# Self-Regulation, Self-Efficacy, Outcome Expectations, and Social Support: Social Cognitive Theory and Nutrition Behavior

**Eileen S. Anderson, Ed.D., Richard A. Winett, Ph.D., and Janet R. Wojcik, Ph.D.**
Virginia Polytechnic Institute and State University

## ABSTRACT

***Background:*** *Understanding the need for and accessibility to healthier foods have not improved the overall diets of the U.S. population. Social cognitive theory (SCT) may explain how other variables, such as self-regulation and self-efficacy, may be key to integrating healthier nutrition into U.S. lifestyles.* ***Purpose:*** *To determine how SCT accounts for the nutritional content of food purchases and consumption among adults in a health promotion study.* ***Methods:*** *Participants were 712 churchgoers (18% African American, 66% female, 79% overweight or obese) from 14 churches in southwestern Virginia participating in the baseline phase of a larger health promotion study. Data were collected on the nutrition related social support, self-efficacy, outcome expectations, and self-regulation components of SCT, as well as on the fat, fiber, fruit, and vegetable content of food-shopping receipts and food frequency questionnaires. These data were used to test the fit of models ordered as prescribed by SCT and subjected to structural equation analysis.* ***Results:*** *SCT provided a good fit to the data explaining 35%, 52%, and 59% of observed variance in percent calories from fat, fiber g/1000 kcals and fruit and vegetable servings/1000 kcals. Participants' age, gender, socioeconomic status, social support, self-efficacy, negative outcome expectations, and self-regulation made important contributions to their nutrition behavior—a configuration of influences consistent with SCT.* ***Conclusions:*** *These results suggest a pivotal role for self-regulatory behavior in the healthier food choices of adults. Interventions effective at garnering family support, increasing nutrition related self-efficacy, and overcoming negative outcome expectations should be more successful at helping adults enact the self-regulatory behaviors essential to buying and eating healthier foods.*

Janet R. Wojcik is now at the Department of Health and Physical Education, Winthrop University.

The study conducted at the Center for Research in Health Behavior, Department of Psychology, Virginia Tech, Blacksburg, was supported by a grant from the National Cancer Institute (RO1CA79469). The trial is registered in the National Cancer Institute's PDQ trial registry (VPISU-05-209).

*Reprint Address*: E. S. Anderson, Ed.D., CRHB (Mail Code 0274), Department of Psychology, Virginia Tech, Blacksburg, VA 24061. E-mail: eileen@vt.edu



(**Ann Behav Med** 2007, *34*(3):304–312)

## INTRODUCTION

People living in the United States are generally aware that body weight contributes to chronic illnesses such as diabetes and high blood pressure with growing understanding of dietary recommendations (e.g., controlling portion sizes and eating more fruits and vegetables) to prevent these and other diseases (1,2). Despite the recent proliferation in the United States of fat modified foods, lower prices for fruits and vegetables (i.e., about 25 cents per serving (3)), and decreasing prices for whole-grain products compared to non-whole-grain products (4), the overall diets of most of the U.S. population may be worsening. Although, for example, "88% of U.S. households had access, at all times, to enough food for an active, healthy life for all household members" (5, p. 3), fruit and vegetable consumption is declining and fat (6,7) and calorie consumption (8) is increasing. Convenience foods, pricing strategies, agricultural policies, and increases in typical U.S. portion sizes (9–12) contribute to what has been described as a "toxic environment" (13) requiring considerable vigilance and conscious effort for individuals to maintain a healthy diet (14). When armed with necessary knowledge, skills, and confidence, self-regulation enables people to make changes in the face of less than ideal circumstances (15). This suggests that a better understanding and harnessing of the presumed psychosocial determinants of monitoring and maintaining a healthy diet will be key to constructing more effective dietary interventions (15,16).

### Social Cognitive Theory, Self-Regulation, and Nutrition Behavior

Bandura's social cognitive theory (SCT) delineates the presumed sources and mediators of behavior and behavior change (15).

*Self-efficacy.* Bandura posited that when behavior change requires regular performance of familiar behaviors, self-regulatory efficacy supersedes performance self-efficacy. With the growing proliferation of good-tasting and affordable lower fat foods, fruits and vegetables, and whole grain foods, individuals' confidence in their abilities to buy and prepare healthier foods becomes less important to establishing a healthy diet. Instead, individuals' confidence in their abilities to get themselves to make healthy food choices on a daily basis even when it is difficult will determine to a large extent one's success in achieving healthy nutritional balance (15, p. 64). In previous research, self-efficacy has been associated with healthy nutrition patterns (15 [especially chap. 7], 17–19).

*Social support.* The perceived support for healthy eating from important others, such as family and friends (a precursor to self-efficacy in SCT), has been associated with better nutrition behaviors in previous studies (20,21). Social support, however, has not been studied in the context of other psychosocial variables, as is needed for understanding how this environmental variable influences behavior.

*Outcome expectations.* Social, physical, and self-evaluative outcomes expected of behavior are dependent on the individuals' efficacy beliefs and serve as incentives (or disincentives) for healthier food choices (15). Anderson et al. (17,18) found outcome expectations, especially those related to satisfaction with the cost and taste of healthier foods, could contribute beyond self-efficacy to the understanding the nutrition behavior of a diverse sample of supermarket shoppers.

