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Examining How Adding a Booster to a Behavioral Nutrition Intervention Prompts Parents to Pack More Vegetables and Whole Grains in Their Preschool Children's Sack Lunches

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Abstract

Data from a five-week intervention to increase parents' packing of vegetables and whole grains in their preschool children's sack lunches showed that, although changes occurred, habit strength was weak. To determine the effects of adding a one-week booster three months post-intervention, children's ($N = 59$ intervention and 48 control) lunches were observed at baseline (week 0), post-intervention (week 6), pre-booster (week 20), and post-booster (week 26). Servings of vegetables and whole grains were evaluated in repeated measures models and results inspected relative to patterns projected from different explanatory models of behavior change processes. Observed changes aligned with projections from the simple associative model of behavior change. Attention in future studies should focus on behavioral intervention elements that leverage stimulus-response associations to increase gratification parents receive from providing their children with healthy lunches.

Keywords

behavior-change process; early childhood; sack lunch; follow-up prompts

Packing fruit, vegetables, and whole grains in preschool children's sack lunches is a powerful way for parents to teach their children eating habits and food preferences to support a lifetime of good health. Diets rich in these foods provide nutrients children need for healthy growth and development, protect against certain cancers, and reduce risks for diabetes and other chronic diseases.^{1–3} But the majority of children eat much less than the recommended amounts of vegetables and whole grains.^{4–6} Children's acceptance and intake of vegetables and other healthy foods is positively associated with early introduction, frequent exposure, and parental modeling.^{7–8} Packing a daily serving of vegetables and whole grain foods in preschoolers' sack lunches ensures early introduction and frequent exposure to these healthy choices and also communicates the parents' preference of these foods for the mid-day meal. But sack lunches parents actually pack for their young children to eat at the early care and education (ECE) center or school seldom contain adequate servings of vegetables or whole grain foods, often include foods of low nutrient density such as chips and cookies and sweetened beverages, and have been shown to supply less than one-third of the recommended Dietary Reference Intake for energy, calcium, iron, and other essential nutrients.^{9–16}

Studies of interventions to improve nutritional quality of sack lunches that parents pack for young children have yielded mixed results. The “SMART” lunch box intervention, for example—which consisted of food boxes and supporting materials targeted to parents and children—was tested in primary schools in the UK. Small improvements in the food and nutrient content of children's packed lunches were obtained, but the researchers concluded further interventions would be required to bring packed lunches in line with government standards for school meals.¹⁷ The *Munch and Move* intervention—which consisted of professional development for directors and teachers—was evaluated at preschools in Australia. Decrease in servings of sweetened drinks in the lunchboxes was obtained, but other low nutrient dense foods persisted.¹⁸ The researchers concluded a more comprehensive set of interventions would be required to improve the nutritional quality of lunches parents pack for their young children. The *Lunch is in the Bag* intervention—which included five weeks of newsletters to parents, classroom activities for the children, and parent–child activity stations at the ECE center—was tested in central Texas, USA. Increases in the number of servings of vegetables and whole grain foods were obtained, but even after the intervention the percent of children whose lunches provided a daily serving of vegetables was less than 20%, less than 25% for whole grains, and near zero for a serving each of fruit, vegetables, and whole grains.^{19–21}

Adding follow-up prompts has potential for boosting the effectiveness of interventions to improve the nutritional quality of lunches parents pack for their young children. Use of follow-up prompts is responsive to parents' advice that they need “reminders” to help them pack healthy lunches for their preschool children.²² It is the technique used as post-intervention maintenance strategy for most health behavior change interventions.²³ But in the taxonomy of techniques used in interventions for healthy eating, follow-up prompts is listed without cross-reference to a theoretical framework.²⁴ Increased understanding of how follow-up prompts work (or do not work) is, therefore, necessary groundwork for optimizing

the design of behavioral interventions to improve health behavior change and maintenance.²⁵

Simple associative process^{23–27} is one mechanism by which adding follow-up prompts might boost effectiveness of behavioral interventions to improve healthy eating. Simple association is the effortless unconscious process in which behavior change results from repeated pairing of the behavior with external cues. Newly acquired but weak habits would be expected to degrade during the post-intervention interval but then rebound when cues are reintroduced through follow-up prompts.²⁸ Because of the spacing effect that is well documented in studies of learning over time,^{29,30} the rebound could result in higher level of the target behavior post-booster than post-intervention. This pattern of potential effects of adding follow-up prompts is labeled “simple associative” in Figure 1.

