INVESTIGATION OF THE EFFECTS OF NUTRITION EDUCATION ON THE LIFESTYLES OF THIRD-GRADE CHILDREN AND THEIR PARENTS

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Abstract

The current study assessed improvement in healthy lifestyles of third-grade children from Iowa schools who participated in nutrition education lessons provided by the Iowa Department of Public Health's Building and Strengthening Iowa Community Support for Nutrition and Physical Activity (BASICS) program in 2009. The program encourages children to eat more fruits and vegetables as snacks and to be active

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every day. Autoregressive models and logistic regression analysis results showed that the BASICS program improved awareness of the "Pick a better snack™ & Act" campaign among children and their parents. The program also led to children's increased preferences toward fruits, vegetables, and low-fat milk products, and to parents' increased willingness to offer healthy foods to their children. The program stimulated children's desires to be physically active and parents' attentiveness toward children's physical activity. These results indicated that the children influenced their parents' recognition of campaign materials and how often their parents provided them with fruits and vegetables. Increasing parent age negatively influenced the probability of children receiving free and reduced-price lunch, reflecting the better economic situation of families with older parents.

Introduction

Obesity, one of the most important contemporary health problems, is spreading throughout developed countries. This problem relates to habits of consumption and physical activity in an environment that contains abundant amounts of food. Ease of food accessibility in more developed countries has increased cases of overconsumption resulting in obesity, which negatively affects health. Consequently, many public health organizations have committed funding and governmental programs to support efforts to combat this problem. Overweight and obese children draw special attention from healthcare and governmental organizations. Numerous factors lead to children becoming overweight or obese. These factors include an abundance of high-calorie foods that children like to eat, as well as the ready availability of television, videos, and computer games, which can lead to a sedentary lifestyle and insufficient physical activity. According to the American Academy of Pediatrics, "American children and adolescents today are less physically active as a group than were previous generations" (2003:424). Children from low-income families and minority groups are especially vulnerable to becoming overweight and obese (Caprio et al. 2008; Eagle et al. 2012). These results indicate the necessity of developing programs and campaigns that will help reduce the number of children who are overweight or obese. The Centers for

Disease Control and Prevention (CDC) supports the development of school programs to promote physical activity and healthy eating. Veugelers and Fitzgerald (2005:432) emphasized that it is "crucial to establish the effectiveness of school programs" to support broader implementation of healthy lifestyles.

The Iowa Department of Public Health has a goal to improve the health of children through the promotion of a healthy lifestyle. A healthy lifestyle is beneficial for all children and helps children with obesity and overweight problems reduce their weight. The Iowa Nutrition Network, housed in the Department of Public Health, coordinates the Building and Strengthening Iowa Community Support for Nutrition and Physical Activity Program (BASICS), which uses a social marketing model to encourage and empower children, parents, and caregivers to eat healthily and be physically active. The BASICS program provides federal funding for community coalitions to expand nutrition and physical activity education programs serving Supplemental Nutrition Assistance Program (SNAP) recipients and SNAP-eligible populations. The goal of the program is to provide educational programs that increase opportunities for low-income audiences to make healthy food choices consistent with the dietary advice of MyPyramid (www.idph.state.ia.us/INN/). The program's marketing campaigns and nutrition education resources convey and reinforce healthy eating and lifestyle behaviors to low-income children and their families. During the timeframe that these data were collected, the BASICS nutrition education program focused on three key behaviors: (1) eating fruits and vegetables for snacks, (2) eating calcium-rich, 1%, or fat-free dairy products, and (3) being physically active every day.

BASICS provides nutrition education to more than 20,000 children attending low-income schools in Iowa (i.e., schools that have high rates of students receiving free and reduced-price lunch) with a combination of federal SNAP education funds and local contributions. In school, children participate in lessons conducted by nutrition educators that provide the opportunity to taste different kinds of fruits, vegetables, and low-fat milk products, and demonstrate simple recipes for snack preparation from these products. Newsletters and bingo cards, which include information about physical activities and foods for each season, provide parents

with information on food resources and low-cost, practical ways to implement the program's key behaviors.

"Pick a better snack™ & Act" is the network's flagship campaign that promotes fruit and vegetable snacks and daily physical activity. Although the health belief model was foundational in the formative design of the campaign, the classroom lessons are framed with social cognitive theory (SCT). SCT was developed by Bandura (1977, 1986) to understand human social behaviors. Self-efficacy and outcome expectancies are central determinants of behavior in SCT.

