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# Adding a Social Marketing Campaign to a School-Based Nutrition Education Program Improves Children's Dietary Intake: A Quasi-experimental Study

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## Abstract

### Background

Evidence supports the use of social marketing campaigns to improve nutrition knowledge and reinforce the effects of nutrition education programs. However, the additional effects of parent-focused social marketing with nutrition education have received little attention.

### Objective

Our aim was to assess the impact of the Iowa Nutrition Network's school-based nutrition education program (Building and Strengthening Iowa Community Support for Nutrition and Physical Activity [BASICS]) and the benefits of adding a multichannel social marketing intervention (BASICS Plus) to increase parent-directed communication.

### Design and intervention

A quasi-experimental design with three study conditions compared a school-based nutrition education program (BASICS) with a school-based and social marketing intervention (BASICS Plus) and a no-treatment comparison group.

### Participants/setting

The study included 1,037 third-grade students attending 33 elementary schools and their parents.

### Main outcome measures

Measures included parents' reports of their children's in-home consumption of fruits and vegetables (F/V) and use of low-fat/fat-free milk. Data on F/V were collected using a modified version of the University of California Cooperative Extension Food Behavior Checklist; and data on milk use were collected using two questions from the National Health and Nutrition Examination Survey.

### Statistical analyses

Multilevel, mixed-effect regression models that account for correlation within repeated measures and children within school were used to compare the mean change over time in the outcome variable for one study group with the mean change over time for another study group.

### Results

Children in BASICS increased mean consumption of fruit by 0.16 cups ( $P=0.04$ ) compared with children in the comparison group. Children in BASICS Plus increased mean consumption of fruit by 0.17 cups ( $P=0.03$ ) and mean consumption of vegetables by 0.13 cups ( $P=0.02$ ). Children in BASICS Plus were 1.3 times

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( $P=0.05$ ) more likely to use low-fat/fat-free milk than children in either the BASICS group or the comparison group.

### Conclusions

Gaining parents' attention and engaging them in healthy eating practices for their children can be a useful way to increase the effectiveness of school-based nutrition education programs. This study demonstrates the benefits of incorporating a parent-focused social marketing campaign in nutrition education interventions.

### Keywords

Supplemental Nutrition Assistance Program (SNAP), Child, Nutrition education, Social marketing, Intervention

### Disciplines

Political Science

### Comments

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## ABSTRACT

**Background** Evidence supports the use of social marketing campaigns to improve nutrition knowledge and reinforce the effects of nutrition education programs. However, the additional effects of parent-focused social marketing with nutrition education have received little attention.

**Objective** Our aim was to assess the impact of the Iowa Nutrition Network's school-based nutrition education program (Building and Strengthening Iowa Community Support for Nutrition and Physical Activity [BASICS]) and the benefits of adding a multichannel social marketing intervention (BASICS Plus) to increase parent-directed communication.

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**Main outcome measures** Measures included parents' reports of their children's in-home consumption of fruits and vegetables (F/V) and use of low-fat/fat-free milk. Data on F/V were collected using a modified version of the University of California Cooperative Extension Food Behavior Checklist; and data on milk use were collected using two questions from the National Health and Nutrition Examination Survey.

**Statistical analyses** Multilevel, mixed-effect regression models that account for correlation within repeated measures and children within school were used to compare the mean change over time in the outcome variable for one study group with the mean change over time for another study group.

**Results** Children in BASICS increased mean consumption of fruit by 0.16 cups ( $P=0.04$ ) compared with children in the comparison group. Children in BASICS Plus increased mean consumption of fruit by 0.17 cups ( $P=0.03$ ) and mean consumption of vegetables by 0.13 cups ( $P=0.02$ ). Children in BASICS Plus were 1.3 times ( $P=0.05$ ) more likely to use low-fat/fat-free milk than children in either the BASICS group or the comparison group.

**Conclusions** Gaining parents' attention and engaging them in healthy eating practices for their children can be a useful way to increase the effectiveness of school-based nutrition education programs. This study demonstrates the benefits of incorporating a parent-focused social marketing campaign in nutrition education interventions.