*Self-regulation.* Within SCT, self-efficacy and outcome expectations are posited to influence behavior directly and through the development and use of self-regulatory behaviors (15). Among people who desire a healthy diet and who have access to healthy foods, the content their diets will be determined largely by how well they set goals, plan, and monitor—self-regulate—what they buy and eat. Outside the obesity and weight management research literatures, self-regulation of nutrition has received scant attention and has often been poorly defined (22). Nevertheless, self-regulatory behavior (especially goal setting) has been associated with healthier eating (23) and with promoting healthier fat, fiber, and fruit and vegetable intake in adults (23–27).

In addition to delineating the variables essential to healthy nutritional balance, SCT specifies how these variables relate to each other (15,28). Self-efficacy (which stems from personal variables including, among others, the individual's age, gender, and socioeconomic status [SES], and from environmental variables including social support [15, p. 416]) is the preeminent social cognitive determinant of consistent healthful eating. Stronger efficacy beliefs lead individuals to expect to reap the benefits and avoid the difficulties associated with healthy nutrition. Individuals with higher self-efficacy and more favorable outcome expectations will ultimately be more likely to implement the self-regulatory strategies essential to adopting and maintaining healthier eating patterns (15,28).

The purpose of the study presented here was to model (according to SCT) baseline data from a diverse group of adults recruited for a large health promotion trial, modeled to explore how and to what extent social support, self-efficacy, outcome expectations and especially self-regulation influenced their nutrition behavior, ultimately, to uncover potential approaches to nutrition behavior change in similar samples (29).

## METHOD

Participants were enrolled in a larger research project designed to test the effectiveness of a health promotion intervention that was conducted in 14 Baptist and United Methodist churches (including three Baptist churches with predominantly African American congregations) in southwestern Virginia. Of an estimated 2,454 adult members (60–340 per church) who regularly attended these churches (i.e., one or more times per month), about half ($n = 1{,}194$) expressed interest in participating in the study, 60% (712) of whom completed baseline nutrition assessments and contributed data to our study. No interested church member was excluded from the study. Data collected included psychosocial questionnaires, Block Food Frequency Questionnaires (FFQ [29]) and family food shopping receipts. Psychosocial questionnaires were collected 10 to 14 days prior to FFQ data and prior to the 6-week receipt data-collection period. Participants received a $20 honorarium for completing these assessments and up to $30/family for submitting annotated food-shopping receipts. The participants were 66% female and 18% African American with ages ranging from 18 to 92 ($M = 53.54$, $SD = 14.37$). Participants reported a median annual household income of about $50,000 and a mean of 14.93 years of education ($SD = 5.1$). Nine percent reported incomes of $20,000 or less, and 19% reported 12 or fewer years of education, 64% lived in households with no children younger than 18 years of age, 79% were classified as overweight (body mass index $\geq 24$ and $< 30$, 43%) or obese (body mass index $\geq 30$, 36%).

### Measures

*Social cognitive variables.* The Food Beliefs Survey shown to be reliable and valid in previous research (17,18) was refined and piloted with 158 members of two church congregations. This yielded measures of nutrition related family social support, self-efficacy, outcome expectations, and self-regulation that correlated ($p < .01$) with nutrition behavior in the pilot and baseline samples. Principal axis factor analysis (oblique rotation) was used to generate factor-based scales for the SCT variables, these are described in Table 1 (pattern matrixes and interfactor correlations from factor analyses are available from Eileen

TABLE 1
Social Cognitive Measures: Scale Descriptions and Internal Consistency Estimates

| *Social Cognitive Variable* | *Description* | *Subscale* | *No. of Items* | *α* |
|---|---|---|---|---|
| Social support | Perceived support from family for eating healthier eating | Lower fat foods | 8 | .89 |
| | | Fiber, fruits and vegetables | 7 | .88 |
| Self-regulatory efficacy | Certainty of performance of behaviors to improve nutrition, across time and situations | Increase fiber, fruits and vegetable intake | 12 | .90 |
| | | Decreasing fat intake | 12 | .89 |
| | | Reducing sugar intake | 5 | .76 |
| Positive outcome expectations | Expectations of positive physical and self-evaluative outcomes | | 7 | .89 |
| Negative outcome expectations | Expectations of negative physical, social, and self-evaluative outcomes | | 6 | .87 |
| Self-regulaztion | Use in past 3 months of self-regulatory behaviors | Planning and tracking | 8 | .91 |
| | | Regulate calories and fat | 13 | .90 |
| | | Regulate fiber, fruit and vegetable intake | 3 | .85 |

*Note*. $\alpha$ = Cronbach's alpha coefficient of internal consistency.

Anderson). Responses to items within each scale were averaged to form the scale scores used to measure social support, self-efficacy, and self-regulation in the structural model. Factor analysis of outcome expectation items yielded two weakly correlated factors (factor correlation = .18). *Negative outcome expectations* included items reflecting negative physical outcomes (i.e., immediate sensory experiences such as taste), social outcomes (i.e., devoting too much time and energy to nutritional goals), and self-evaluative outcomes (i.e., emotional responses to change). *Positive outcome expectations* reflected positive physical outcomes (i.e., better fit of clothing, losing weight, and healthier appearance) and longer term expectations that tended to be more self-evaluative in nature (i.e., feeling better, living longer, and having better health). Latent positive and negative outcome expectation variables were modeled separately with individual items serving as their indicators.

