Evaluation of Supplemental Nutrition Assistance Program Education: Application of Behavioral Theory and Survey Validation

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ABSTRACT

Objective: Application of the Transtheoretical Model (TTM) to Supplemental Nutrition Assistance Program Education (SNAP-Ed) evaluation and development and validation of an evaluation tool used to measure TTM constructs is described.

Methods: Surveys were collected from parents of children receiving food at Summer Food Service Program sites prior to SNAP-Ed participation.

Results: Item analysis of survey data (n = 149) suggests the survey is valid and reliable. Structural Equation Modeling confirmed the use of the TTM constructs in predicting SNAP-Ed participants’ fruit and vegetable consumption. Perceived barriers (P = .04) and self-efficacy (P = .006) were associated with fruit and vegetable consumption, whereas perceived benefits were not.

Conclusions and Implications: Application of theory and survey validation can enhance SNAP-Ed evaluation.

Key Words: Transtheoretical Model, Supplemental Nutrition Assistance Program, Supplemental Nutrition Assistance Program Education (J Nutr Educ Behav. 2012;44:360-364.)

INTRODUCTION

The aim of the Supplemental Nutrition Assistance Program (SNAP), which operates through the Food and Nutrition Services (FNS) of the United States Department of Agriculture (USDA), is to give individuals with low incomes access to food and, through education programs known as Supplemental Nutrition Assistance Program Education (SNAP-Ed), encourage low-income individuals to adopt healthful eating habits.1 In 2009, national participation in SNAP was at nearly 38 million people, an increase of over 22% from 1 year prior.2 The increase in participation has driven program costs up considerably. Federal spending on SNAP has increased from $37 billion in 2008 to over $50 billion in 2009.4 As expenses continue to rise, the need to demonstrate that SNAP-Ed is reaching its stated goals becomes more evident.

The effectiveness of SNAP-Ed projects, run through state-level organizations, is of particular interest with regard to evaluation needs. The SNAP-Ed program is a voluntary component of SNAP participation in which educational messages on dietary quality, food safety, and food resource management are delivered to low-income individuals. A 2004 report compiled by the US General Accounting Office concluded that data used to evaluate trends in the USDA’s nutrition education efforts, such as SNAP-Ed, were not clearly associated with any particular program and that more effort was needed to determine whether behavior change in the targeted population is influenced by education or other factors.4

To address concerns about evaluation of SNAP-Ed, FNS and state-level SNAP-Ed leaders have collaborated with the Society for Nutrition Education and Behavior to identify specific evaluation needs of SNAP-Ed programs and to determine the best strategies to meet these evaluation needs.5 As part of this collaborative work, Guthrie et al have reported on 2 strategies that can enhance SNAP-Ed evaluations: identification of an appropriate theoretical model of behavior change and construction of measurement instruments that can be universally used as a program evaluation tool for SNAP-Ed initiatives.5

A prescribed theory-based evaluation model and/or measurement instrument that fits all SNAP-Ed projects may be challenging to develop. State agencies have a great deal of flexibility in how SNAP-Ed can be delivered.6 Approximately 98% of implementing agencies include direct education in their SNAP-Ed projects, delivered by nutrition educators who work for or are contracted by the agency. Although most SNAP-Ed nutrition educators use FNS materials for nutrition education, some develop their own or use a wide variety of other resources.7 These materials are likely addressing a variety of behavioral determinants from several theories, which demands individualized evaluation plans. However, most SNAP-Ed implementing agencies do not feel they have
a reliable evaluation model in place, believe it would be difficult to design an evaluation instrument, and do not feel they have sufficient resources for evaluation efforts. Moreover, practitioners delivering the education bring “real world” concerns about evaluation of SNAP-Ed projects. As Taylor-Powell cautions, educators may be skeptical or uncomfortable with the complex inquiry into the particulars of their programs.

