Improving family and community involvement has the potential to increase the impact of existing school-based efforts aimed at positively impacting child overweight and obesity rates.<sup>23–26</sup>

Recent studies indicate that successful child obesity prevention efforts, particularly those in low-income communities, require coordinated efforts and consistent messages from schools, communities, and families for optimal effectiveness.<sup>27–30</sup> Few models, however, have focused on achieving this coordinated effect in a manner that could be sustained at the local level and disseminated to other locations.<sup>31</sup> Further, limited rigorous studies had been developed using the Cooperative Extension Programs (Extension). Determining whether promising Extension family-focused programs can increase the efficacy of existing programs on childhood obesity will build an evidence base for national school–Extension collaborations, in which Extension serves as a diffusion mechanism for programs and provides an infrastructure for the institutionalization of family-focused childhood obesity programs within the school/community setting.

The Texas A&M AgriLife Extension Services—which employs experts in health, nutrition, and horticulture—collaborated with academic partners from other disciplines within the A&M system, and the University of Texas School of Public Health to develop the TEXAS! GROW! EAT! GO! (TGEG) study. TGEG is an innovative “Integrated Research–Extension” project funded through the USDA National Institute for Food and Agriculture. The study’s primary aim is to assess the efficacy of enhancing existing school-based efforts with two family-focused, experiential gardening, nutrition, and physical activity (PA) Extension programs on the prevalence of child overweight and obesity. Social cognitive theory tenets support each program component. Moreover, external project advisers, including national food and nutrition experts, reviewed and provided feedback on the selected curriculum components for cultural relevance and effectiveness with limited-resource families and youth.

For the full TGEG study, one coordinated school health program, Coordinated Approach to Child Health (CATCH), was enhanced with two interventions, the Junior Master Gardner Program (JMG) and Walk Across Texas (WAT). Since 1987, CATCH has been implemented as a elementary school–community intervention to combat childhood obesity through the promotion of healthy food choices and increased PA.<sup>32</sup> Currently, CATCH is implemented in 7000 US schools.<sup>32</sup> JMG is a youth horticulture classroom curriculum used to teach students about “plant needs and

people needs,” including health and nutrition concepts.<sup>33</sup> WAT “is a program designed to establish regular PA as a lifetime habit in students.”<sup>34</sup> The refinements and combinations of these three interventions into a coordinated, comprehensive approach to childhood overweight and obesity reduction is the innovative basis of TGEG.

Using a randomized, controlled study (RCT) design, the TGEG study will evaluate different combinations of these 1-year interventions in 28 Title 1 elementary schools (1600 student-parent pairs), within four regions of Texas. The study focuses on child and parent/guardian behavioral factors that are strongly related to childhood obesity. The four child behaviors include increased F&V consumption, decreased sugar-sweetened beverage (SSB) consumption and increased water consumption, increased PA, and decreased sedentary activity. The four parent/guardian behaviors include increased access and availability of F&Vs at home, limited availability of SSBs at home, providing PA opportunities for childrens and limiting children’s sedentary activity. The four child and parent interaction behaviors include gardening together, snacks and meals together, dinners eaten together, and PA together.

The 5-month pilot study described in this article was implemented with third-grade students and their parents/guardians at one school to test the feasibility and effectiveness of the interventions and further test the child and parent research surveys preceding the full RCT. All third-grade students, without a previous chronic disease diagnosis that could impact weight, were eligible for participation in the study. During the pilot, three teachers in one Title 1 school implemented CATCH, JMG, and WAT with the students in their third-grade classes. Students’ experiential learning included building a class garden, growing seven vegetables, tasting and rating each vegetable, raw, and participating in vegetable recipe tasting, demonstrated by Extension staff. Take-home recipes in English and Spanish were used to promote family adoption. Teachers also engaged their classrooms in the 8-week WAT PA competition. These activities included family bonus miles, waling Bingo, and class activity breaks. This article describes and reports on the outcomes of the TGEG pilot study.

## Methods

After obtaining institutional review board approval from the research institutions and the school district, the TGEG pilot study was conducted in one Texas elementary school with a study population of 122 third-grade students and their parents. The pilot study took place during the spring semester of 2012, in three classrooms, using the JMG and WAT interventions. JMG was implemented in the study population for the entire 5-month semester; whereas WAT was implemented for 8 weeks within the same 5-month study period. Data were collected through pre and post student and parent/guardian surveys (see Table 1). Student height/weight and body composition data were also collected at baseline and postintervention.