A second mechanism by which follow-up prompts might boost effectiveness of behavioral interventions to improve healthy eating is incentive processes in the instrumental learning model of goal-directed behavior.³¹ In this model the parent's non-prompted practice of packing healthier lunch post-intervention could become self-sustaining due to memory of the reinforcements and emotionally appealing messages and images provided during the intervention and/ or as a consequence of the parent's accumulation of experiences of satisfaction with the outcomes received from packing healthier lunch for the child.^{32,33} In this model, conscious outcome expectations mirror the memory of positive affect associated with packing healthier lunch. The additional reinforcements and emotional appeals provided in the booster could intensify these outcome expectancies and drive the parent to pack even more servings of healthy foods. This pattern of potential effects of adding a booster is labeled “instrumental incentive” in Figure 1.

Conscious thought plays a causal role in an alternative perspective on the goal directed mechanism by which follow-up prompts might boost effectiveness of the initial intervention.^{34–37} Behavior change is traced to reflective, language-supported, decisional reasoning and consequent intentional action motivated by *outcome expectations* but also by *subjective norms*³⁸ to recruit *social support* and adapt the family's rules of daily living to achieve *behavioral control/self-efficacy*^{39,40} in the routine packing of healthy foods in the child's sack lunch. Continued improvement of lunch packing behavior would be expected during the period of non-intervention, and the follow-up prompts could boost the parent's further effortful examination of reasons and means for packing age appropriate servings of healthy foods. This pattern is labeled “decisional reasoning” in Figure 1.

The current study was conducted to examine these different theories of how the use of follow-up prompts influences the effectiveness of behavior change interventions. Follow-up prompts were added to *Lunch is in the Bag*,^{19–21} and data were collected to test the following hypotheses: (a) the positive effects of *Lunch is in the Bag*'s initial five weeks of intervention would be replicated; (b) adding follow-up prompts in the form of a booster week of activities after three months of unprompted lunch packing would contribute to maintenance of the positive changes in lunch packing behavior; and (c) the follow-up prompts would boost packing of vegetables and whole grains to levels greater than the post-intervention amounts. In addition to measuring intervention and booster effects on servings

of fruit, vegetables, and whole grains parents packed in the children's lunches, the role of changes in parents' outcome expectations, subjective norms/social support, and perceived behavioral control/self-efficacy for packing fruit, vegetables and whole grains in their children's sack lunches also was examined. These multiple measures before and after the initial five weeks of intervention and again before and after the booster week enabled exploratory investigation of processes by which the use of follow-up prompts influences health behavior change.

Methods

Study Design

Three ECE centers that require children to bring sack lunch were recruited from an ethnically diverse metropolitan area in Central Texas to participate in this exploratory study in a quasi-experimental design with repeated measures and a control condition. Families at the centers were eligible to participate if they had a 3–5 year-old child who regularly attended the center and ate lunch brought from home. Because of large differences in sizes of the centers, the two smaller centers with a combined total of 94 eligible families comprised “Group A”; the one center with 110 eligible families was “Group B”; and these groups were randomly assigned to intervention or to control. The total of 204 eligible families received a letter inviting their participation in the study from their respective Center Directors. Families participated as parent–child dyads with the adult member the person with primary responsibility for packing the child's lunch. Only one dyad was enrolled per family. Servings of fruit, vegetables, and whole grains were measured through direct observation of the content of the children's sack lunches on three nonconsecutive days at week 0 (baseline), week 6 (post-intervention), week 20 (pre-booster), and week 26 (post-booster). At each point in time parents were asked to complete a questionnaire measuring outcome expectations (OE), subjective norms/social support (SN), and perceived behavioral control/self-efficacy (PC) for daily packing one serving of the targeted foods in the child's sack lunch. At baseline parents also completed a brief demographic questionnaire.

Signed informed consent of the parent was obtained prior to data collection. Protocol for the study was approved by the Institutional Review Boards of both the University of Texas at Austin and the University of Texas Health Science Center at Houston. Families received gift cards to reimburse time and effort spent answering the questionnaires. After completion of the study, the *Lunch is in the Bag* materials were offered to the center(s) assigned to the control condition.

Intervention

Lunch is in the Bag was designed to increase to one serving each the amount of fruit, vegetables, and whole grain foods parents pack in sack lunches for their preschool children to eat at the ECE center or school. Development of the original five-week intervention included components at the individual (eg, handouts sent home to the parents), interpersonal (eg, parent–child activity stations at the center) and environmental levels (eg, teacher training and materials to support a daily teacher-guided lunch sack unpacking activity for the children). To ensure the intervention would be apprehensible to families across a broad

spectrum of circumstances, all materials were developed in English language but at the sixth grade reading level, and clarity and cultural appropriateness of the messages and images were evaluated and improved in consultation with an Advisory Group constituted of parents, ECE teachers and directors, and nutrition and behavioral science experts. The kit of intervention materials included weekly activity logs completed by the center directors and classroom teachers to assist their self-assessment of implementation fidelity and also supply process evaluation information to the research team.