Considering the issues surrounding rigorous and consistent SNAP-Ed evaluation, taking into account steps to addressing practitioners’ concerns about evaluation, and making use of suggested methodologies for SNAP-Ed evaluation, the preliminary steps of a program-specific evaluation model, grounded in behavioral theory and supported by validated measurement, were tested in this study. The evaluation model was incorporated into the SNAP-Ed program, Just Say Yes to Fruits and Vegetables, run by the New York State Department of Health in collaboration with the Regional Food Bank of Northeastern New York. The program follows the national SNAP-Ed guidelines to provide education to low-income individuals on how to plan, buy, and prepare healthy meals that include fruits and vegetables; the program also reports analyses of behavioral mediators to FNS as measures of program outcomes. The program received FNS approval to offer education to parents at Summer Food Service Program (SFSP) sites in 2008.

As this was a new audience and setting for the program, a needs assessment was conducted for SFSP sites in New York State. The results of the needs assessment suggested that the curriculum should focus on specific constructs from the Transtheoretical Model (TTM), which includes decisional balance (the relative significance placed on perceived benefits and barriers of behavior change) and self-efficacy (confidence one has in his or her ability to change). Specifically, perceived benefits and barriers of eating fruits and vegetables and self-efficacy regarding eating more fruits and vegetables were issues identified as facilitators or inhibitors of eating fruits and vegetables through focus groups with parents at the SFSP sites. Additionally, associations have been found between these constructs and behavioral change in similar studies of SNAP-Ed programs.

In this study, the psychometric properties of a survey designed to evaluate TTM mediators of behavior change were first examined. Additional processes of change and other constructs from the TTM were not included, as these were not identified in the formative research or feasible to include. Data collected with this survey were then used to assess the application of the TTM to evaluation of this program.

METHODS
Participants and Recruitment
Nine SFSP sites were selected for the study. As there are a limited number of sites where parents accompany children, the sites were selected through convenience sampling to ensure enough parents were surveyed. During the first week of operation at each site, parents were asked whether they would participate in a nutrition education workshop while their children ate lunch. Before the workshop began, participants were asked to complete the pilot survey. As an incentive, participants were given a small gift that cost less than $4. The survey and evaluation study were given exemption by the New York State Department of Health Institutional Review Board.

The structural equation models (SEM) used in the analysis included at least 3 indicators for each factor; therefore, a minimum of 100 participants was needed to prevent nonconvergence and improper solutions. Of 165 surveys collected, 149 were included in the analysis. Surveys with at least 1 missing value were excluded (n = 16). Most participants were female (91%), non-Hispanic (91%), and between the ages of 18 and 38 years (56%) or 39 and 59 years (46%). Also, the majority of participants identified themselves as white (59%) or black/African American (28%).

Measures
Items used to measure behavioral constructs were selected from the literature that assessed these constructs in similar populations. Simplicity of administration and easy comprehension by low-literacy audiences, concerns cited in reviews of SNAP evaluation tools, were considered in the construction of the questionnaire. Items used in the questionnaire were presented in an easy-to-read format found to be appropriate in low-literacy populations.

Items were selected from decisional balance scales that measured low-income individuals’ perceived benefits and barriers to eating fruits and vegetables. Three items were selected to measure benefits and 3 were selected to measure barriers. Participants were asked how much they agree with each item. A 4-point response scale was used, with response options of “I disagree a lot,” “I disagree a little,” “I agree a little,” and “I agree a lot.” The items used to measure participants’ self-efficacy were also selected from the TTM literature and used the same 4-point agreement responses.

To test the hypothesized linkage between the TTM mediators and dietary behavior, the Food Stamp Program Fruit and Vegetable Checklist (FVC) was used to measure behaviors related to fruit and vegetable consumption. The behaviors measured by the FVC—frequency of consuming fruits and vegetables as snacks, servings consumed each day and the frequency of eating a variety of fruits and vegetables—have been validated by recall and blood serum data in studies of SNAP-eligible persons as measures of behaviors related to fruit and vegetable consumption.

All questions used are displayed in the Table.