Glanz, Rimer, and Lewis (2002) mentioned that learning techniques including observation and active participation improve self-efficacy for performing a targeted behavior. This approach has been used in the BASICS project by providing school children a possibility to taste different kinds of fruits and vegetables, teaching them to prepare the snacks from healthy food products, and providing them information about a healthy lifestyle. According to SCT, activities that increase the values of expected outcomes are helpful for the improvement of task performance. For example, children can eat fruits and vegetables "and still be cool for peers" (Contento 2007:117). According to SCT's principle of reciprocal determinism, the "Pick a better snack™ & Act" campaign helps create a social environment that supports a healthy lifestyle. Children and their family members receive information about healthy lifestyles and influence each other by interactions with and exchange of this information.

SCT is an appropriate theoretical grounding for designing nutrition and physical activity education programs for school children. Numerous literature sources indicate SCT as a basis for developing health education program intervention plans (Sharma 2011; Hildebrand, Jacob, and Garrard-Foster 2012; Lent et al. 2012). Sharma (2011) analyzed 25 school-based interventions, published between 2000 and 2009, which were designed to prevent childhood and adolescent obesity by modifying dietary behavior. SCT was the most popular of the theories that were used. Sharma recommended use of SCT in planning and evaluating educational programs.

The purpose of the current study is to assess the effects of the "Pick a better snack™ & Act" campaign on health-related behaviors

of third-grade children and their parents. The study presents four hypotheses:

> *Hypothesis 1*: Information about the healthy lifestyles that third-grade children received through BASICS positively influenced their health-related behaviors.
>
> *Hypothesis 2*: The BASICS nutrition education program materials and "Pick a better snack™ & Act" campaign positively influenced health-related behaviors of the parents of third-grade children.
>
> *Hypothesis 3*: Participation by children in lessons provided through BASICS positively influenced health-related behaviors of their parents.
>
> *Hypothesis 4*: Parents who received information through BASICS and the "Pick a better snack™ & Act" campaign positively influenced health-related behaviors of their children.

Method

Participants were 283 third-grade children and 283 matched parents of these children. The children were from Iowa schools that participated in the BASICS program. BASICS is a school-based program and has access to parents through the school. BASICS lessons and materials are based primarily on the "Pick a better snack™ & Act" campaign. Each year third-grade students and their parents complete evaluation measures in a pre and postmatched design. Parents of third-grade students are matched with their children. Ages of parents ranged from 18 to 55 years old ($M = 30.80$, $SD = 7.372$).

For the program evaluation, classes were sampled randomly from the Iowa schools participating in the program. Data from completed surveys before and after program participation were used to assess changes in awareness of the campaign materials and of healthy lifestyles, and changes in health-related behaviors of the third-grade children and their parents. The surveys included questions about the awareness of "Pick a better snack™ & Act" messages, logos, and materials, and various theoretical constructs or mediating variables related to the program's targeted key behaviors (i.e., fruit and vegetable snacks, low-fat milk, and physical activity).

Table 1. Sample Size

	Total	High Income Group	Low Income Group	Boys	Girls
Children	283	84	139	120	161
Parents	283	84	139	120[a]	161[b]

[a] Parents of boys
[b] Parents of girls

Surveys

The survey for children asked respondents to indicate their gender (boy or girl); it included behavior-related questions designed as three-point Likert-type items, with response options of "almost never," "sometimes," and "almost always," or "not sure," "sure," and "very sure." The survey for parents included demographic items such as the parent's age and gender, their children's eligibility for free or reduced-price lunch, and five-point Likert-type questions ranging from "never" to "always" about how often they practice supportive behaviors for their children (e.g., role modeling, offering, purchasing) and how often their children perform related behaviors (e.g., like to try new fruits and vegetables, ask for milk at meals, ask to buy his/her favorite fruit or vegetable).

The eligibility for free and reduced-price lunch indicates a family's level of income. This provides the opportunity to compare the program's effect on low-income and high-income groups of participants. Participants who received free and reduced-price lunch before and after the program's intervention belong to the low-income group. Participants who did not receive free and reduced-price lunch belong to the high-income group. The sample size is reported in Table 1. Logistic regression analysis, exploratory factor analysis, and autoregressive models were used to assess patterns in the survey data. Data analysis was conducted using SPSS and AMOS software (Stevens 2009:17, Tabachnick and Fidell 2007:705,780).