**Table 1. Parent, Child, and Parent/Child Behaviors Targeted for Intervention Piloting**

	Dietary behaviors		Physical activity	
	Fruits and vegetables	Sugar-sweetened drinks	Physical activity	Sedentary time
Parent	↑ Availability to their child	↓ Availability to their child	↑ Opportunities for their child	↓ Opportunities for their child
Child	↑ Consumption	↓ Consumption	↑ Frequency	↓ Frequency
Parent x Child	↑ Preparing foods together	↑ Eating meals together	↑ Gardening together	↑ Physical activity together

### Measures and Protocol

Surveys were developed using validated questions from the School Physical Activity and Nutrition study, Gimme 5, Eat Your Way to Better Health (an instrument developed by Purdue), and other surveys. Additional survey questions were developed specifically for this study, in an effort to ensure appropriateness in the context of the study population. Both the student and parent surveys were translated into Spanish and then back into English to ensure correct translations. To ensure that the surveys were at appropriate literacy levels and that the items within the survey were understandable to the target population, both the student and parent surveys were tested using cognitive testing methods.

Student surveys were administered orally by research assistants. All research assistants were trained by the University of Texas' School of Public Health's research coordinator, utilizing standardized protocol to ensure consistency of training. A PowerPoint presentation of all vegetables, in a variety of forms, were presented along with the survey to increase students' recognition of the vegetable. The questions were designed to capture demographic information and information on specific behaviors (see Table 1) and knowledge. Parent surveys were sent home to parents through the school, by their children. The surveys contained 60 primarily multiple-choice items measuring demographic data, general knowledge of vegetables, cooking experience, and specific behaviors (see Table 1).

*Sociodemographic variables.* Students were given multiple-choice items to report their sex, age, and grade. Parents were asked to provide more detailed demographic information than the students, for additional context and a more robust analysis. Accordingly, the parent survey included 20 questions regarding demographics including age, race, sex, marital status, work status, languages spoken in the home, level of education, and child's participation in the school's free and reduced lunch program.

*Vegetable preference and consumption.* To measure vegetable preference and consumption, students were asked whether they had eaten a vegetable (response options "yes," "no," or "I don't know"), followed up with a query of whether they liked the vegetable depicted in the presentation (response options "no," "yes, a little," or "yes, a lot"). Emoticons, or pictorial emotion icons, ac-

companied the item response options surrounding preference to aid student comprehension of the survey response options. Students' vegetables consumption frequencies were also assessed by a series of "Yesterday, I ate" questions targeting specific vegetables (*i.e.*, those likely to be part of the gardening aspect of the project). Table 2 provides examples of these items as well as example items from other domains. Table 3 details the number of items used to develop aggregate scores this and other domains.

*Food availability.* The parent survey included items to assess in-home availability of various food and beverage options. Example items included: "Last week, did you have 100% juice in your home?" with response options of "never," "some of the time," "most of the time," and "all of the time." Items assessed included F&V juices and SSBs, as well as vegetable in various forms (*e.g.*, canned, fresh, and frozen). Items for each domain were combined to create aggregate (scale) scores (see Table 3).

*Physical activities.* As illustrated in Table 1, we measured various aspects of PA. For student reports of their family activities, participating students were asked to respond to multiple-choice questions and by various Likert scales. For example, students were asked to describe adults in their families by responding to the statement "spend time teaching you how to play sports and be active" on a 5-point Likert scale with the options "never," "once in a while," "sometimes," "a lot of times," and "all of the time." Students were also asked to respond to questions such as, "In the past year, have you planted seeds or plants in a vegetable garden with members of your family?" and asked to select either "yes" or "no." Similar to food availability, the PA items were also aggregated into scales (see Table 3). PA was also recorded and reported by the teachers of each class participating in the pilot study. Teachers registered their classes in WAT to recorded class level data for the number of miles walked per week.