Data Analysis
Item analysis and tests for internal consistency were conducted using SPSS (version 18.0, SPSS Inc., Chicago, IL, 2009). The ratio of each item’s mean to its maximum score was used to generate an item difficulty index, which reflects the proportion of participants who answered each item in the desired direction. To allow for variation in scores, it is preferred to have difficulty values between 0.2 and 0.8. Item-total correlation statistics were used to generate an item
discrimination index. Internal consistency was assessed using Cronbach \( \alpha \). Next, a multivariate measurement model was assessed using maximum likelihood solutions (AMOS; version 7.0, SPSS Inc., Chicago, IL, 2006). Reliability estimates were generated for each item using squared multiple correlation values, and factor loadings were assessed. Finally, a full latent variable structural model was assessed in AMOS to determine the relative contribution of each TTM domain in predicting fruit and vegetable consumption behavior. Indices used to assess the measurement and structural model fit were: chi-square, root mean square error of approximation, traditional goodness of fit indices (GFI) and the comparative fit index (CFI).

**RESULTS**

**Item Analysis and Internal Consistency**

The Table lists the item difficulty and item discrimination values for each survey item, as well as the Cronbach \( \alpha \) for each domain subscale. The scales for perceived benefits, self-efficacy, and the FVC each satisfied the recommended \( \alpha \) value of .70,\(^{18}\) whereas the perceived barriers scale met the minimally acceptable \( \alpha \) level of .60.\(^9\) All items included in the scale have sufficient item-total correlation values (≥ 0.40) and removal of any item would reduce the scale’s \( \alpha \) value. Only 1 item in the perceived barriers scale had an item difficulty value within the recommended range of 0.2 to 0.8.\(^9\)

**Measurement and Structural Model Assessment**

Before the predictive values of perceived benefits, perceived barriers, and self-efficacy were assessed, the measurement model for these 3 TTM constructs was examined using SEM. The overall chi-square test of model

<table>
<thead>
<tr>
<th>Survey Item</th>
<th>Item Difficulty(^{a})</th>
<th>Item Discrimination(^{b})</th>
<th>Reliability Estimate(^{c})</th>
<th>Factor Loading(^{d})</th>
<th>Cronbach ( \alpha ) for Scale</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Perceived benefits(^{c})</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Eating fruits and vegetables with my family adds variety to what we eat.</td>
<td>.93</td>
<td>.48</td>
<td>.66</td>
<td>.58</td>
<td>.70</td>
</tr>
<tr>
<td>I would feel better if I ate more fruits and vegetables with my family.</td>
<td>.90</td>
<td>.55</td>
<td>.49</td>
<td>.70</td>
<td></td>
</tr>
<tr>
<td>By serving more fruits and vegetables at family meals, my family and I would learn which ones we like and which ones we do not like.</td>
<td>.90</td>
<td>.53</td>
<td>.50</td>
<td>.71</td>
<td>.60</td>
</tr>
<tr>
<td><strong>Perceived barriers</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>My family and I do not eat more fruits and vegetables because I do not know how to prepare them.</td>
<td>.89</td>
<td>.49</td>
<td>.53</td>
<td>.69</td>
<td></td>
</tr>
<tr>
<td>It is difficult to find fruits and vegetables the whole family likes.</td>
<td>.66</td>
<td>.40</td>
<td>.68</td>
<td>.57</td>
<td></td>
</tr>
<tr>
<td>It takes too much time to prepare fruits and vegetables.</td>
<td>.89</td>
<td>.40</td>
<td>.69</td>
<td>.56</td>
<td></td>
</tr>
<tr>
<td><strong>Self-efficacy(^{c})</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>I feel I can keep fruits and vegetables available at home.</td>
<td>.92</td>
<td>.67</td>
<td>.49</td>
<td>.72</td>
<td></td>
</tr>
<tr>
<td>I feel I can eat the suggested number of servings of fruits and vegetables.</td>
<td>.83</td>
<td>.73</td>
<td>.37</td>
<td>.80</td>
<td></td>
</tr>
<tr>
<td>I feel I can shop for a variety of fruits and vegetables.</td>
<td>.91</td>
<td>.69</td>
<td>.41</td>
<td>.77</td>
<td></td>
</tr>
<tr>
<td>I feel I can make time to eat more fruits and vegetables.</td>
<td>.92</td>
<td>.71</td>
<td>.38</td>
<td>.78</td>
<td></td>
</tr>
<tr>
<td>I feel I can include fruits and vegetables in every meal I eat at home with my family.</td>
<td>.88</td>
<td>.69</td>
<td>.47</td>
<td>.73</td>
<td>.87</td>
</tr>
<tr>
<td><strong>Food Stamp Program Fruit and Vegetable Checklist</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Do you eat fruits and vegetables as snacks?</td>
<td>.68</td>
<td>.59</td>
<td>.55</td>
<td>.67</td>
<td></td>
</tr>
<tr>
<td>How many servings of fruit do you eat each day?</td>
<td>—</td>
<td>.64</td>
<td>.59</td>
<td>.64</td>
<td></td>
</tr>
<tr>
<td>Do you eat more than one kind of fruit each day?</td>
<td>.61</td>
<td>.78</td>
<td>.23</td>
<td>.88</td>
<td></td>
</tr>
<tr>
<td>Do you eat more than one kind of vegetable each day?</td>
<td>.64</td>
<td>.70</td>
<td>.48</td>
<td>.72</td>
<td></td>
</tr>
<tr>
<td>How many servings of vegetables do you eat each day?</td>
<td>—</td>
<td>.83</td>
<td>.69</td>
<td>.55</td>
<td></td>
</tr>
<tr>
<td>Do you eat 2 or more vegetables at your main meal?</td>
<td>.58</td>
<td>.71</td>
<td>.52</td>
<td>.70</td>
<td></td>
</tr>
</tbody>
</table>