Variables

Structural equation modeling (SEM) may include both measured or observed variables and latent variables. Latent variables are "hypothetical constructs that cannot be directly measured," and "in SEM each such construct is typically represented by multiple"

Table 2. Simple Observed Variables

Survey Item	Abbreviation	
	Time 1	Time 2
Items from children's survey		
Question 2: "Eat Smart. Play Hard."	q2	Post q2
Question 3: "Be Strong."	q3	Post q3
Question 10: "I like to drink white milk."	q10	Post q10
Question 13: "I like to eat yogurt."	q13	Post q13
Question 18: "How sure are you that you can play outside instead of watching TV after school?"	q18	Post q18
Items from parents' survey		
Question 1: "Is your child (or children) eligible to free or reduced-price lunch at school?"	pq1	Post pq1
Question 16i: "I offer milk, cheese, or yogurt 3 times a day to my children."	pq16i	Post pq16i
Question 16o: "I limit the amount of time my child watches TV or DVDs during the weekend (Sat–Sun)."	pq16o	Post pq16o

observed variables "that serve as indicators of the construct" (MacCallum and Austin 2000:202). In the current study, some of the observed variables were used directly from the survey (Table 2), while others were created by summating several related survey items (Table 3). Questions asked at Time 1 are related to the presurvey and questions asked at Time 2 are related to the postsurvey.

Results

The data were analyzed by using two-wave autoregressive models with cross-lagged effects and synchronous effects. This method provides the possibility of estimating the direction and strength of causal effects between the variables. The models "Labels," "Fruits and Vegetables," "Milk Products," and "Television" were constructed to assess the effect of the educational program on health-related behaviors of the participants. The evaluation of each model was done for the total sample of the participants, and by income and gender separately. Only the models that fit the data well were chosen for the analysis. The chi-square test, comparative fit index (CFI) and root mean square of approximation (RMSEA) were used to evaluate goodness of model fit in this study (Hu and Bentler 1999; Barret 2007; Steiger 2007; Hooper, Coughlan, and Mullen 2008).

Table 3. Composed Observed Variables

Observed Variable	Items Used for Construction	Abbreviation and Cronbach's Alpha	
		Time 1	Time 2
Parents' labels recognition	"Have you heard or seen any of the following messages? Wash. Bite. Peel. Eat. Slice. Eat. Dip. Eat."	0.777	0.611
	"Pick a better snack logo."		
	"Stickers similar to these."		
	"Bingo card."		
Parents' preferences toward fruits and vegetables	"I eat fruits and vegetables for snacks."	0.787	0.796
	"I offer fruits and vegetables to my child for snacks daily."		
	"I offer fruits and vegetables to my child at meals."		
	"I keep fruits and vegetables available in my home for snacks."		
	"My child likes to try new fruits and vegetables."		
	"My child asks me to buy his/her favorite fruit or vegetable."		
Children's preferences toward: avocado, tangerine, mango, and jicama		c1 0.709	Post c1 0.647
Children's preferences toward: kiwi, pineapple, cantaloupe, cucumber, and cauliflower		c2 0.659	Post c2 0.643
Children's preferences toward: peppers, tomato, celery, and broccoli		c3 0.656	Post c3 0.629

Note: The observed variables c1, c2, c3, Post c1, Post c2, and Post c3 were created according to the corresponding components received from the results of Exploratory Factor Analysis of the list of fruits and vegetables used in the survey for measurement of children's preferences toward fruits and vegetables

A nonsignificant chi-square test ($p > .05$) indicates failure to reject the null hypothesis that the observed covariance matrix is equal to the covariance matrix implied by the model. The goal is to construct a model with a covariance matrix as close as possible to the observed covariance matrix. Consequently, the model fits the data well if the chi-square test is nonsignificant (Hu and Bentler 1999:2; Barrett 2007:816).

The RMSEA "estimates the lack of fit in the model compared to a saturated model" (Dragan and Akhtar-Danesh, 2007:19; Tabachnick and Fidell, 2007:717). According to Hooper et al. (2008), up until the early 1990s RMSEA below 0.08 was considered to indicate a good fit. More recently a cutoff value for RMSEA is

considered "close to .06" (Hu and Bentler 1999; Hooper et al. 2008:55).