*Nutrition and health knowledge.* To assess students' baseline knowledge and knowledge gains, students were asked questions about healthy living. Questions such as, "How much of your lunch or dinner plate should be vegetables?" were asked, followed by four pictograms depicting different portion sizes followed by wording to describe the picture such as "quarter (1/4)," "half (1/2),"

**Table 2. Examples of Items Used from Questionnaires for TGEG Pilot**

Source	Domain and example items	Response scale
Student-about self	<p>Example of vegetable and sugar sweetened beverage items</p> <p>Yesterday, did you eat any other vegetables like tomatoes, asparagus, red cabbage, cauliflower, cucumbers, mushrooms, green or red bell peppers, eggplant, or celery?</p> <ul style="list-style-type: none"> <li>• No, I didn't eat any of these vegetables yesterday</li> <li>• Yes, I ate these vegetables 1 time yesterday</li> <li>• Yes, I ate these vegetables 2 times yesterday</li> <li>• Yes, I ate these vegetables 3 times yesterday</li> </ul>	Ordinal
Parent	<p>Last week did you have fresh vegetables in your home?</p> <p>Soft drinks or sugar sweetened beverages in your home?</p>	<p>Likert</p> <p>Never – All of the time</p>
Source student-about self	<p>Examples of physical activity items</p> <p>About every day I do light physical activity</p> <p>Yesterday, did you do any moderate or vigorous physical activities for about 30 minutes (about the time it takes to watch a cartoon) DURING THE DAY?</p>	<p>Dichotomous</p> <p>Yes/No</p>
Source about parents and family	<p>In the past year, have you planted seeds or plants in a vegetable garden with members of your family?</p> <p>Please tell us how often adults in your family play sports and are active with you?</p>	<p>Dichotomous</p> <p>Yes/No</p> <p>Likert</p> <p>Never – All of the time</p>
Parent	<p>During the last seven days, on how many days did you do vigorous physical activities like heavy lifting, digging, aerobics or fast bicycling?</p> <p>How much time did you usually spend doing vigorous physical activities on one of those days?</p>	<p>Ratio</p> <p>Open Ended</p>
Student-about self	<p>Examples of sedentary behavior items</p> <p>Yesterday, how many hours did you sit watching TV, DVD's, or movies AWAY FROM SCHOOL?</p> <ul style="list-style-type: none"> <li>• I didn't spend any time watching TV yesterday</li> <li>• Less than 1 hour</li> <li>• 1–2 hours</li> <li>• 2–4 hours</li> <li>• More than 4 hours</li> </ul>	Ordinal
Parent	<p>After work, I am too tired to be physically active with my child</p>	<p>Likert</p> <p>Strongly Agree – Strongly Disagree</p>

“three fourths (3/4),” and “whole (all).” Students were also asked whether things such as protein, carbohydrates, fat, and so on, were examples of nutrients found in food and asked to select either “yes,” “no,” or “I don’t know.”

*Health status.* Parent participants were asked to provide information about their personal health, including several chronic conditions often associated with obesity, such as heart disease and type 2 diabetes. Parents were also asked about genetic disorders, such as cystic fibrosis and sickle cell anemia. For each condition listed, respondents were asked to respond “yes” or “no.” For each disease, the respondent answered “yes” to, they were also asked to respond “yes” or “no” to the taking medication for the condition.

*Anthropometric information.* Height and weight data were collected pre- and postintervention for each student participant using standardized protocols.<sup>34,35</sup> Data were collected twice for reliability by pairs of trained project staff or research assistants during school site visits. Per-

spective Enterprise (Model PE-AIM-10; Perspective Enterprise, Portage, MI) stadiometers were used to measure student height, and the Tanita scale (model BWB-800S; Tanita Corporation of America, Inc., Arlington Heights, IL) was used for measurement of student weight and body composition. BMI categories for the students were calculated using the CDC growth charts.<sup>36</sup>

*Implementation of interventions.* Third-grade teachers completed a survey designed to capture teacher health behaviors and perceptions of effectiveness with regard to the lessons used within the study. Teachers were asked to respond using a 4-point Likert scale, where a rating of 1 was considered “not at all successful” and a rating of 4 was considered “very successful.” Teachers also completed a weekly electronic survey about each lesson’s timing and ease of implementation. Three teachers, the school principal, assistant principal, and parent support specialist were also interviewed by TGEG staff to provide recommendations for improvement.

