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Research report

# Nutrition self-efficacy is unidirectionally related to outcome expectations in children ☆

Andrew L. Larsen [a,*], John J. McArdle [a], Trina Robertson [b], Genevieve F. Dunton [a]

[a] University of Southern California, 3620 S. McClintock Ave, SGM 501, Los Angeles, CA 90089-1061, USA
[b] Dairy Council of California, 2151 Michelson Drive, Suite 235, Irvine, CA 92612-1339, USA

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ABSTRACT

Objective: To clarify the underlying relationship between nutrition self-efficacy and outcome expectations because the direction of the relationship (unidirectional vs bidirectional) is debated in the literature. Methods: Secondary data analysis of a 10-week, 10-lesson school-based nutrition education intervention among 3rd grade students (N = 952). Nutrition self-efficacy (7 items) and nutrition outcome expectations (9 items) were measured through student self-report at intervention pre- (time 1) and post- (time 2) assessments. A series of two time point, multi-group cross-lagged bivariate change score models were used to determine the direction of the relationship. Results: A cross lag from nutrition self-efficacy at time 1 predicting changes in nutrition outcome expectations at time 2 significantly improved the fit of the model (Model 3), whereas a cross lag from nutrition outcome expectations at time 1 to changes in nutrition self-efficacy at time 2 only slightly improved the fit of the model (Model 2). Furthermore, adding both cross lags (Model 4) did not improve model fit compared to the model with only the self-efficacy cross lag (Model 3). Lastly, the nutrition outcome expectations cross lag did not significantly predict changes in nutrition self-efficacy in any of the models. Conclusions: Data suggest that there is a unidirectional relationship between nutrition self-efficacy and outcome expectations, in which self-efficacy predicts outcome expectations. Therefore, theory-based nutrition interventions may consider focusing more resources on changing self-efficacy because it may also lead to changes in outcome expectations as well.



## Introduction

Self-efficacy and outcome expectations (and conceptually similar constructs with alternate labels) are key components of several prominent models of self-regulation, including: Social Cognitive Theory (SCT; Bandura, 1997, 2004), the Health Action Process Approach (HAPA; Schwarzer, 1992), the Theory of Planned Behavior (TPB; Ajzen, 1991), and Protection Motivation Theory (PMT; Maddux & Rogers, 1983; Rogers, 1975). Self-efficacy is described as a person's perceived competency in a given domain (Bandura, 1997). Outcome expectations are anticipated outcomes that people expect their actions to produce, such as the belief that eating healthy food will make your body feel better (Bandura, 1997). Outcome expectations and self-efficacy are explicitly included in the SCT and HAPA models, and similar constructs are included in the TPB and PMT, such as response efficacy, perceived behavioral control, and attitudes (Bandura, 1997; Conner & Norman, 2005). Social cognitive theories of self-regulation hypothesize that people with high self-efficacy and high positive outcome expectations are more likely to successfully self-regulate their behavior in a given domain (Bandura, 1997).

However, the relationship between self-efficacy and outcome expectations (as well as similar constructs from other models) is debated (Fishbein et al., 2000). SCT posits a unidirectional relationship from self-efficacy to outcome expectations, HAPA posits a bidirectional relationship, and other models (e.g., PMT, TPB) fail to specify specific relationships (Bandura, 1997; Conner & Norman, 2005; Schwarzer, 1992). The direction of the relationship is integral for understanding processes of behavior change, which the social cognitive self-regulation literature has been criticized for failing to do in research (Leventhal & Mora, 2005). Additionally, understanding processes of change helps to determine which constructs to prioritize in interventions, particularly minimalist interventions and interventions with limited resources. If a unidirectional relationship exists in which self-efficacy predicts changes in

*Abbreviations:* SCT, Social Cognitive Theory; HAPA, Health Action Process Approach; TPB, Theory of Planned Behavior; PMT, Protection Motivation Theory; SEM, structural equation modeling; *df*, degrees of freedom; $d\chi^2$, change in chi-square; *ddf*, change in degrees of freedom; CFI, comparative fit index; TLI, Tucker–Lewis index; RMSEA, root mean square error of approximation.

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* Corresponding author.
*E-mail address:* allarsen@usc.edu (A.L. Larsen).

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outcome expectations – as posited in SCT – then interventions may primarily target self-efficacy because changes in self-efficacy would presumably lead to changes in outcome expectations. However, if there is a bidirectional relationship then interventions with limited resources should target both constructs relatively equally.

A weakness of past research has been an over-reliance on between-group analyses, such as cross-sectional designs (Weinstein 2007). Instead, longitudinal within-subjects research is required for testing processes of change – particularly for understanding temporal sequencing of construct effects (Rhodes & Nigg, 2011; Cervone, Shadel, Smith, & Fiori, 2006) – and is facilitated by modern statistical techniques. The aim of the present research is to clarify the underlying relationship between nutrition self-efficacy and outcome expectations by testing a series of longitudinal bivariate crossed-lagged latent change score models.