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**C**HILDHOOD OBESITY IS A PUBLIC HEALTH CONCERN. Recent estimates indicate that 17% of youth aged 2 to 19 years in the United States were obese in 2011 to 2012.<sup>1,2</sup> The immediate and long-term health consequences of childhood obesity are troubling. Obese children are more likely to develop diabetes<sup>3,4</sup> and cardiometabolic

disorders,<sup>5,6</sup> and these children suffer more negative social and emotional outcomes than normal-weight children.<sup>7,8</sup>

School-based nutrition education programs attempt to reduce behaviors that can lead to obesity by teaching children about the benefits of eating a healthy diet that includes adequate amounts of fruits and vegetables (F/V) and choosing

low-fat/fat-free dairy options. F/V have high water content and low energy density, which can lead to feelings of satiety that reduce energy intake and prevent weight gain.<sup>9</sup> While milk consumption is associated with overall better dietary quality<sup>10</sup> and development of optimal bone mass,<sup>11</sup> whole milk is a major source of total fat and saturated fat,<sup>12</sup> and low-fat/fat-free options are recommended for children 2 years of age or older.<sup>13</sup> Despite recommendations, the majority of children in the United States continue to drink whole milk and 2% milk, although the prevalence of whole-milk consumption has declined in recent years.<sup>14</sup>

School-based nutrition education programs reach children in a place where they are predisposed toward learning. The majority of children eat at least one and often two meals per day in schools, affording the opportunity for practical application of new knowledge and skills.<sup>15</sup> However, school-based nutrition education programs have had mixed success in reducing obesity<sup>16</sup> and influencing dietary behavior.<sup>17-20</sup> A review of 24 studies of children aged 5 to 12 years found that school-based interventions moderately improve daily fruit intake but have minimal impact on daily vegetable intake.<sup>18</sup> One reason for the limited success of school-based interventions may be conflicting influences beyond the school setting. Nutrition education may fail to promote behavior change when strong cultural influences and social expectations drive dietary choice.<sup>21</sup> Interventions aimed at improving children's diets may falter when parents fail to create supportive home environments. Parents, and the home environment they create, are primary shapers of children's behavior.<sup>22-28</sup> Parents provide modeling that can help children internalize beliefs and attitudes that support a healthy diet and physically active lifestyle.<sup>29,30</sup> Parental practices also determine children's access to healthy foods in the home.<sup>31,32</sup>

School-based nutrition education interventions may be able to capture parental attention through the use of community-based social marketing campaigns.<sup>33,34</sup> Systematic reviews highlight evidence showing that social marketing can improve nutritional knowledge, improve nutrition-related psychosocial variables (eg, preference and self-efficacy), and encourage a variety of healthy eating behaviors.<sup>35,36</sup> Community-wide campaigns, such as the "1% or Less" campaign, have demonstrated that a social marketing campaign can produce significant and sustained behavior change in a cost-effective way.<sup>37,38</sup>

This study addressed the question, "Can a social marketing campaign directed at parents increase the effectiveness of a school-based, nutrition education curriculum among a primarily low-income population?" To answer this question, the impact evaluation assessed the Iowa Nutrition Network's efforts to improve diet and diet-related outcomes of third-grade students by adding a social marketing campaign to Building and Strengthening Iowa Community Support for Nutrition and Physical Activity (BASICS), a school-based nutrition education program administered by the Iowa Department of Public Health. The BASICS program is supported by the US Department of Agriculture's Supplemental Nutrition Assistance Program Education, a nutrition education and obesity prevention grant program. Although all Supplemental Nutrition Assistance Program Education programs are encouraged to conduct self-evaluations, the US Department of Agriculture initiated a series of independent evaluations to identify

model programs of nutrition education that effectively change eating behaviors.

The evaluation compared pre-intervention and post-intervention measures of fruit consumption, vegetable consumption, and use of low-fat/fat-free milk among third-grade students exposed to one of the following study conditions: (1) a treatment group that included third-grade students participating in the BASICS program; (2) a treatment group that included third-grade students participating in BASICS Plus, which included the standard BASICS program along with a multichannel, community-based social marketing intervention; and (3) a no-treatment comparison group that included third-grade students who did not participate in the BASICS program and were not exposed to the social marketing campaign.

We hypothesized that third-grade students who participated in either the BASICS program or BASICS Plus program would increase mean F/V consumption and would be more likely to use low-fat/fat-free milk than third-grade students in the no-treatment comparison group. In addition, we hypothesized that third-grade students who participated in the BASICS Plus program would increase mean F/V consumption and would be more likely to use low-fat/fat-free milk than third-grade students in the BASICS program.

## METHODS

### Overview of the BASICS and BASICS Plus Programs

The BASICS program was designed to improve diet and diet-related health outcomes based on social cognitive theory.<sup>39,40</sup> The goals of the BASICS program are to increase F/V consumption and the use of low-fat/fat-free dairy products consistent with the 2010 Dietary Guidelines for Americans<sup>13</sup> and to increase daily levels of physical activity.