*Nutrition behavior.* Nutrition behavior was measured with family food-shopping receipts and with the FFQ (29). Food-shopping receipts were annotated by the family's designee and specified the brand, type (low fat, whole grain, canned or frozen, etc.), and package size of each food item on the receipt. Compliance with receipt annotation was high, more than 90%, across families. Receipts spanned an average of 48 days and 123 food items analyzed following procedures used in prior research (17,18,30,31). Values for percentage kcals from fat, fiber g/1000 kcals, and fruits and vegetable servings/1000 kcals were gleaned from each measure. Fiber grams and servings of fruit and vegetable were evaluated per 1000 kcals to provide a standard unit of measure across instruments (17,18). Receipt and FFQ measures were used as indicators of latent fat, fiber, and fruits and vegetables in the structural equation modeling (SEM) analyses.

*Demographic variables*. Participants' responses to paper-and-pencil questionnaires were used to measure age (reported in whole years), gender (female = 0, male = 1), education (years completed), income level (1 = $10,000 or less per year to 10 = greater than $90,000), and occupation (coded based on Duncan's system [32] ranging from 0 = *no paid job or profession indicated* to 13 = *school teacher*). Education, income, and occupational status were used as measures of the latent SES variable.

*SCT-based causal ordering.* Three causal models were developed following Bandura's specifications (15,28; one each for fat, fiber, and fruits and vegetables). Within each model, person variables (age, gender, SES) preceded social cognitive variables. Within the social cognitive variables social support (e.g., modeling of healthy behavior by family members) was a source of self-efficacy and other SCT variables. Efficacy beliefs influenced the outcomes expected from behavior, and self-efficacy and outcome expectations influenced the extent to which individuals engaged in goal setting, self-monitoring, and other regulatory behaviors. Although the model presented here is fully recursive, Bandura suggested the magnitude of some of the modeled relations (Figure 1) might fluctuate across behaviors. Outcome expectations, for example, may not contribute to behavior when self-efficacy is controlled to the extent that outcomes flow from the performance of the behavior (15, p. 24). On the other hand, even though an individual's use of self-regulation strategies is determined by self-efficacy and other SCT variables, self-regulation is expected to contribute independently to behavior. Finally, although SCT does not preclude social support from influencing behavior directly or through outcome expectations and self-regulatory behaviors (as modeled here), Bandura suggested for some health behaviors (i.e., physical activity)

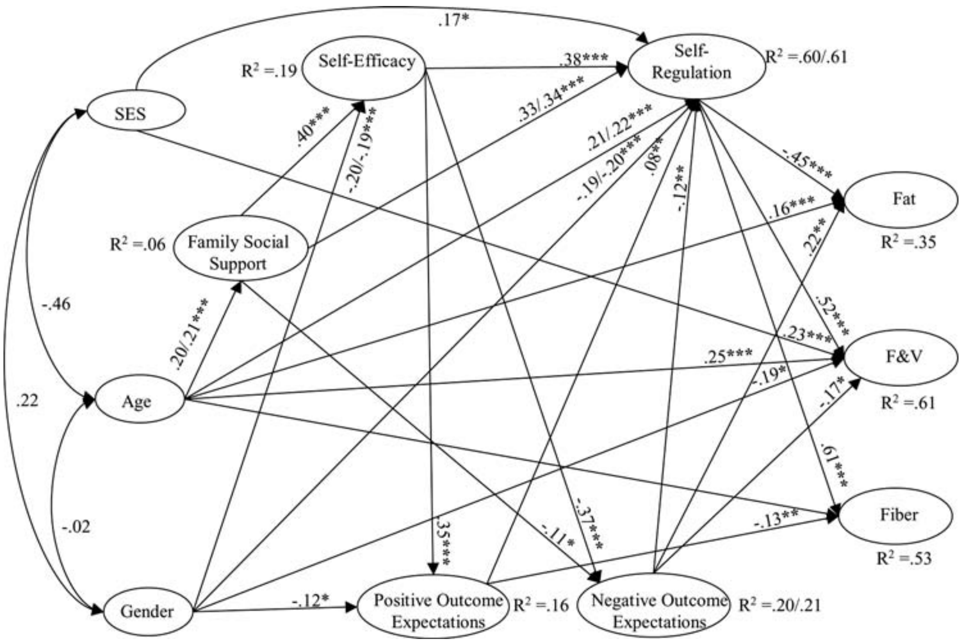


FIGURE 1 Completely standardized significant direct effects. *Note*. When parameter coefficients in the fat model differed from those in the fiber and fruit and vegetable models, the fat parameters are reported to the left of the slash (/). $^{*}p < .05$. $^{**}p < .01$. $^{***}p < .001$.

social support influences behavior through self-efficacy rather than directly (15).

### Data Analysis

Latent-variable SEM (LISREL 8.8, 33) was used to test the fit of the social cognitive model to fat, fiber, and fruit and vegetable data (modeled separately). No measure was assumed error free, so for the latent variables age and gender the error term was set to the measure's variance times estimated error. To make full use of the available data, full information maximum likelihood estimation (FIML) was used. Fit of the models to the data was evaluated with root mean square error of approximation (RSMEA) equal to or less than .05 ($p$ close fit $> .95$ or $\alpha = .05$ [34,35]) and FIML chi-square equal or less than three times degrees of freedom in deference to our large sample size (35). In FIML, the null model is not available, consequently, the measures of fit such as the comparative fit index and standardized root mean square residual could not be computed when the proposed model was fitted to the data (33).