SEM indicates Structural Equation Model.  
\(^{a}\)Item difficulty scores were generated by dividing the mean value of the responses to the item by 4 (the maximum value possible on a 4-item agree/disagree scale). Items that ask about servings consumed per day do not have a true “maximum value”; therefore, a difficulty value was not included for these 2 items; \(^{b}\)Value derived from item-total correlation; \(^{c}\)Value derived from SEM squared multiple correlations results (1 – \(r^2\)); \(^{d}\)Value derived from SEM standardized regression weights; \(^{c}\)Response options and response scores included: “I disagree a lot” (1), “I disagree a little” (2), “I agree a little” (3), and “I agree a lot” (4). Scores were reversed for perceived cons, as disagreement with the statement is considered positive.
fit was nonsignificant ($\chi^2 \ [41] = 55.10, P = .06$). The traditional GFI was .94. The root mean square error of approximation was 0.05, with 90% confidence intervals of > 0.001 to 0.08. The $P$ value for test of close fit was .50. The CFI was .97. The consistency of these fit indices suggests a good fitting model.

Perceived benefits, perceived barriers, and self-efficacy were each placed in the structural model as exogenous latent variables, along with their respective indicators. The model assessed how well these variables regressed onto a latent endogenous variable constructed by the indicators on the FVC. Thus, the model provided information on how well the constructs of interest from the TTM predict fruit and vegetable consumption behavior. The chi-square test of model fit was significant ($\chi^2 \ [107] = 142.43, P = .01$); however, all other indices suggest a good fitting model. The traditional GFI was .90. The root mean square error of approximation was 0.05, with 90% confidence intervals of > 0.02 to 0.07. The $P$ value for test of close fit was .57. The CFI was .97. Holding all other variables in the model constant and adjusting for measurement error, it was found that with every unit change in perceived barriers, fruit and vegetable consumption behavior scores decreased by 0.46 units ($P = .05$) and for every unit change in self-efficacy, fruit and vegetable consumption behavior scores increased by 0.62 units ($P = .006$). The regression weight for perceived benefits was not found to be statistically significant. Overall, the TTM variables accounted for 40% of the variance in behaviors related to fruit and vegetable consumption. The parameter estimates for the SEM models are presented in the Table.