The CFI compares the sample covariance matrix with the null model. The null/independence model assumes that all measured variables are uncorrelated (Hooper et al. 2008:55; Tabachnick and Fidell 2007). "A value of CFI $\geq$ 0.95 is presently recognized as indicative of good fit" (Hooper et al. 2008:55; Hu and Bentler 1999).

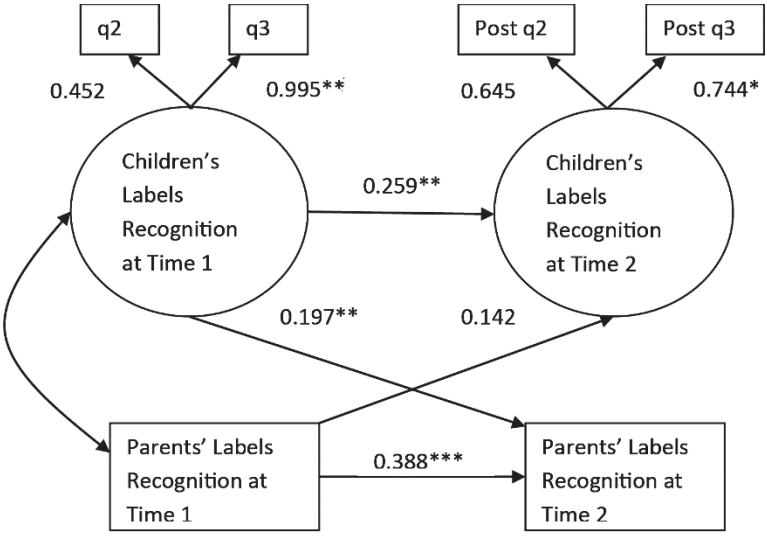
Chi-square tests were not significant and CFA values were greater than 0.95 in all models selected for the current study. The values of RMSEA were less than 0.08 in all models except for the model "Television" for the high-income group, in which case the RMSEA was 0.146.

Labels

The model "Labels" was analyzed for the total sample and for high- and low-income groups separately. The regression weights for the total sample are presented in Figure 1. The results demonstrate the presence of a significant and positive regression coefficient of Children's Labels Recognition at Time 2 on Children's Labels Recognition at Time 1 both in the total sample and for the high-income group. This indicates improved recognition of the "Eat Smart Play Hard" and "Be Strong dairy logo" labels by third-grade children in the high-income group from Time 1 to Time 2. The significant and positive regression coefficient of Parents' Labels Recognition at Time 2 on Parents' Labels Recognition at Time 1 indicates improvement of label recognition by parents from Time 1 to Time 2.

The regression coefficient of Parents' Labels Recognition at Time 2 on Children's Labels Recognition at Time 1 was significant and positive in the total sample. In the high-income group the level of significance of this coefficient was borderline ($p = 0.051$). That is, children's label recognition at Time 1 affects parents' label recognition at Time 2 in the high-income group; children received information about the labels in school and informed their parents. Thus, it is possible to conclude that information children receive in school leads to improvement of their awareness about the labels "Eat Smart Play Hard" and "Be Strong dairy logo," and that the information received by parents from their children and from the

Figure 1. Autoregressive Model "Labels" with Cross-lagged Effects



Notes: Definitions of q2, q3, Post q2, and Post q3 are given in Table 2 Parameter estimates are standardized
*$p <$ 05, **$p <$ 01, ***$p <$ 001

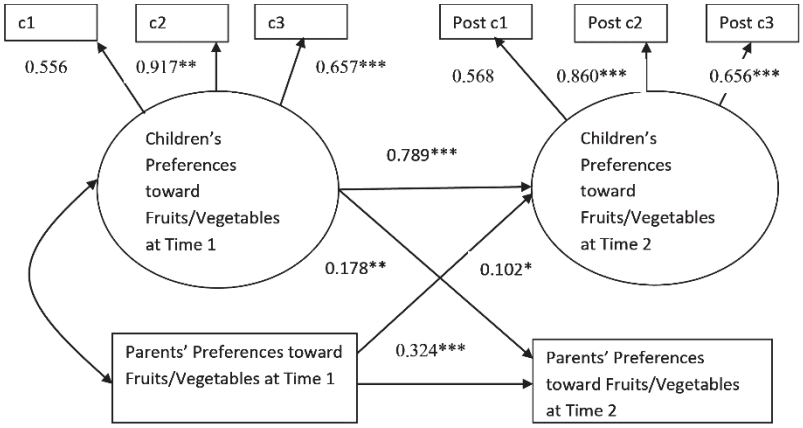
materials provided by the "Pick a better snack™ & Act" campaign leads to improved parental awareness about the campaign's labels.[1]