The BASICS intervention included eight 30-minute nutrition education and physical activity lessons administered in classrooms by trained nutrition educators and additional nutrition and physical activity education activities administered by classroom teachers over a 7-month intervention period. BASICS lessons were developed around the Pick a Better Snack nutrition education program that Iowa Nutrition Network nutrition educators have used for more than a decade. BASICS reinforces key nutrition education and physical activity messages by providing take-home materials and activities for parents or caregivers and their children. Previous evaluations of the BASICS program have shown it to be an effective mechanism for increasing preferences for F/V and low-fat/fat-free milk products.<sup>41</sup>

The BASICS Plus intervention had the same goals and approach for nutrition education and was supplemented with a multicomponent social marketing campaign. Program planners focused community activities in supermarkets and outdoor signage in areas around participating schools to increase exposure among low-income households with children participating in BASICS. The campaign encompassed two sets of messages. The first set reiterated the Pick a Better Snack goals of eating F/V as snacks; this messaging was aimed at children and parents. The second set included parent-focused messages targeted to low-income women aged 18 to 34 years with the aim of encouraging the switch to low-fat/fat-free milk products (eg, "Their Bodies Change, So Should Their Milk"). Message delivery included (1) point-of-purchase signage

and demonstrations at supermarkets; (2) billboards and community-placed signage at bus shelters, Special Supplemental Nutrition Program for Women, Infants, and Children offices, YMCAs, and schools; (3) television and radio ads; and (4) Family Nights Out events (ie, nutrition-themed, family events that include games and healthy snacks held at the school after regular school hours).

## Study Design

The evaluation was based on a quasi-experimental design that included two treatment groups (BASICS and BASICS Plus) and a no-treatment comparison group. This design was chosen to accommodate the inherently ecological nature of the social marketing campaign, which could not have been applied using random assignment of schools to study conditions without a strong risk of contamination. Four Iowa school districts (two small school districts were combined in one study condition) in non-overlapping media markets were recruited and assigned to study conditions based on logistical considerations (eg, local availability of staff, willingness of supervisors at the school district level, community support for the social marketing effort). After applying exclusion rules designed to avoid year-round schools and ensure sufficient sample size, 11 schools were available in the comparison school district and the BASICS school district. In the BASICS Plus school district, 11 schools were randomly selected from

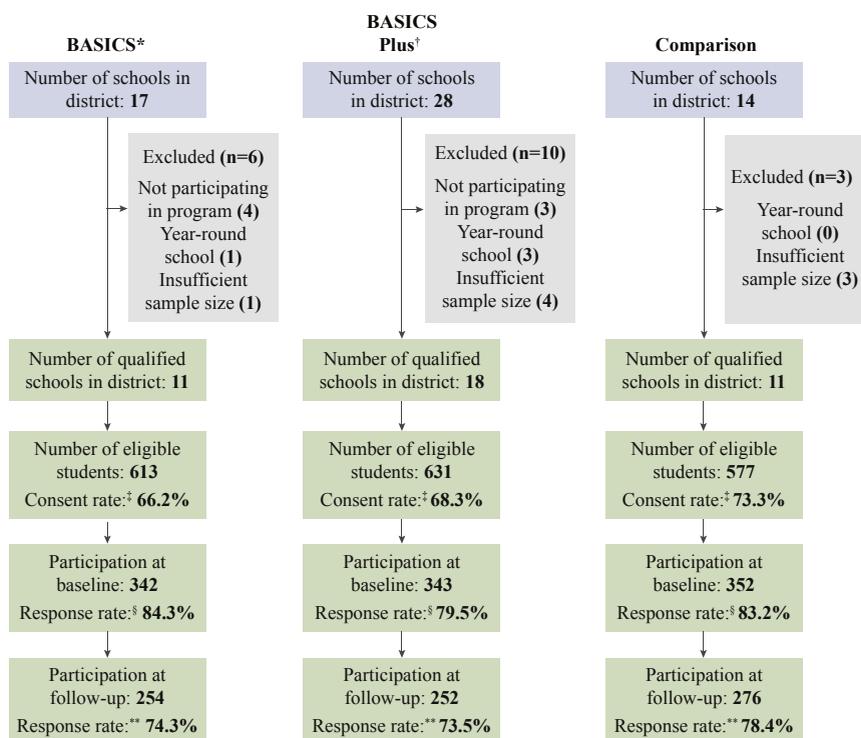
among the 18 schools that met the inclusion criteria (Figure). All recruited elementary schools had >59% of children eligible to receive free and reduced-price school lunches. The intervention was conducted from November 2011 to May 2012.

Sample size calculations carried out using the formulas provided by Murray<sup>42</sup> indicated that with 11 schools and 242 children in each group, statistical models that account for the study's multilevel design and assess change across time between the intervention groups and the comparison group could identify mean differences of  $\geq 0.3$  cups of F/V using two-tailed hypothesis tests with 80% statistical power and a type I error rate of 0.05.<sup>42,43</sup>

## Data Collection

Using a mail and telephone survey approach, parents/caregivers were surveyed at baseline and follow-up to collect information on their child's consumption and other dietary behaviors at home. They were instructed not to include children's meals eaten at school so that they were reporting only on observed consumption behavior. Baseline data collection occurred September through October 2011 and follow-up data collection occurred May through July 2012.