**Table 3. Domain Measures Used for Composite Participant Scores**

Domain	No. of items
Food and beverage related	
Child knowledge scores	9
Child vegetable preferences	2
Child vegetable attempts	20
Child vegetable (only) consumption	4
Child fruits and vegetables consumption	26
Child sugar-sweetened drinks intake	2
Child Water intake	1
Parental provision of vegetable options	9
PA	
Child preference for PA	4
Child PA frequency	23
Parent and child joint gardening	5

PA, physical activity.

**Results**

Sixty-two students and parents enrolled in the pilot study. Parental consent could not be obtained for 60 of the 122 students in the original sample; accordingly, those students were not included in the study results. Data cleaning was also performed, by automatic database features and manual reviews, to evaluate outliers and completeness of data. At the conclusion of the pilot study, 44 students and 34 parents completed both baseline and postsurveys. Of the survey respondents, 95% were self-reported as low income; 63% Hispanic, 13% black, 11% white, and 13% other. Thirty-two percent (32%) of parents were enrolled in the Supplemental Nutrition Assistance Program; 10% in the Special Supplemental Nutrition Program for Women, Infants, and Children.

*Body mass index classification.* Students’ weight statuses at baseline were categorized as 57% obese, 10% overweight, 31% healthy weight, and 2% underweight. Post-

intervention weight status was as follows: 39% obese, 16% overweight, and 45% healthy weight. No students were categorized as underweight in postintervention (see Fig. 1).

*Physical activity.* Student PA was measured at the class level through the WAT curriculum. Week 1 measurements were approximately 4 miles per student. By week 8, student PA increased to 9 miles per week. The number of PAs performed by students each week increased from 11 to 13. The number of hours students spent performing PAs with parents each week also increased slightly from 4.45 to 4.63 hours.

*Child and parent outcomes.* Paired *t*-tests were performed on student and parent focused outcome variables and revealed promising changes. As detailed in Table 5, child knowledge, vegetable preferences, and vegetable consumption increased between baseline and postintervention. Student preferences for gardening compared to other activities increased from 26% preintervention to 38% postintervention. In addition, there was an increase in the mean amount of the time students spent gardening. In terms of parent variables, significant differences were found for home availability of vegetables.

Teachers in the study population were asked to evaluate components of the JMG curriculum used in the TGEG study for feasibility and perceived effectiveness. The average rating was 3.6, which would be categorized between “mostly” and “very” successful based on the 4-point Likert scale provided. Four components were assessed. The teachers rated the vegetable tasting component the highest, with a mean score of 3.9. Gardening and outdoor activities received an overall rating of 3.6. The mean score for journaling was 3.5. Classroom activities were rated as 3.3. Teachers also commented on the high level of student engagement in all activities and made recommendations on each lesson and activity for JMG and WAT.

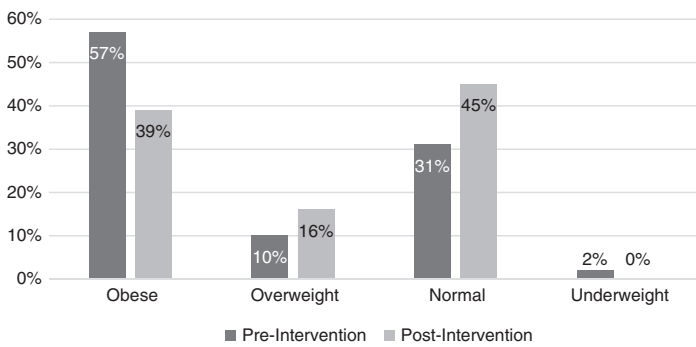
**Discussion and Conclusions**

Consistent with previous research, the TGEG pilot study showed positive changes. There were significant changes in students’ weight statuses, diets, and rates of PA.<sup>28,38</sup> Students also increased vegetable preferences and nutrition knowledge levels.<sup>39</sup> On average, students consumed more vegetables, and greater varieties, postintervention and

**Table 4. Tracking Physical Activity through WAT**

Class	Number of miles walked by week								Total miles walked
	Week 1	Week 2	Week 3	Week 4	Week 5	Week 6	Week 7	Week 8	
1	92	138	139	250	216	154	216	216	1421
2	15	25	55	120	200	250	200	250	1115
3	79	144	151	145	135	138	155	160	1107

Data reported on the class level, with approximately 20 students in each class (62 students total). WAT, Walk Across Texas.