**DISCUSSION**

There have been few published examples of studies that apply evaluation recommendations from SNAP-Ed stakeholders to specific SNAP-Ed projects. The current study demonstrates how the application of theory and survey validation can enhance the evaluation of SNAP-Ed projects.

Using needs assessment data that matched the domains highlighted in the needs assessment, a survey instrument was developed to assess the underlying program theory. Psychometric evaluation of the survey found it to have reasonable levels of internal consistency and construct validity. The perceived barriers subscale had moderately low internal consistency; however, with only 3 items included in the scale (for simplicity of administration), this result may be expected. As can be seen in the item difficulty index, the low internal consistency for this scale was largely the result of 1 question—regarding finding fruits and vegetables the whole family likes—that had a greater variety in responses. This was perceived as a barrier by more people than the other barriers considered. Adding questions about additional difficulties would likely increase the internal consistency of the scale. Overall, the measurement model shows support for each scale's unidimensionality. Each indicator has a fairly high factor loading for its corresponding latent variable, and most indicators have moderate reliability estimates. Thus, it appears the TTM domains of interest are validly measured using the survey.

Moreover, results from the model fit assessment suggest that the theoretical framework applied is appropriate and the domains in the model explained a fair amount of the variance in fruit and vegetable consumption. The chi-square test of the structural model was significant; however, use of Likert-like ordinal scales in SEM may inflate the chi-square statistic. All other fit indices suggested a good fitting model. An association was not found between perceived benefits of eating fruits and vegetables and consumption behaviors, whereas there is a significant association between perceived barriers and self-efficacy and consumption behaviors. This pattern has been noted elsewhere, which emphasizes the importance of recognizing appropriate determinants to target with SNAP-Ed. Although public awareness of the benefits of fruits and vegetables has increased in the past 2 decades, most Americans do not consume the recommended amounts of either fruits or vegetables. To see change in SNAP participants, it is necessary to reassess what SNAP-Ed activities motivate behavior change. In this sample of SNAP-Ed participants, addressing barriers, such as finding fruits and vegetables the whole family enjoys, and improving self-efficacy are more likely to promote change than efforts to improve perceptions of the nutritional benefits of fruits and vegetables. Building SNAP-Ed program theory around this information has the potential to improve dietary choices made by SNAP participants.

**Limitations**

Although the results of this study provide valuable information on developing tools to evaluate a SNAP-Ed program, there are limitations to consider. First, efforts to make the survey simple to administer did not allow for collection of data related to TTM, outside of what matched formative research. Associations between TTM constructs and participants’ processes of changes and stage of change may be found with a more thorough study design. Additionally, difficulty scores for all but 1 of the variables were above the acceptable range of 0.80, which does not allow for much improvement on most of the measured variables. Adding questions to the survey may address these concerns; however, doing so will also add to the participant and program staff burden. Finding a balance between these 2 issues is a challenge that each SNAP-Ed program must address.

Another concern is that few males and Hispanics were included in this study. Thus, the external validity of the findings is limited, which is a consequence of convenience sampling. Likewise, as no information about those who chose not to complete a survey is available, the effects of a selection bias are unknown. Future studies should apply random sampling or oversampling of certain demographic groups. Additionally, as follow-up data were not included in this study, no information was provided about the evaluation tool’s sensitivity to change in longitudinal assessment. Repeated measures should be considered in future studies, using an experimental design.

Limitations notwithstanding, the results of this study provide SNAP-Ed researchers and practitioners with information on how to develop validated tools to assess the relative
contribution of constructs from behavioral theory in their own programs. The authors encourage SNAP-Ed evaluators to use the results of this study in a comprehensive, strategic plan to build “evaluation capacity,” which may increase the frequency of rigorous evaluation.20

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REFERENCES