Approximately 8 weeks before the start of the intervention, teachers sent home with the child a study invitation (with information on informed consent), a contact card, and



**Figure.** Flow diagram representing the recruitment of schools and participants. \*BASICS=Building and Strengthening Iowa Community Support for Nutrition and Physical Activity, the Iowa Nutrition Network's school-based nutrition education program, administered by the Iowa Department of Public Health. †BASICS Plus is the Iowa Nutrition Network's school-based nutrition education program with an added social marketing campaign directed at parents/caregivers. ‡Consent rate=number of parents who returned contact card and agreed to participate in the study divided by eligible sample. The eligible sample is based on class enrollment date available at the start of the intervention. §Response rate at baseline=number of completed baseline surveys divided by the number of parents who returned contact card and agreed to participate in the study. \*\*Response rate at follow-up=number of completed follow-up surveys divided by the number of completed baseline surveys.

paper-and-pencil questionnaire. Parents/caregivers who wanted to participate in the study were asked to return the contact card (to provide their consent) and the questionnaire. One week after completion of the intervention, the follow-up survey was mailed to the parent/caregiver participant's home address. Parent/caregivers who did not respond to the mailed survey were contacted by telephone and offered an opportunity to complete the survey. Both baseline and follow-up surveys were available in either English or Spanish.

The survey instrument was tested with the target audience; the Fry Test<sup>44</sup> for readability indicated reading levels between fourth- and eighth-grade. RTI International's Institutional Review Board approved all instruments, informed consent materials, and procedures to ensure the rights of study participants.

### Survey Measures

Use of low-fat/fat-free milk (drank or used on cereal) during the past week was assessed with two questions from the National Health and Nutrition Examination Survey<sup>45</sup> that asked parents/caregivers whether their child drank milk or used milk on his or her cereal at home during the past week and the kind of milk that was used. From the responses, a binomial variable was created indicating whether the child used low-fat/fat-free milk in the home.

Cups of fruit or vegetables consumed each day were assessed using two questions from the University of California Cooperative Extension Food Behavior Checklist<sup>46</sup>; one asked about fruit intake and the other asked about vegetable intake. The questions were modified to ask parents/caregivers to report the child's daily, in-home consumption of F/V during the previous week; response options included pictures of filled 8-oz measuring cups and ranged from "none" to "3 or more cups" (per day) in one-half cup increments. Validity and reliability of the Food Behavior Checklist have been reported by the authors.<sup>46</sup>

### Data Analysis

Comparability of participants in the three treatment groups was assessed at baseline using unadjusted models that accounted for the clustering of respondents within schools. The potential influence of attrition on generalizability was investigated via simple logistic regression analysis.

Primary impact analyses used multilevel, mixed-effect regression models that compared the average change over time in the outcome variable for one study group with the mean change over time for another study group. The models included the baseline measure of the outcome variable and accounted for the over-time correlation of repeated measures to estimate program impacts on fruit consumption, vegetable consumption, and use of low-fat/fat-free milk. To account for the multiple sources of random variation that result from clustering students within schools, the study specified multilevel regression equations using SAS PROC MIXED (version 9.3, 1996, SAS Institute Inc)<sup>47</sup> for linear mixed-effect models and SAS PROC GLIMMIX (version 9.3, 2006, SAS Institute Inc)<sup>48</sup> for logistic mixed-effect models. The structural components of the models reflect the research design. The models included fixed effects for time, condition, and their interaction; they also included random intercepts for schools and for individuals nested within schools, and

random slopes for repeated measures on schools and individuals across time. Fixed-effects covariates in the model included parent's/caregiver's age, sex, and race/ethnicity; child's age and sex; and household size. Respondents who self-identified as American Indian or Alaska Native, Asian, or Native Hawaiian or other Pacific Islander and individuals reporting more than one race were collapsed into "other" race for statistical analysis. Two-tailed tests of statistical significance at  $\alpha \leq .05$  were based on the time-by-condition interaction. For continuous outcomes, residual analysis confirmed that the assumption of normal error was satisfied. Examination of tolerance and condition index values indicate no evidence of collinearity. All analyses were conducted using SAS software (version 9.3, 2006, SAS Institute).<sup>49</sup>

### RESULTS

At baseline, the sample included 1,037 parents/caregivers: 342 in the BASICS group, 343 in the BASICS Plus group, and 352 in the comparison group (Table 1); response rates ranged from 80% to 85% across the three treatment groups. More than 90% of the respondents in each group were female. The children's mean age was 8.6 years (standard deviation=0.4), and 49% of the children were male. There were no statistically significant differences across the three groups in the measured characteristics of children; however, there were differences in the characteristics of parents/caregivers and the households. Compared with the control group, parents/caregivers in the BASICS group were more likely to be white or Native Hawaiian/Pacific Islander and less likely to be black. Compared with the comparison group, parents/caregivers in the BASICS Plus group were more likely to be older than 45 years of age and more likely to be Asian or Native Hawaiian/Pacific Islander. Compared with the BASICS group, parents/caregivers in the BASICS Plus group were more likely to be female, more likely to be Asian, less likely to be Native Hawaiian/Pacific Islander, and more likely to represent single-adult households.