**Figure 1. Student weight status.**

reported preferences for gardening increased.<sup>14,17,40</sup> Additionally, students reported increased PA and limited sedentary behavior.<sup>40</sup> There was also a reported increase in vegetable availability in the home by parents participating in the study. The average teacher rating for components of the program was between “mostly” and “very” successful.

The pilot study findings are limited, in part, because there was no control group utilized for comparison. The lack of a control group is customary, however, for pilot studies. Additionally, the study’s sample size was small, owing to high student mobility and difficulties obtaining completed parental consent forms. It should be noted also that it cannot be assessed whether the large decrease in obesity within the study population can be attributed solely to the TGEG intervention. However, we argue that the purposes of pilot studies are to ensure intervention feasibility, and therefore the limitations expressed are not of major concern at this time. Subsequent implementation of the full intervention, using a randomized control design, is

currently underway and addresses concerns regarding internal validity, sample size, and generalizability.

Additional study limitations exist and should be noted. The study’s retention rates were less than optimal, with 70.96% of students and 54.83% of parents. These numbers are not entirely surprising, however, based on the transient nature of the community surrounding the school used in the pilot study. The results presented utilize comparisons between the initial study sample and those that completed the study, so the groups are not matched exactly. Exact matching will be utilized in the full study. PA was measured at the class level and by participant self-reports. Actual accelerometer reports would have been preferable. Regarding dietary intake, parent reports were used, but a 24-hour dietary recall would have been preferable.

The feasibility of the combined programs for the larger RCT was supported by the pilot study findings. However, based on teacher and expert reviewer feedback, modifications were made. The student survey was shortened. For example, many of the students had difficulty responding to the survey question regarding ethnicity. This question was removed from the child’s survey and added to the parent survey. PowerPoints depicting the vegetables described were developed to accompany the student survey. Additional staff, four to five members in total, were added during survey administration to help answer student questions. The consent process was streamlined. Forms were combined, where prudent, to reduce the amount of paperwork required of parents. The number of lessons included in the intervention were increased—six vegetables were added and the implementation was expanded to 14 weeks. Additional student journal activities and family

**Table 5. Result of t-Tests on Outcome Variables**

	Pre		Post		T	df	Sig. (2-tailed)
	M	SD	M	SD			
<b>Food and beverage-related</b>							
Child knowledge scores	3.12	1.41	4.36	1.70	4.16	32	0.00*
Child vegetable preferences	18.07	9.77	20.43	9.93	2.41	29	0.02*
Child vegetable attempts	3.58	2.28	4.00	2.32	0.85	30	0.40
Child vegetable (only) consumption	13.03	5.31	15.42	5.25	3.98	30	0.00*
Child fruits and vegetables consumption	7.46	2.56	8.43	3.97	1.94	40	0.06
Child sugar-sweetened drinks intake	1.75	1.84	2.05	1.78	1.41	43	0.17
Child water intake	1.15	0.80	1.18	0.81	0.23	39	0.82
Parental provision of vegetable options	16.76	5.00	21.00	5.78	2.37	28	0.02*
<b>Physical activity</b>							
Child preference for PA	3.42	0.98	3.34	9.67	0.49	37	0.63
Child PA frequency	11.08	6.31	13.21	6.10	1.61	23	0.12
Parent & child joint gardening	4.60	3.27	4.89	4.03	0.63	41	0.53

Note M = Mean and SD = Standard Deviation.

\* Significant at  $p < .05$ .

stories, coupled with a modified WAT newsletter in both English and Spanish, were included to increase dosage and connections to home. We are confident that these changes will help to strengthen the overall program and its impact on the larger study population.

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## Author Disclosure Statement

No competing financial interests exist.

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Address correspondence to:

*Erica C. Spears-Lanoix, MA*

*Transdisciplinary Center for Health Equity Research*

*Texas A&M University*

*4243 TAMU*

*Blocker Suite 311*

*College Station, TX 77843*

*E-mail: [espears@hlkn.tamu.edu](mailto:espears@hlkn.tamu.edu)*