## RESULTS

### Measurement Models

Means and standard deviations for demographic, social cognitive, and nutrition measures used in the SEM are presented in Table 2. These measures served as indicators of the latent variables in the social cognitive models (one each for fat, fiber, and fruits and vegetables). Prior to the analyses measures were examined for outliers. Both FFQ and food receipt data included outliers (percentage calories from fat $> 60$ [$n = 1$] or $< 10$ [$n = 3$], fiber g/1000 kcal $> 30$ [$n = 1$] or $< 2$ [$n = 2$], fruit and vegetable servings/1000 kcal $> 9$ [$n = 11$], these data points were eliminated from the analyses. Next, the data were examined for multivariate normality. With few exceptions, the distribution of responses to items and scales were skewed beyond acceptable bounds (i.e., skewness statistic divided by its standard error $> 2$) and several outcome expectations items displayed unacceptable kurtosis (kurtosis $> 2$), these measures were normalized using the Blom proportional estimate formula in SPSS 15.0. Additional variables were similarly normalized to retain a consistent unit of measurement within latent variables. Finally, prior to analysis of the structural models, each measurement model was evaluated to confirm the factor structure of the latent variables. The fit of the measurement models were assessed in single models for all latent variables independent of the structural models. The latent variables were allowed to correlate. The measurement models fit well (RMSEA $< .05$), but examination of modification indexes provided by LISREL suggested several adjustments to improve model fit. In each model, fit could be improved by allowing correlations between the errors associated with four negative outcome expectation measures and associated with four positive outcome expectations measures. These adjustments seemed reasonable as they reflected a method effect that might explain additional covariation in the measured variables (i.e., multiple items with similar wording and Likert-type response scales). The fit of the revised model was also good (RMSEA $< .05$).

TABLE 2
Means and Standard Deviations of Measured Variables

| *Variables* | *Range* | *M* | *SD* |
|---|---|---|---|
| Age | 18–92 | 53.54 | 14.37 |
| Years of schooling | 8–20 | 14.93 | 5.10 |
| Occupation | 0–13 | 6.55 | 2.34 |
| Annual income | < \$10k – > \$90k | 6.38 | 2.65 |
| Family support | | | |
| Increase fiber and F&V | .67–5.00 | 3.22 | 1.08 |
| Reduce fat | .71–5.00 | 3.29 | .96 |
| Self-efficacy | | | |
| Reduce fat | 5.71–100 | 72.63 | 19.15 |
| Increase fiber and F&V | 0–100 | 64.85 | 20.59 |
| Reduce sugar | 0–100 | 68.04 | 21.88 |
| Positive outcome expectations | | | |
| Have more energy | 1–5 | 4.44 | .85 |
| Feel healthier and happier | 1–5 | 4.42 | .86 |
| Lose weight | 1–5 | 4.29 | .95 |
| Live longer | 1–5 | 4.40 | .87 |
| Feel better in my clothes | 1–5 | 4.50 | .85 |
| Health will improve | 1–5 | 4.54 | .74 |
| Healthier skin, hair, or teeth | 1–5 | 4.24 | .94 |
| Negative outcome expectations | | | |
| Time keeping track of foods | 1–5 | 2.92 | 1.25 |
| Food will not taste as good | 1–5 | 2.37 | 1.19 |
| Take too long to prepare meals | 1–5 | 2.36 | 1.17 |
| Have to plan too far in advance | 1–5 | 2.47 | 1.23 |
| Shopping too much trouble | 1–5 | 2.75 | 1.27 |
| Bored with what I have to eat | 1–5 | 2.73 | 1.24 |
| Self-regulation | 1–5 | 2.13 | .92 |
| Plan and track nutrition | | | |
| Increase fiber and F&V | 1–5 | 3.59 | .91 |
| Decrease fat and calories | 1–5 | 3.29 | .78 |
| F&V servings/1000 kcal | | | |
| Receipts | .06–8.75 | 2.18 | 1.09 |
| FFQ | .00–12.78 | 2.93 | 1.67 |
| Fiber g/1000 kcal | | | |
| Receipts | 1.13–21.67 | 7.28 | 2.32 |
| FFQ | 3.36–31.77 | 10.09 | 3.69 |
| Percentage kcal from fat | | | |
| Receipts | 12.83–59.02 | 36.16 | 6.92 |
| FFQ | 12.44–55.97 | 33.26 | 7.32 |

*Note*. F&V = fruits and vegetables; FFQ = Block Food Frequency Questionnaire.

## Social Cognitive Models of Fat, Fiber, and Fruits and Vegetables

Structural equation analyses of the models indicated nearly identical fit—fat model:RMSEA = .044, $p$ (close fit) = .99, $\chi^2(313, N = 712) = 753.71$, $p < .001$, $\chi^2/df$ ratio = 2.41; fiber model:RMSEA = .044, $p$(close fit) = .99, $\chi^2(313, N = 712) = 749.31$, $p < .001$, $\chi^2/df$ ratio = 2.39; fruits and vegetable model: RMSEA = .045, $p$ (close fit) = .99, $\chi^2(313, N = 712) = 772.19$, $p < .001$, $\chi^2/df$ ratio = 2.47. The models differed, however, in how much observed variance each explained, the SCT model explained 35% of the variance in the fat content of participants purchases and intake, 53% of the variance in fiber, and 61% of fruits and vegetables variance.