Post-intervention response rates ranged from 73% to 78% across the three treatment groups. Results of the attrition analysis indicated that participants who provided post-intervention data differed from those who did not only by respondents' age group. Parents/caregivers younger than 35 years of age were less likely to provide post-intervention data than parents/caregivers aged 35 to 44 years (odds ratio [OR]=2.2, 95% CI 1.6 to 3.0) or parent/caregivers 45 years of age or older (OR=3.6; 95% CI 1.7 to 7.5).

### Program Implementation

There were no significant differences between the BASICS group and the BASICS Plus group in the level of exposure to the school-based program (Table 2). Close to 80% of parents in both groups reported that they read the Family Newsletters, and a little less than one-third of parents in both groups reported making one or more of the recipes printed on the back of the bingo cards. Slightly more parents from the BASICS Plus group (62%) than from the BASICS group (56%) reported completing F/V bingo cards with their children.

The BASICS Plus social marketing campaign included billboards and posters in Supplemental Nutrition Assistance Program and Special Supplemental Nutrition Program for Women, Infants, and Children offices; messages in these

**Table 1.** Baseline characteristics of children and their parents/caregivers who participated in the BASICS<sup>a</sup>/BASICS<sup>b</sup> Plus evaluation

Sample characteristics	Overall	BASICS	BASICS Plus	Comparison
	←————— <i>mean ± standard error<sup>c</sup></i> —————→			
Age of children (y)	8.6 ± 0.01	8.6 ± 0.02	8.6 ± 0.02	8.6 ± 0.02
	←————— <i>% (standard error<sup>c</sup>)</i> —————→			
Female children	50.7 (1.3)	49.0 (2.3)	49.3 (2.3)	53.6 (2.3)
Parents'/caregivers <sup>d</sup> age, y				
18-34	58.6 (1.8)	60.5 (3.1)	57.9 (3.1)	57.4 (3.1)
35-44	33.5 (1.6)	32.0 (2.8)	32.0 (2.8)	36.6 (2.8)
≥45	7.8 (0.8)	7.2 (1.3)	10.2 (1.3)	6.00 (1.3)
Female (parents/caregivers <sup>d</sup> )	93.0 (0.7)	90.8 (1.2)	94.6 (1.2)	93.4 (1.2)
For race/ethnicity of parents/caregivers <sup>d</sup>				
American Indian or Alaska Native	0.9 (0.3)	1.0 (0.5)	1.3 (0.5)	0.6 (0.5)
Asian	2.4 (0.7)	0.4 (1.1)	5.5 (1.1)	1.4 (1.1)
Black or African American	15.0 (2.2)	8.3 (3.4)	13.4 (3.4)	23.0 (3.3)
Native Hawaiian or Pacific Islander	0.6 (0.2)	1.6 (0.4)	0.3 (0.4)	0.0 (0.3)
White	76.8 (2.6)	86.5 (4.1)	75.0 (4.1)	69.3 (4.0)
More than one race	4.1 (0.7)	2.0 (1.3)	4.7 (1.3)	5.44 (1.2)
	←————— <i>mean ± standard error<sup>c</sup></i> —————→			
Size of households	4.9 ± 0.07	5.0 ± 0.1	4.8 ± 0.1	4.9 ± 0.1
	←————— <i>% (standard error<sup>c</sup>)</i> —————→			
Single adult households	23.9 (1.2)	20.4 (2.2)	27.0 (2.2)	24.1 (2.1)
Households receiving SNAP <sup>e</sup> benefits	51.8 (2.3)	47.5 (3.9)	49.8 (4.0)	58.0 (3.9)
	←————— <i>n</i> —————→			
Parents/caregivers	1,037	342	343	352
Schools	33	11	11	11

<sup>a</sup>BASICS=Building and Strengthening Iowa Community Support for Nutrition and Physical Activity, the Iowa Nutrition Network's school-based nutrition education program, administered by the Iowa Department of Public Health.

<sup>b</sup>BASICS Plus is the Iowa Nutrition Network's school-based nutrition education program with an added social marketing campaign directed at parents/caregivers.

<sup>c</sup>Sample characteristics estimated using unadjusted, mixed-effect models that account for the clustering of respondents within schools.

<sup>d</sup>Indicates the parent/caregiver who completed the survey.