Fruits and Vegetables

The model "Fruits and Vegetables" with cross-lagged effects was analyzed for the total sample, for high- and low-income groups separately, and for boys and girls separately. The regression weights for the total sample are presented on Figure 2. The significant regression coefficient of Children's Preferences toward Fruits and Vegetables at Time 2 on Children's Preferences toward Fruits and Vegetables at Time 1 indicates an improvement in self-reported preferences toward eating fruits and vegetables by third-grade children from Time 1 to Time 2. The significant regression coefficient of Parents' Preferences toward Fruits and Vegetables at

[1] Constraining the cross-lagged effects to be zero makes it possible to identify the parameters in the model "Labels" with synchronous effects. However, the model "Labels" with synchronous effects does not fit the data well because the observed variable, Parent Labels T2, has a negative value of Pseudo R^2.

Figure 2. Autoregressive Model "Fruits and Vegetables" with Cross-lagged Effects



Notes: Definitions of c1, c2, c3, Post c1, Post c2, and Post c3 are given in Table 3 Parameter estimates are standardized

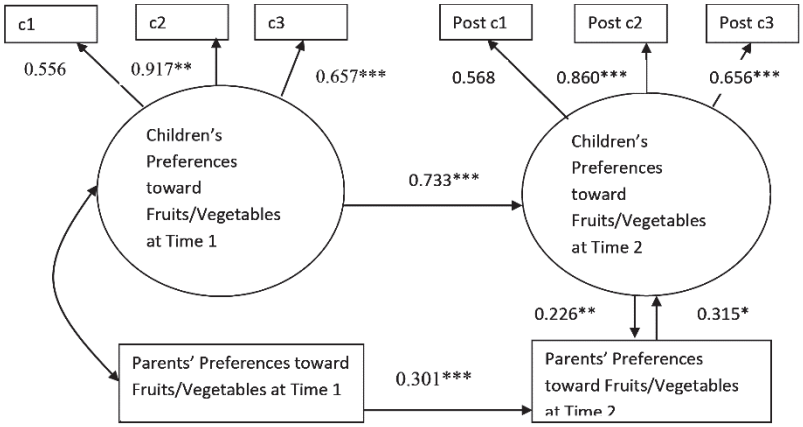
*p < 05, **p < 01, ***p < 001

Time 2 on Parents' Preferences toward Fruits and Vegetables at Time 1 indicates an improvement in parents providing fruits and vegetables from Time 1 to Time 2.

The regression coefficient of Parents' Preferences toward Fruits and Vegetables at Time 2 on Children's Preferences toward Fruits and Vegetables at Time 1 was significant in the total sample, for the low-income group, and for girls. This indicates children's preferences toward eating fruits and vegetables at Time 1 affects the provision of fruits and vegetables by parents at Time 2. The regression coefficient of Children's Preferences toward Fruits and Vegetables at Time 2 on Parents' Preferences toward Fruits and Vegetables at Time 1 was significant only in the total sample. Also, the *p*-value for this coefficient was 0.047, indicating a marginal level of significance. The results showed that the effect of children's preferences toward fruits and vegetables at Time 1 on parents' provision of these products at Time 2 was stronger than the opposite effect (parents' provision of fruits and vegetables at Time 1 on children's preferences toward fruits and vegetables at Time 2).