The completely standardized parameter coefficients associated with direct, indirect, and total effects of the latent variables in the models are shown in Table 3. Significant direct effects ($p < .05$) are illustrated in Figure 1. A variable's direct effect is the portion of its total effect that is independent of other variables in the model, a variable's indirect effect is the portion of its total effect that is dependent on other variables in the model. The measurement of the demographic and social cognitive variables was constant across the three models. As expected, the coefficients

TABLE 3
Standardized Direct, Indirect, and Total Effects

| | | *Gender* | *SES* | *Age* | *Social Support* | *Self-Efficacy* | *Positive OE* | *Negative OE* | *Self-Regulation* |
|---|---|---|---|---|---|---|---|---|---|
| Social support | Direct | .01 | −.06 | .20/.21*** | | | | | |
| | Indirect | | — | — | | | | | |
| | Total | .01 | −.06 | .20/.21*** | | | | | |
| Self-efficacy | Direct | −.20/−.19*** | .07/.06 | .02 | .40*** | | | | |
| | Indirect | .00 | −.03/−.02 | .08*** | — | | | | |
| | Total | −.19*** | .04 | .10 | .40*** | | | | |
| Positive OE | Direct | −.12* | −.02 | −.01 | .02/.03 | .35*** | | | |
| | Indirect | −.07*** | .01 | .04*** | .14*** | — | | | |
| | Total | −.18*** | −.01 | .03 | .16./17*** | .35*** | | | |
| Negative OE | Direct | .07 | .02 | −.04 | −.11* | −.37*** | | | |
| | Indirect | .07*** | −.01 | −.06* | −.15*** | — | | | |
| | Total | .14** | .01 | −.10 | −.26*** | −.37*** | | | |
| Self-regulation | Direct | −.19/−.20*** | .17* | .21/.22*** | .33/.34*** | .38*** | .08 | −.12** | |
| | Indirect | −.10*** | −.01 | .12** | .19/.20[a]*** | .07*** | — | — | |
| | Total | −.30*** | .16/.17** | .33/.34*** | .52/.54*** | .45*** | .08 | −.12** | |
| Fat | Direct | .00 | −.04 | .16* | −.11 | .01 | .08 | .22** | −.45** |
| | Indirect | .15** | −.06 | −.19*** | −.27*** | −.26*** | −.04* | .06** | — |
| | Total | .15* | .02 | −.03 | −.38*** | −.25*** | .04 | .28*** | −.45** |
| Fiber | Direct | −.08 | .10 | .18** | .02 | .06 | −.13** | −.03 | .61*** |
| | Indirect | −.18*** | .11 | .22*** | .34*** | .24*** | .05* | −.07** | — |
| | Total | −.26*** | .21** | .40*** | .36*** | .30*** | −.08 | −.10* | .61*** |
| F&V | Direct | −.19*** | .23*** | .25*** | .05 | .02 | −.05 | −.17** | .52*** |
| | Indirect | −.17*** | .08 | .20*** | .32*** | .27*** | .04* | −.06** | — |
| | Total | −.36*** | .31** | .45*** | .37*** | .29*** | −.01 | −.23*** | .52*** |

*Note*. When parameter coefficients in the fat model differed from those in the fiber and fruit and vegetable models, the fat parameters are reported to the left of the slash mark. SES = socioeconomic status; OE = outcome expectations; F&V = fruits and vegetables.
*$p < .05$. **$p < .01$. ***$p < .001$.

associated with paths linking these variables to each other were virtually identical. In the few exceptions, the coefficients from the fat model were slightly different from the fiber and the fruit and vegetable models (which had identical coefficients). These differences are reflected in Table 3 and Figure1 with the fat-coefficient followed by a slash (/) followed by the coefficient from the fiber and the fruit and vegetable models. (Covariance matrices and factor loadings associated with the analyses are available from Eileen Anderson).

*Age, gender and SES.* Each of the demographic variables included in the models were related to the nutritional content of participants' food shopping receipts and food intake questionnaires, although there were some differences in these effects across the three models. Being male was related to lower levels of fiber ($\beta$ [total] = − .26, $p < .001$) and fruits and vegetables ($\beta$ [total] = − .17, $p < .001$) and to higher levels of fat ($\beta$ [total] = .15, $p < .05$; Table 3). The nature of the effect of gender varied across models; the effect of gender on fat was indirect through self-efficacy, negative outcome expectations, and self-regulation. The effect of gender followed these pathways to a lesser extent in as it related to fiber and fruits and vegetables. Older age was also associated with healthier levels of fiber ($\beta$ [total] = .40, $p < .001$) and fruits and vegetables ($\beta$ [total] = .45, $p < .001$) but not to participants' fat levels ($\beta$ [total] = − .03, *ns*). The effects of age on fiber and fruits and vegetables were mediated in part by the positive effect of age on social support and self-regulation. Finally, higher SES was associated with healthier fiber ($\beta$ [total] = .21, $p < .01$) and fruits and vegetable ($\beta$ [total] = .31, $p < .001$) levels, but SES was not related to participants' fat levels ($\beta$ [total] = .04, *ns*). The effect of SES on fiber were fairly equally direct and indirect through self-regulation, whereas the effect of SES on fruits and vegetables was largely direct.

*Social support.* Family social support made an important total contribution to participants' healthier nutrition; participants perceiving family members making attempts at healthier eating had lower levels of fat ($\beta$ [total] = −.38, $p < .001$) and higher levels of fiber ($\beta$ [total] = .36, $p < .001$) and fruits and vegetables ($\beta$ [total] = .37, $p < .001$) in their food purchases and intake. The total effect of social support on participants' nutrition was in large part indirect through self-efficacy and self-regulation.