## Material and methods

The present work is a secondary analysis from a previously reported intervention (Dunton et al., 2012). The data were collected to evaluate a 10-week (10-lesson) school-based nutrition education program developed by the Dairy Council of California to teach 3rd grade students the importance of healthy eating and physical activity behaviors and attitudes (see www.HealthyEating.org/SMC). The regular classroom teachers, all of whom received training prior to starting the intervention, taught the lessons. Lessons taught: (1) the five food groups; (2) the main nutrients and their roles in the body; (3) the importance of balanced meals; (4) how to read food labels; (5) how to measure portion sizes; (6) healthy beverage choices; and (7) how to be active for 60 minutes a day. Self-efficacy was targeted through activities such as children practicing making balanced meals, substituting healthy snacks for unhealthy ones, and by exposing students to a wide variety of foods to give them confidence that they could find healthy foods to eat. Outcome expectations were targeted through explaining benefits of healthy eating, including the roles of the main nutrient groups, importance of balanced meals, the importance of being physically active, and importance of reducing added sugar in their diet.

Data were collected during the 2010–2011 school year. The study included pre-, post- and follow-up assessments of nutrition knowledge, outcome expectancies, self-efficacy, and dietary intake for Intervention and Control groups. Only pre- (time 1) and post- (time 2) assessments were included in the current analyses. Post-assessments were completed immediately following the 10-week program.

A sample of 22 public elementary schools across California (consisting of 1147 students) who had either ordered the program materials from the Dairy Council of California in previous years or had been recommended by district level contacts were recruited to participate in the study. Schools were selected so that the sample resembled the state-level demographic profile of 3rd grade students attending public schools in California. Within each school, two third grade classrooms were randomly selected for participation in the evaluation. Classrooms were considered eligible if they were not a combination grade classroom and did not teach other nutrition information as part of the regular classroom curriculum. If a teacher did not agree to be in the evaluation, an additional classroom from that school was chosen as a replacement. Within each school, one classroom was randomly assigned to be in the Intervention group and one in the Control group. Six teachers did not agree to random assignment and were placed in the Intervention group. The Control group completed the assessments only (and as part of eligibility requirements, did not teach any other nutrition information). Study procedures were approved by the ethics committee of the Institutional Review Board at Independent Review Consulting, Inc. Written informed assent was obtained from students and a passive parental consent procedure was used (i.e., if the parent did not decline consent, the student was approached for consent).

Nutrition self-efficacy and outcome expectations were measured using scales developed to gauge specific components of the intervention because few measures of nutrition self-efficacy and outcome expectations exist for children. The scales were based on previously validated scales typically used on different populations and contexts (Hagler, Norman, Radick, Calfas, & Sallis, 2005; National Cancer Institute, 2005). Highly trained research staff used a standardized scripted procedure to administer the questionnaires. Self-efficacy was measured with seven items on a four item response scale (Cronbach's $\alpha = 0.71$) with anchors *I can* and *I can't* (e.g., "I can eat breakfast every day, even if I am in a hurry.", "I can choose to drink water or milk instead of soda at restaurants.", "Every day, I can eat foods that are low in sugar for meals and snacks."). Outcome expectations were measured with nine items on a four item response scale (Cronbach's $\alpha = 0.73$) with anchors *Yes* and *No* (e.g., "I think that I will feel healthier if I eat fewer sweets.", "I think that skipping a meal will make me feel tired.", "I think that I will build strong muscles if I eat more meat."). Both scales were pilot tested in 3rd graders ($n = 57$) and were determined to have adequate 7 d test–retest reliability with an $r = .75$ for nutrition outcome expectations and $r = .57$ for nutrition self-efficacy (see Dunton et al., 2012). Additionally, factor analyses of the self-efficacy and outcome expectations scales revealed that all items loaded >.40 onto a single factor for each scale. Although a formative test of validity was not conducted, predictive validity was evaluated by testing correlations between the self-efficacy and outcome expectation scales with other measured constructs within the present sample. Both scales were positively correlated with nutrition knowledge (e.g., knowledge of food groups, main nutrients, types of foods; $r$'s = .056 – .374, $p$'s = .104 – < .001), positively correlated with a number of healthy foods children reported consuming (e.g., fruits, vegetables; $r$'s = .070 – .185, $p$'s = .033 – < .001), and negatively correlated with a number of unhealthy foods children reported consuming (e.g., soda, junk foods; r's ranged from –.153 to –.264, $p$'s = < .001) as measured through the School Physical Activity and Nutrition (SPAN) 24-hour recall instrument (data not shown; Hoelscher, Day, Kelder, & Ward, 2003; Thiagarajah et al., 2008).

### Statistical analysis

The data analyses were conducted in R version 2.15.2 using the Lavaan package. The goal of the analysis was to test the directionality of the relationship between nutrition self-efficacy and outcome expectations by comparing model fit of a series of four multi-group cross-lagged bivariate change score models (Fig. 1). In Structural Equation Modeling (SEM), longitudinal latent change scores can be created by setting the regression path between Time 1 and Time 2 equal to 1, implying that some portion of the Time 2 score is exactly equal to Time 1, and the residual variable (e.g., DSE and DOE in Fig. 1) is directly interpretable as a difference score (McArdle & Nesselroade, 1994). An arrow from Time 1 to the difference score represents an association between the previous time point and any changes over time (e.g., being high at Time 1 could be associated with a decrease at Time 2).

Means and variances at the first time point were held invariant across group (Intervention vs Control) to control for group differences at the start of the study. Based on significant differences in self-efficacy and outcomes expectancies observed between the Intervention and Control groups (see Dunton et al., 2012), all parameters were allowed to vary across study groups (i.e., mean changes, variance of changes, covariance between changes, and regression coefficients). The first model had no cross-lags, the second model contained one cross-lag from outcome expectations at time 1 to changes in self-efficacy at time 2 (referred to as the outcome