Constraining the cross-lagged effects to be zero makes it possible to identify the parameters in the model "Fruits and Vegetables" with synchronous effects (Figure 3) because models

Figure 3. Autoregressive Model "Fruits and Vegetables" with Synchronous Effects



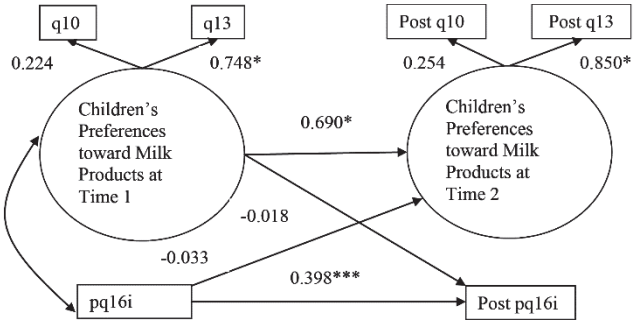
Notes: Definitions of c1, c2, c3, Post c1, Post c2, and Post c3 are given in Table 3 Parameter estimates are standardized

*p < 05, **p < 01, ***p < 001

that include both cross-lagged and synchronous effects present problems in identification. Identification determines whether it is theoretically possible to derive a unique estimate of every parameter in the model; model estimates may not converge if the model is not identified (Finkel 1995; Tabachnick and Fidell 2007).

The model "Fruits and Vegetables" with synchronous effects was analyzed for the total sample, for high- and low-income groups separately, and for boys and girls separately. The regression weights for the total sample are presented in Figure 3. The regression coefficient of Parents' Preferences toward Fruits and Vegetables at Time 2 on Children's Preferences toward Fruits and Vegetables at Time 2 was significant and positive in the total sample, for the low-income group, and for girls. This indicates children's preferences toward eating fruits and vegetables during Time 2 affects the provision of fruits and vegetables by parents to their children during Time 2. The regression coefficient of Child Fruits T2 on Parent Fruits T2 was significant only in the total sample and the result was of only marginal statistical significance ($p = 0.045$). This indicates that the provision of fruits and vegetables by parents at Time 2 slightly affects the children's preferences toward fruits and vegetables at Time 2.

Figure 4. Autoregressive Model "Yogurt and Milk" with Cross-lagged Effects



Notes: Definitions of q10, q13, Post q10, Post q13, pq16i, and Post pq16i are given in Table 2 Parameter estimates are standardized

*p < 05, **p < 01, ***p < 001

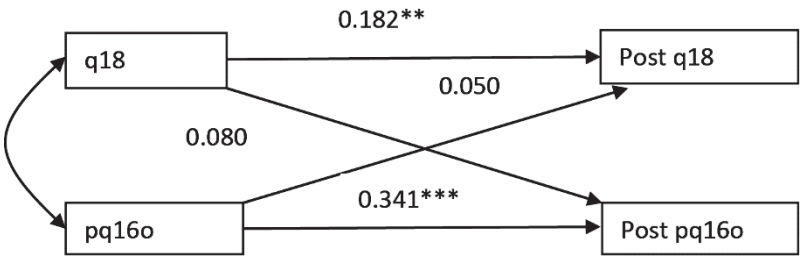
Yogurt and Milk

The model "Yogurt and Milk" with cross-lagged effect was analyzed for the total sample only. The regression weights are presented in Figure 4. The significant regression coefficient of Children's Preferences toward Milk Products at Time 2 on Children's Preferences toward Milk Products at Time 1 indicates increased frequency of eating yogurt and drinking milk by third-grade children from Time 1 to Time 2. The significant regression coefficient of Post pq16i on pq16i indicates improvement by parents in providing milk products from Time 1 to Time 2. The results of the analysis of the model "Yogurt and Milk" with synchronous effects were identical to the results of the analysis of the model "Yogurt and Milk" with cross-lagged effects. Neither model demonstrated reciprocal influence among children and parents concerning consumption of milk products.

Television

The model "Television" with cross-lagged effects was analyzed for the total sample and for high- and low-income groups separately. The regression weights for the total sample are presented in Figure 5. The regression coefficient of Post q18 on q18 was significant for the total sample and the high-income group. This indicates that children from the high-income group are more likely to say they are sure they can play outside instead of watching TV after school at

Figure 5. Autoregressive Model "Television" with Cross-lagged Effects



Notes: Definitions of q18, Post q18, pq16o, and Post pq16o are given in Table 2 Parameter estimates are standardized

*p < 05, **p < 01, ***p < 001

Time 2 than at Time 1. The significant regression coefficient for Post pq16o on pq16o indicates that parents are more likely to limit the time their children watch TV at Time 2 than during Time 1. There is no significant cross-lagged effect between Time 1 (children) and Time 2 (parents) and no cross-lagged effect between Time 1 (parents) and Time 2 (children).