*Self-efficacy.* Healthy nutrition was also associated with self-efficacy; participants with higher confidence in their ability to make healthier choices had lower levels of fat ($\beta$ [total] = $-.25$, $p < .001$) and higher levels of fiber ($\beta$ [total] = .30, $p < .001$) and fruits and vegetables ($\beta$ [total] = .29, $p < .001$). The effect of self-efficacy on nutrition was largely indirect through self-regulation and negative outcome expectations.

*Outcome expectations.* Positive outcome expectations did not exert any total effect on fat, fiber, or fruits and vegetables. Negative outcome expectations, however, had a negative effect on the quality of food purchases and intake. These total effects on fat ($\beta$ [total] = .28, $p < .01$), fiber levels ($\beta$ [total] = $-.10$, $p < .05$), and fruits and vegetables ($\beta$ [total] = $-.21$, $p < .001$) were partially indirect through the negative effect of these expectations on participants' use of self-regulatory strategies.

*Self-regulation.* Enactment of self-regulatory behaviors was the best predictor of participants' nutrition in the models. Planning and tracking healthier eating, using strategies to increase fruits, vegetables, and fiber and to decrease fat led to lower levels of fat ($\beta$ [total] = $-.45$, $p < .01$), higher levels of fiber ($\beta$ [total] = .61, $p < .001$), and higher levels of fruits and vegetables ($\beta$ [total] = .52, $p < .001$) in participants' food purchases and intake.

## DISCUSSION

SCT posits that self-efficacy, especially as it pertains to regulating food intake and purchases, is the most important determinant of nutrition behavior. Stemming from personal and environmental variables, higher self-efficacy promotes more positive and fewer negative expectations about the consequences of healthier food choices. Higher levels of efficacy and favorable outcome expectancies lead individuals to set goals for and plan and monitor their healthier eating behaviors. The fit of SCT to nutritional data from 712 adults participating in the baseline phase of a larger health promotion study was tested using SEM. The social cognitive models provided good fit to the data, explaining 35%, 53%, and 61% of the variance observed, respectively, in the fat, fiber, and fruit and vegetable content of participants' food-shopping receipts and food intake questionnaires.

Although self-efficacy made an important contribution to nutrition behavior (i.e., standardized effect parameters [$\beta$] of .25–.30), relationships within the models suggest that it was not the preeminent determinant of healthier nutrition. Instead, enactment of self-regulatory behaviors exerted greater total effects on fat, fiber, and fruit and vegetable purchases and intake (i.e., $\beta$ = .45–.61). In addition to self-efficacy and self-regulation, social support and negative outcome expectations were important determinants of nutrition behavior (i.e., $\beta = -.38$ to .36). Positive outcome expectations, however, were not. Although, the role of self-efficacy was somewhat diminished, the configuration of influences supported here was consistent with that posited by Bandura (15,28). As suggested for other health behaviors (15), the effect of social support was indirect, largely through self-efficacy but also through self-regulation. In addition, self-regulation is recognized in SCT as having effects on behavior independent of other SCT variables as evidenced here (15). SCT also allows that outcome expectations can make no additional or only a small contribution to understanding certain behaviors after accounting for self-efficacy (15, pp. 21–28), which is consistent with the current findings regarding positive outcome expectations.

The person variables included in the model, age, SES, and gender each made important contributions to the sample's nutrition behavior—effects that were mediated by the social cognitive variables. Older adults exhibited healthier fiber, fruit, and vegetable intake in part perhaps because they perceived greater social support and were more likely to use self-regulation strategies. Women had better nutrition perhaps because they exhibited greater self-efficacy and were more likely to use self-regulation strategies. Participants with higher levels of SES had healthier fiber in part because of higher levels of self-regulation, whereas their healthier levels fruits and vegetables were largely independent of the SCT variables.

### Limitations

Although supportive of SCT, this research was nonexperimental and the data correlational. Despite this limitation, the causative links between the psychosocial and nutrition variables as modeled here were strengthened by the study's prospective design; the 3-month follow-back period of the FFQ, however, overlapped the collection of the Food Beliefs Survey. It has been suggested that prospective correlational designs could be further strengthened by controlling for past behavior (29). According to Bandura (15), however, the reciprocal nature of relations within SCT clouds the interpretation of such designs. Controlling for past behavior in SCT analyses "without any regard to the determinants governing it [past behavior] obscures rather than clarifies the factors regulating human performance. Theoretical considerations should prescribe which determinants get controlled in causal analyses" (15, p .69). When past and current behavior are highly correlated, Bandura posited that this is the result of a common set of psychosocial determinants, suggesting the determinants only need to be measured prior to behavior to reflect causation. If past behavior and current behavior are not highly correlated, this, according to Bandura, is due to change in their psychosocial determinants, suggesting determinants need to be measured at some point between. In either case, prior measures of behavior would not contribute to the understanding of future behavior. Nevertheless, nonexperimental research designs, including prospective causal modeling, can only suggest how behavior might be controlled; only through experimental designs can we know if and how psychosocial variables might be manipulated to effect behavior change. Finally, although diverse, our sample was not large enough to test the fit of the models across specific demographic groups even though the results suggested differences might exist by participants' gender, age, and SES.