<sup>e</sup>SNAP=Supplemental Nutrition Assistance Program.

venues were potentially viewed as many as 280,000 times during a 2-month period. TV ads were aired during two 2-week periods and were estimated to have obtained 302,000 impressions (ie, potential views) for "Pick a Better Snack" and 194,000 impressions for "Their Bodies Change, So Should Their Milk" among the target audience of women aged 18 to 34 years with young children. The radio portion of the campaign aired 36 spots per week for 5 weeks, with an estimated 244,000 impressions to each set of ads among the target audience. These exposure measures are estimates provided by media marketing companies based on audience share data and anticipated foot traffic in the selected intervention areas.

Data collected in the follow-up survey indicated that significantly more parents/caregivers ( $P \leq 0.05$ ) in the BASICS Plus group (30%) than in the BASICS group (20%) reported being aware of the campaign slogan "Their Bodies Change, So

Should Their Milk." By comparison, only about 10% of parents/caregivers in either group reported seeing "Mr. Juice-bar"—a factitious campaign slogan included in the response option to help us gauge false-positive reporting. While awareness of TV or radio ads was modest, it was significantly higher ( $P < 0.01$ ) in the BASICS Plus group; 7% of parents/caregivers in the BASICS Plus group compared with 1% of parents/caregivers in the BASICS group reported seeing or hearing an ad on TV or radio for "Their Bodies Change, So Should Their Milk." Additional information on the programs and their implementation is provided elsewhere.<sup>50</sup>

### Program Impacts

At baseline, mean in-home fruit consumption was 1.3 cups in the BASICS group, 1.2 cups in the BASICS Plus group, and 1.4 cups in the comparison group. Mean in-home vegetable consumption was 1.2 cups in the BASICS group, 1.0 cups in the

**Table 2.** Estimated and reported exposure to BASICS<sup>a</sup> program materials and BASICS Plus<sup>b</sup> social marketing campaign messages among children and parent/caregivers

Children's exposure to BASICS nutrition education in school	BASICS group	BASICS Plus group
Mean exposure (min) by nutrition educators (8 sessions)	240	248
Mean exposure (min) by classroom teachers (7 mo)	378	350
Parent's/caregiver's awareness of BASICS <sup>c</sup>	n=251	n=252
Reported reading family newsletters (%)	82	76
Completed "Be a Milk Superstar" worksheet with child (%)	32	32
Family played bingo cards 5 or more times to get child to eat fruit and vegetables (%)	56	62
Made one or more recipes on back of bingo cards (%)	30	31
Parent's/caregiver's exposures to BASICS Plus social marketing <sup>d</sup> (n)		
TV ads (two 2-wk periods)		
"Pick a Better Snack"	NA <sup>e</sup>	302,000
"Their Bodies Change, So Should Their Milk"	NA	194,000
Earned TV media: impressions	NA	73,000
Radio ads (5-wk period)		
"Pick a Better Snack"	NA	244,000
"Their Bodies Change, So Should Their Milk"	NA	244,000
Billboards (2 mo)		
Impressions	NA	280,000
Point of purchase (7 mo)		
Individuals participated in point-of-purchase food tasting	NA	10,764
Parent's/caregivers awareness of the BASICS Plus social marketing <sup>f</sup>	n=250	n=250
Recalled campaign slogan (any exposure) (%)		
"Pick a Better Snack"	80	86
"Their Bodies Change, So Should Their Milk"	20	30*
Mr. Juicebar (factitious campaign slogan)	9	11
Recalled campaign slogan (TV or radio ads) (%)		
"Pick a Better Snack"	5	7
"Their Bodies Change, So Should Their Milk"	1	7**

<sup>a</sup>BASICS=Building and Strengthening Iowa Community Support for Nutrition and Physical Activity, the Iowa Nutrition Network's school-based nutrition education program, administered by the Iowa Department of Public Health.

<sup>b</sup>BASICS Plus is the Iowa Nutrition Network's school-based nutrition education program with an added social marketing campaign directed at parents/caregivers.

<sup>c</sup>Proportion of parents/caregivers at follow-up who reported seeing BASICS take-home materials.

<sup>d</sup>Estimated exposure to BASICS Plus campaign messages among women aged 18 to 34 years with young children, provided by media marketing agencies based on audience share data and anticipated foot traffic in designated areas.

<sup>e</sup>NA=not applicable.

<sup>f</sup>Proportion of parents/caregivers at follow-up who reported seeing social marketing campaign ads.

\*Statistically significant ( $P \leq 0.05$ ) based on unadjusted  $\chi^2$  goodness of fit test.

\*\*Statistically significant ( $P \leq 0.01$ ) based on unadjusted  $\chi^2$  goodness of fit test.