Constraining the cross-lagged effects to be zero makes it possible to identify the parameters in the model "Television" with synchronous effects. The model "Television" with synchronous effects was analyzed for the total sample only. Results of the analysis were identical to results of the analysis of the same model with cross-lagged effects. The synchronous regression coefficients were not significant.

A logistic regression was used to predict the odds of children receiving a free or reduced-price lunch based on the age of their parents. Age of parents was a significant negative predictor of receiving a free or reduced-price lunch by children before and after the treatment. For every one unit increase in a parent's age, the odds of the child receiving a free or reduced-price lunch before the treatment decreased by 6.6%. Similarly, for every one-unit increase in a parent's age, the odds of a child receiving a free or reduced-price lunch after the treatment decreased by 5.8%.

Discussion

The third-grade children who participated in the current study learned about a healthy way of life from school lessons provided by

the BASICS program. Their parents received information about healthy foods and physical activities recommended for school-aged children through the "Pick a better snack™ & Act" campaign materials. Parents and children answered surveys before and after receiving this information. The results demonstrate improvement in recognition of the program's labels and materials, in preferences toward fruits, vegetables, and low-fat milk products by children, in parents' willingness to offer healthy food to their children, and in children's preferences toward physical activity and parents' support in this issue.

By analyzing numerous school-based programs designed to prevent childhood obesity, Sharma concluded that "Most interventions use a behavioral theory but do not measure the changes in constructs of that theory. Absence of such data prevents advancement of our understanding about what works and what does not" (2011:214S). The current study helps to fill this gap. Autoregressive models make it possible to reveal positive changes in health-related behaviors of participants after the program's intervention.

The first hypothesis, that information about healthy lifestyles the third-grade children received in schools positively influenced their health-related behaviors, and the second hypothesis, that participation in BASICS and exposure to the "Pick a better snack™ & Act" campaign positively influenced health-related behaviors of the parents, were confirmed by the autoregressive models. The first autoregressive model showed improvement of label recognition by the third-grade children and their parents. The improvement of label recognition by children was detected in the total sample and in the high-income group, but not in the low-income group. The second autoregressive model demonstrated increased preferences toward fruits and vegetables by the third-grade children and improvement of parents providing their children with fruits and vegetables after the end of the campaign cycle. These results indicate the campaign taught children and their parents that fruits and vegetables taste good and are beneficial for healthy eating.

The third autoregressive model demonstrates increased frequency of eating yogurt and drinking milk by the third-grade children and an improvement of parents providing their children

with milk products after learning about their health benefits from the campaign.

The fourth autoregressive model demonstrated increased children's confidence to be physically active instead of watching television in their free time. This effect was significant in the total sample and for the high-income group, but not in the low-income group. Better income provides the ability to attend athletic activities, buy sports equipment, and live in more prosperous neighborhoods where children are able to be physically active outside and be safe. Zhang et al. (2006) indicated that a neighborhood's socioeconomic status is very important for health and wellbeing, including being overweight and physical activity among children. Eagle et al. (2012) reported increased screen time and decreased physical activity as household income decreased. These results can provide part of the explanation for why children from the high-income group find it easier to be physically active after school than children from the low-income group. The fourth model also demonstrated that parents become more attentive in limiting the amount of television time by their children after receiving information from the campaign about the importance of physical activity for their children's health.

The third hypothesis, that children who attended the lessons provided by BASICS would positively influence the health-related behaviors of their parents, was confirmed by the autoregressive models. The cross-lagged causal effect showed that children's label recognition before learning this information in school influenced parents' label recognition after the program's implementation. This result indicates that children who had previously participated in nutrition education and were knowledgeable about the campaign provided their parents with information about the campaign labels.[2]

The cross-lagged causal effect showed children's preferences toward fruits and vegetables before implementation of the campaign's program led to improvement in providing them with these products by their parents at the end of the program's cycle. This result indicates that children who learn that they like to eat fruits and vegetables ask their parents to buy these foods. The

[2] BASICS can be provided to a variety of grade levels from kindergarten to upper-elementary. The community's BASICS contractor and the school determine which grades will participate.

autoregressive model with a synchronous effect demonstrated that children's preferences toward fruits and vegetables after they learned about the benefits of these foods in school positively influenced the likelihood of their parents providing them with these foods. The significant cross-lagged and synchronous effects were found in the total sample, in the low-income group, and for girls. The results that children from the low-income group and girls influenced their parents in providing them with fruits and vegetables, but children from the high-income group and boys did not demonstrate these effects coincide with existing literature. Haroldson et al. (2012) found that study participants who belonged to the low-income group reported that their children influenced the purchasing of foods at the supermarket, preparing family dinner, participating in family weekend activities, and increasing intake of fruits and vegetables. Wilson and Wood (2004:330) indicated that "female children were found to be more successful than male children in persuading parents to make purchase decisions."