### Implications for Interventions

This study suggests that nutrition interventions may be more successful to the extent that they (a) strengthen family social support, (b) build self-efficacy, (c) improve the use of self-regulatory behaviors, (d) dispel negative outcome expectations related to making healthier food choices, and (e) are appropriately tailored for certain demographic groups. It also suggests that changes in these areas build on one another.

### Social Support

There were indications in our study that perceived family support for eating healthier foods could positively influence food purchases and intake. Although this study does not shed light on how social support might be improved, it suggests that interventions that are successful at improving family attitudes and behaviors may result in healthier nutrition behavior because family social support boosts individuals' nutrition self-efficacy, offsets negative outcome expectations, and encourages individuals' self-regulatory behaviors.

*Self-efficacy.* The findings presented here suggest that nutrition interventions should be designed to target self-efficacy for setting goals and for planning and monitoring progress toward these goals. Interventions that, in addition to building social support, provide progressive mastery experiences in self-regulation would be expected to be effective in building participants' efficacy (15,28). As self-efficacy improved in such interventions, negative outcome expectations would be offset and self-regulatory behavior boosted leading to healthier food choices.

*Negative outcome expectations.* Participants' nutritional health was affected in our study by their expectations of negative self-evaluative, social, and physical outcomes. Participants' food purchases and intake contained more fat and less fiber, fruits, and vegetables to the extent that they expected healthier nutrition to detract from other activities or to be physically or emotionally dissatisfying.Increased support from family members and self-efficacy building mastery experiences that target specific negative outcomes are approaches suggested by SCT and supported by the current analyses.

*Self-regulation.* Although self-regulation was the strongest predictor of healthier nutrition, participants used self-regulatory behaviors largely only "occasionally" suggesting these behaviors may have room for change in similar populations. In addition to improving social support, self-efficacy, and outcome expectations, interventions to increase nutrition self-regulation should provide specific skill training in setting appropriate and realistic goals, planning for challenges to healthy food choices, and monitoring food intake, preferably through progressive mastery experiences that allow for tailored, regulatory approximations and feedback (15,28).

*Target groups.* Finally, nutrition interventions might be more successful to the extent that they are tailored for the age, household SES, and gender of participants. In sum, interventions involving younger participants might be enhanced by special emphasis on building social support for healthier food purchases and intake and on building confidence and skill in regulating nutrition behavior. Interventions involving men or lower SES participants might anticipate poorer initial levels of nutrition. Further, male participants may need specific content to enhance self-efficacy and self-regulation and to dispel expectations that better eating habits will be inconvenient and less satisfying.

## CONCLUSIONS

The study presented here suggests a pivotal role for self-regulatory behaviors in the nutrition behavior of adults. Understanding the place of self-regulation in the context of other social cognitive factors could provide a powerful tool in counterbalancing the social and environmental factors contributing to the recent deterioration of diet and activity patterns observed in the United States. Adults who regulate their nutrition behavior could be expected to have healthier diets, and interventions that are effective at garnering family support, at increasing nutrition related self-efficacy, and at overcoming negative outcome expectations should be more successful at helping adults enact the self-regulatory behaviors essential to buying and eating healthier foods.

## REFERENCES


(1) Blendon RJ, DesRoches CM, Benson JM, et al.: *Harvard School of Public Health OBESITY POLL, July 2005*. Boston: Harvard School of Public Health. Retrieved May 31, 2007 from http://www.hsph.harvard.edu/press/releases/blendon/ObesityTopline.doc

(2) U.S. Department of Agriculture Agricultural Research Service Food Surveys Research Group Beltsville Human Nutrition Research Center: *Results from USDA's 1994–96 Diet and Health Knowledge Survey: Table Set 19. October 2000*. Beltsville, MD: Author. Retrieved May 31, 2007 from http://www.ars.usda.gov/SP2UserFiles/Place/12355000/pdf/dhks9496.PDF

(3) Reed J, Frazão J, Itskowitz R: *How Much Do Americans Pay for Fruits and Vegetables? Agriculture Information Bulletin, Number 790, July 2004*. Washington, DC: Economic Research Service, USDA. Retrieved May 31, 2007 from http://www.ers.usda.gov/publications/aib790/

(4) Buzby J, Farah H, Vocke G: *Will 2005 Be the Year of Whole Grains?* Washington, DC: Economic Research Service, USDA. Retrieved May 31, 2007 from http://www.ers.usda.gov/AmberWaves/June05/pdf/FullIssueJune2005.pdf

(5) Nord M, Andrews M, Carlson S: *Measuring Food Security in the United States: Household Food Security in the United States, 2004. United States Department of Agriculture Economic Research Service, Report No. Er111*. Washington, DC. Retrieved May 31, 2007 from http://www.ers.usda.gov/publications/err11/

(6) Reeves MJ, Rafferty AP: Healthy lifestyle characteristics among adults in the United States, 2000. *Archives of Internal Medicine*. 2005, *165*:854–857.

(7) USDA, Economic Research Service: *Food Guide Pyramid Servings Data*. Washington, DC: Author. Retrieved May 31, 2007 from http://www.ers.usda.gov/data/foodconsumption/FoodGuideIndex.htm#calories

(8) Farah H, Buzby J: *US Food Consumption up 16% Since 1970. Amber Waves*. Washington DC: Economic Research Service, USDA. Retrieved May 31, 2007 from http://www.ers.usda.gov/AmberWaves/November05/pdf/FullIssueNovember2005.pdf

(9) French SA, Harnack L, Jeffery RW: Fast food restaurant use among women in the Pound of Prevention study: Dietary, behavioral and demographic correlates. *International Journal of Obesity and Related Metabolic Disorders*. 2000, *24*:1353–1359.