BASICS Plus group, and 1.3 cups in the comparison group (Table 3). The percentage of children using low-fat/fat-free milk at baseline was 36.7% in the BASICS group, 36.3% in the BASICS Plus group, and 40.9% in the comparison group. Baseline differences in mean consumption of cups of fruit and cups of vegetables between the BASICS Plus group and the comparison group were statistically significant; other baseline differences were not statistically significant.

Parents/caregivers of children in the BASICS group reported a statistically significant increase of 0.16 cup in their child's mean consumption of fruit compared with parents/caregivers of children in the comparison group, but no statistically significant differences in mean vegetable consumption or use of low-fat/fat-free milk (Table 3). Parents/caregivers of children in the BASICS Plus group reported statistically significant increases of 0.17 cup in their child's mean consumption of

**Table 3.** Report of children's daily in-home fruit and vegetable consumption, and use of low-fat/fat-free milk by study group and by data collection period and between-group comparison of changes in daily in-home fruit and vegetable consumption and use of low-fat/fat-free milk<sup>a</sup>

	Cups of fruit	Cups of vegetables	Using low-fat/fat-free milk, % (SE <sup>b</sup> )
<b>Study group</b>	←————— <i>mean (SE)</i> —————→		
<b>BASICS<sup>c</sup></b>			
Baseline (n=342)	1.3 (0.04)	1.2 (0.04)	36.7 (3.8)
Follow-up (n=254)	1.4 (0.05)	1.2 (0.04)	37.8 (4.0)
<b>BASICS Plus<sup>d</sup></b>			
Baseline (n=343)	1.2 (0.04)	1.0 (0.04)	36.3 (3.8)
Follow-up (n=252)	1.3 (0.05)	1.2 (0.05)	44.4 (4.2)
<b>Comparison</b>			
Baseline (n=352)	1.4 (0.04)	1.3 (0.04)	40.9 (3.90)
Follow-up (n=276)	1.4 (0.05)	1.2 (0.02)	42.4 (4.07)
	<b>Change in cups of fruit</b>	<b>Change in cups of vegetables</b>	<b>Odds ratio for using low-fat/fat-free milk</b>
<b>Study group comparisons</b>	←————— <i>mean (95% CI)</i> —————→		
BASICS vs comparison	0.16* (0.01 to 0.3)	0.07 (−0.03 to 0.2)	1.0 (0.8 to 1.3)
BASICS Plus vs comparison	0.17* (0.02 to 0.3)	0.13* (0.02 to 0.2)	1.3* (1.01 to 1.7)
BASICS Plus vs BASICS	0.02 (−0.1 to 0.2)	0.06 (−0.06 to 0.2)	1.3* (1.01 to 1.8)

<sup>a</sup>Standard errors, means, percentages, and CIs were estimated using adjusted linear mixed models (SAS PROC MIXED) for continuous impact variables and adjusted logistic mixed models (SAS PROC GLIMMIX) for dichotomous impact variables that account for the repeated measures design and clustering of students within schools. Covariates in the model included child and respondent sex, child and respondent age, respondent race and/or ethnicity, and household size.

<sup>b</sup>SE=standard error.

<sup>c</sup>BASICS=Building and Strengthening Iowa Community Support for Nutrition and Physical Activity, the Iowa Nutrition Network's school-based nutrition education program, administered by the Iowa Department of Public Health.

<sup>d</sup>BASICS Plus is the Iowa Nutrition Network's school-based nutrition education program with an added social marketing campaign directed at parents/caregivers.

\*Statistically significant differences ( $P \leq 0.05$ ) comparing change from baseline to follow-up between study groups.

fruit and 0.13 cup increase in their child's mean consumption of vegetables compared with parents and caregivers of children in the comparison group. Reported differences in mean fruit consumption and mean vegetable consumption between children in the BASICS Plus and the BASICS groups were not statistically significant. In addition, children in the BASICS Plus group were 30% more likely to use low-fat/fat-free milk at home after the intervention than children in the comparison group (OR=1.3; 95% CI 1.01 to 1.7) or children in the BASICS group (OR=1.3; 95% CI 1.01 to 1.8).

## DISCUSSION

The results of this study demonstrate the potential benefits of a multicomponent nutrition education program for addressing dietary change in low-income children. Parents/caregivers of children in the BASICS program reported increases in their child's in-home fruit consumption, but not in vegetable consumption or in the use of low-fat/fat-free milk when compared with children in the comparison group. In contrast, children in the BASICS Plus program increased their in-home fruit consumption and vegetable consumption compared

with children in the comparison group. In addition, children in the BASICS Plus program were more likely to use low-fat/fat-free milk than children in the BASICS group or comparison group. Accordingly, the findings suggest that the school-based BASICS program is capable of achieving dietary improvement in line with previous interventions.<sup>18,20</sup> The addition of the community-based, social marketing component, however, was necessary to help achieve all program goals.