The fourth hypothesis, that parents who received information provided through the nutrition education program and campaign materials would positively influence the health-related behaviors of their children, was confirmed in the model "Fruits and Vegetables" only. In this model parents' influence on children preferences toward fruits and vegetables was found in the total sample only. This effect was not found when the sample was divided by gender or income. The Iowa Nutrition Network intends to explore further strategies to directly affect parents of school-age children.

The first autoregressive model, "Labels," and the second autoregressive model, "Fruits and Vegetables," confirmed the SCT principle of reciprocal determinism by showing that the "Pick a better snack™ & Act" campaign helps construct a social environment in which children collectively learned new information in school, subsequently influencing their parents' health-related behaviors. In such situations, the social environment, which includes the campaign's instructors, teachers, and peers, influences children's health-related behaviors. At the same time, children have an effect on their social environment by influencing peers and parents.

Improvement in recognition of the program's labels and materials was found in the current study. The fact that participants recognized labels and materials of the educational program better

after the program intervention than they did before the program intervention indicates that they learned from the program. The content of the program's labels and materials is directed toward the improvement of health-related behaviors. Consequently, improved recognition of the program's materials indicated that improvement of health-related behaviors of the participants is related to the program intervention. However, the current study does not have a true control group. Future work will include a control group to help find evidence that the educational program caused improvement in health-related behaviors.

It should be recognized that self-report data were used for the analysis in the current study. Literature sources indicate that such data may vary from reality. For example, Granner and Evans (2012) mentioned that the results of their assessment of variables related to fruit and vegetable intake within a young adolescent population were based on self-report and may have been biased by recall or comprehension.

Free and reduced-price lunch eligibility is related to the socioeconomic status (SES) of the participants. By using the SCT as a theoretical guideline, which indicates "how to equip people with competencies, self-regulatory capabilities, and a resilient sense of efficacy that enables them to enhance their psychological well-being and personal accomplishments" (Bandura, 1988:299), the "Pick a better snack™ & Act" campaign helps children with low SES overcome barriers toward the improvement of health-related behaviors and become more confident in achieving their tasks. This is particularly important to public health departments that strive to reduce health disparities between SES groups.

The results of logistic regression showed that the children of older parents were less likely to receive free or reduced-price lunch. This indicates that with increasing parental age families became more stable financially, and consequently their children live in better economic conditions than do the children of younger parents.

In future studies, it will be helpful to use more detailed socio-demographic information about the children and their families to determine which social barriers prevent children and parents from improving health-related behaviors. This information can be used to build the evidence-base for efforts that will help families lead a healthy lifestyle.

Conclusion

Results showed the following differences based on income and gender:

- Evaluation of the model "Labels" showed improvement of label recognition by children in the high-income group, but not in the low-income group.
- The cross-lagged and synchronous effects results for the model "Fruits and Vegetables" showed that children in the low-income group and girls influenced their parents. These effects were not significant for the high-income group or for boys.
- The model "Television" showed increased children's confidence that they were able to be active physically instead of watching television in their free time in the high-income group, but not in the low-income group.

Previous research provides little evidence of the effectiveness of school-based health education programs on preventing obesity and on the importance of the assessment of their work for supporting broader implementation of successful programs (Veugelers and Fitzgerald 2005; Katz 2009; Inman et al. 2011). According to Inman et al. (2011:214), "Despite the importance of obesity prevention, there is currently a lack of evidence-based programs available for implementation. Given the substantial long-term consequences of obesity, future research will need to address this pressing need." Current research helps to fill this gap in the literature. This study showed practical application of a nutritional education program, which lead to improvement of children's preferences toward healthy foods and physical activity, and attentiveness toward these issues by their parents. According to the SCT principle of reciprocal determinism, reciprocal influence in health-related behaviors between parents and children was found in the current study. These findings provide the possibility to recommend broader implementation of educational programs for health promotion and the prevention of children becoming overweight or obese.

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