(10) Nestle M: The ironic politics of obesity [Editorial]. *Science*. 2003, *299*:781.

(11) Nielsen SJ, Popkin BM: Patterns and trends in food portion sizes, 1977–1998. *Journal of the American Medical Society*. 2003, *289*:450–453.

(12) French SA, Story M, Jeffery RW: Environmental influences on eating and physical activity. *Annual Review of Public Health*. 2001, *22*:309–335.

(13) Wadden TA, Brownell KD, Foster GD: Obesity: Responding to the global epidemic. *Journal of Consulting and Clinical Psychology*. 2002, *70*:510–525.

(14) Peters JC, Wyatt HR, Donahoo WT, Hill JO: From instinct to intellect: The challenge of maintaining healthy weight in the modern world. *Obesity Reviews*. 2002, *3*:69–74.

(15) Bandura A: *Self-Efficacy: The Exercise of Control*. New York: Freeman, 1997.

(16) Hill JO, Peters JC: Environmental contributions to the obesity epidemic. *Science*. 1998, *280*:1371–1374.

(17) Anderson ES, Winett RA, Wojcik JR: Social cognitive determinants of nutrition behavior among supermarket shoppers: A structural equation analysis. *Health Psychology*. 2000, *19*:479–486.

(18) Anderson ES, Winett RA, Wojcik JR, Winett SG, Bowden T: A computerized social cognitive intervention for nutrition behavior: Direct and mediated effects of fat, fiber, fruits, and vegetables, self-efficacy and outcome expectations among adults. *Annals of Behavioral Medicine*. 2001, *23*:88–100.

(19) Luszczynska A, Gibbons X, Piko BF: Self-regulatory cognitions, social comparison, and perceived peers' behaviors as predictors of nutrition and physical activity: A comparison among adolescents in Hungary, Poland, Turkey, and USA. *Psychology & Health*. 2004, *19*:577–593.

(20) Ford ES, Ahluwalia, IB, Galuska DA: Social relationships and cardiovascular disease risk factors: Findings from the Third National Health and Nutrition Examination Survey. *Preventive Medicine*. 2000, *30*:83–92.

(21) Steptoe A, Perkins-Porras L, Rink E, Hilton S, Cappuccio FP: Psychological and social predictors of changes in fruit and vegetable consumption over 12 months following behavioral and nutrition education counseling. *Health Psychology*. 2004, *23*:574–581.

(22) Maes S, Karoly P: Self-regulation assessment and intervention in physical health and illness: a review. *Applied Psychology*. 2005, *54*:267–299.

(23) Pelletier LG, Dion SC, Slovinec-D'Angleo M, Reid R: Why do you regulate what you eat? Relationships between forms of regulation, eating behaviors, sustained dietary behavior change, and psychological adjustment. *Motivation and Emotion*. 2004, *28*:245–277.

(24) Vartanian LR, Herman CP, Polivy, J: Does regulatory focus play a role in dietary restraint? *Eating Behaviors*. 2006, *7*:333–341.

(25) Ammerman AS, Lindquist CH, Lohr KN, Hersey J: Efficacy of behavioral interventions to modify dietary fat and fruit and vegetable intake: A review of the evidence. *Preventive Medicine*. 2002, *35*:25–41.

(26) Schnoll R, Zimmerman BJ: Self-regulation training enhances dietary self-efficacy and dietary fiber consumption. *Journal of the American Dietetic Association*. 2001, *101*:1006–1011.

(27) Grossarth-Maticek R, Eysenck HJ: Self-regulation and mortality from cancer, coronary heart disease, and other causes: A prospective study. *Personality and Individual Differences*. 1995, *19*:781–795.

(28) Bandura A: Health promotion by social cognitive means. *Health Education and Behavior*. 2004, *2*:143–164.

(29) Weinstein ND: Misleading tests of health behavior theories. *Annals of Behavioral Medicine*. 2007, *33*:1–10.

(30) *Block 98 Food Frequency Questionnaire*. Berkeley, CA: Block Dietary Data Systems, 1998.

(31) Anderson ES, Winett RA, Bickley PG, et al.: Improving food purchases: The effectiveness of a public access, multimedia intervention in supermarket settings. *Journal of Health Psychology*. 1997, *2*:209–223.

(32) Winett RA, Anderson ES, Bickley PG, et al.: Nutrition for a Lifetime System: A multimedia system for altering supermarket shoppers' purchases to meet nutritional guidelines. *Computers in Human Behavior*. 1997, *13*:371–392.

(33) Duncan OD, Hatt PK, North CC: A socioeconomic index for all occupations. In Reiss AJ, (ed), *Occupations and Social Status*. New York: Freeman, 1961, 109–138.

(34) Jöreskog KG, Sorbom D: *LISREL 8.8*. Chicago: Scientific Software, 2007.

(35) Jöreskog KG, Sorbom D: LISREL 7: *A Guide to the Program and Applications* (2nd ed.). Chicago: SPSS, Inc., 1989.

(36) Kline RB: *Principles and Practice of Structural Equation Modeling* (2nd ed.). New York: Guilford, 2005.