The combined increase of 0.3 cups F/V is within the range of previous studies that have shown positive effects among elementary school interventions.<sup>20</sup> The observed impact of BASICS Plus was due to increases in both F/V consumption, unlike previous, school-based interventions where program impacts have been driven primarily by increased fruit intake.<sup>18</sup> The fact that the measure was limited to in-home consumption may suggest that even stronger effects could be observed when diet across the full day is considered.

Finding new and more effective methods of engaging parents may be critical to helping young children make healthy food choices. While the BASICS program included some take-home materials for parents, these require time

and effort and are often underused in the home.<sup>50-52</sup> The social marketing campaign provided additional reach into community settings, promoted important nutrition messages, and required little active involvement on the part of parents. It is also likely that the social marketing campaign offered repeated exposure to important nutrition messages. Such repetitions have been found to increase the impact of social marketing campaigns.<sup>53,54</sup> The campaign may have reinforced important intervention messages at times and locations that were relevant and highly salient (eg, supermarkets) to supporting dietary change.

The use of low-fat/fat-free milk among children in BASICS Plus increased significantly when compared with use among children in the BASICS program or the comparison group. Change over time in the use of low-fat/fat-free milk was nearly identical in the comparison group and the BASICS group, with increases of 1.5 and 1.1 percentage points, respectively, while low-fat/fat-free milk use increased 8.1 percentage points among children in the BASICS Plus program. This pattern suggests that improvements in low-fat/fat-free milk use are likely attributable to the “Their Bodies Change” campaign, an intervention element unique to the BASICS Plus program. This finding is not entirely surprising because social marketing campaigns have been used with success to promote the use of low-fat/fat-free milk<sup>55,56</sup> in other community-based studies.

The social marketing campaign was implemented at a total cost of \$206,087. Based on the number of children attending schools receiving the BASICS Plus program, the campaign potentially reached 3,054 households with an estimated cost of \$67.50 per family. This number is considered an upper boundary cost because the social marketing campaign was seen by, and may have influenced, many more families in these low-income neighborhoods. Funding used to develop and implement the program came from federal, state, and private sources.

This study is not without limitations. First, the data for this study came from parent/caregiver reports of their child's eating patterns at home. Accurate assessment of children's food intake is challenging. Deciding on whether to collect information from children or rely on surrogates is an important question. Children 8 and 9 years of age are on the cusp of having the cognitive ability to accurately recall and gauge portion size. Parents have been noted to be at least as reliable as their children in reporting children's food consumption,<sup>57-59</sup> with the caveat that parents may not be accurate reporters of what children eat away from the home. Given these potential tradeoffs, our approach follows the recommendations of using parents to report their children's dietary intake, but restricting what they reported to include only what the children ate in the home<sup>60,61</sup>; this provides a reasonably accurate report while limiting the need for speculation on dietary intake that was not directly observed. Second, this study does not provide detailed information on parental exposure to different aspects of the social marketing campaign. Data on campaign exposure are difficult to collect reliably in a self-reported survey. The questionnaire did not present respondents with logos or other visual elements of the campaign, which may have limited recall. In addition, awareness of a social marketing campaign with a heavy mix of billboards, posters, point-of-purchase promotions, and radio and TV ads may have an influence on food purchases

that was not recalled by parents/caregivers at the time of the follow-up survey. Prior evaluations of social marketing campaigns have found that the levels of broadcast ads can have an impact over and above the effects of measured campaign awareness.<sup>62,63</sup> In the future, researchers should more carefully assess exposure to different components of social marketing campaigns. Third, the characteristics of a community-based social marketing campaign and the logistics of supporting nutrition educators who could provide lessons during the school day did not allow for random assignment of schools to condition. Accordingly, this study employed a quasi-experimental design with schools assigned to study condition based on location and on the availability of BASICS nutrition educators within school districts. Although neither schools nor children were able to self-select into study condition, and none of the schools chose not to participate, the use of purposeful assignment leaves this study vulnerable to validity threats that include selection effects and secular trends (eg, differential history, differential maturation) that could have played a role in the observed results. In addition, differences in the demographic composition of the communities included in the study may have contributed to baseline differences in reported F/V consumption. Statistical models controlled for these differences by including demographic variables as fixed-effect covariates and by employing a modeling approach that includes within-person change over time and differences between study conditions.

## CONCLUSIONS

Policies that bring healthier foods and beverages into schools will give children greater access to fruits, vegetables, and low-fat/fat-free milk. Parents, however, establish dietary norms and are the gatekeepers of foods and beverages available in the home. Accordingly, finding innovative and effective methods of gaining parents' attention and engaging them to encourage healthy and nutritious eating practices for their children may increase the effectiveness of school-based nutrition education programs. Adding a parent-focused social marketing component to a school-based nutrition education intervention can improve dietary outcomes among elementary school children.

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