For the current study, follow-up prompts were added to the original *Lunch is in the Bag* intervention to take place after a three-month interval of non-intervention to remind and reinforce messages and experiences from the initial five weeks of intervention. The booster week included a new parent handout reinforcing key points from the initial five handouts; a lesson plan for a new classroom activity focused on the five food groups plus new copies of lesson plans for the daily teacher-guided lunch unpacking activity and four other activities that were staples of the initial weeks; and a parent-child activity station focused on vegetables and fruits. An overview of core components of *Lunch is in the Bag* with the booster added is presented in Table 1.

Measures

Numbers of servings of fruits, vegetables, and whole grains in lunches children brought from home were measured via direct observation by trained observers. In accord with guidelines for food records,^{41,42} lunches were observed on three random non-consecutive week days. Food observers were trained with a research-based protocol⁴³ modified by training the observers to recognize foods and servings sizes commonly seen in lunches of preschool children. The training included pre-test with 10 sample lunches, stations for the observers to create food items in order to learn what to look for (eg, making sandwiches with different kinds of bread to learn to distinguish whole grain bread), and post-testing with 10 sample lunches which, if the observer scored less than 85% against the scoring key, required retraining. During data collection, the trainer shadowed each observer for 10% of the recorded lunches and coached when necessary to ensure validity in observers' recording a nominal description of each specific food item, its amount in standard measuring units (such as 1/2 cup of carrot or 1 slice of bread or 4 tablespoons of raisins), and characteristics of its presentation (eg, packaging and sensory elements such as shape and texture). The food record also included columns in which the observers post-coded each item's food group and the number of servings based on the child's age and the Child and Adult Care Food Program guide-lines⁴⁴ (eg, 1 serving of vegetable is 1/4 cup for 3-year olds and 1/2 cup for 4 to 5-year olds). Individual components of composite foods were recorded in separate amounts. The lunch observations took place in a room separate from the children approximately 20 to 60 minutes prior to the child's lunch time. Psychosocial variables were measured separately for fruit, vegetables, and whole grains via parents' responses of questionnaires constituted of published scales developed and validated by other researchers.^{45,46} Internal consistency was evaluated with Cronbach Alpha statistic based on parents' baseline responses. Outcome Expectations (OE) (range 1–5) was measured with 12 questionnaire items (eg, “I pack vegetables in my preschool child's lunch because they taste good”) with internal consistency in the current study of 0.81 for fruit, 0.83 for vegetables and 0.81 for whole grains.

Subjective Norms/Social Support (SN) (range 1–5) was measured with 3 questionnaire items (eg, “Most people who are important to me think I should pack 1 serving of whole grains in my preschool child’s sack lunch every day”) with internal consistency assessed in the current study of 0.72 for fruit, 0.63 for vegetables and 0.78 for whole grains. Perceived Behavioral Control/Self-Efficacy (PC)(range 1–5) was measured with 5 questionnaire items (eg, “If I wanted to I could easily pack 1 serving of vegetables in my preschool child’s sack lunch every day”) with acceptable internal consistency obtained in the current study for vegetables (0.69) and for whole grains (0.74).

Demographic questions included parent self-reported weight and height to enable calculation of body mass index (BMI) as well ethnicity, marital status, income, education, employment status, and relationship to the indexed child.

Analyses

Estimates of outcomes were obtained separately for fruit, vegetables, and whole grains for each data collection time point (pre- and post-intervention as well as pre- and post-booster) and each treatment condition (intervention versus control). Time-by-treatment interactions were modeled to detect differences in the outcomes. Because the unit of randomization was ECE centers but the unit of observation was individual lunches it was necessary to account for correlated repeated measures within individuals and for heterogeneity across ECE centers. Multilevel regression models that allowed both random effects and repeated measures were implemented using the MIXED Procedure in SAS v 9.2 (Cary, NC). Repeated measures across time within individuals were modeled using an autoregressive correlation structure (AR1). In addition, models allowed for a center-specific effect via a random intercept modeled at the center level. All regression models were adjusted for parental BMI, ethnicity, number of people in the household, and parental age as preliminary analyses suggested some association of these with one or more of the outcomes. Estimates were obtained at the population mean of each of the continuous covariates and for the population distribution of each of the categorical covariates. To evaluate change in servings of the targeted foods as a function of change in OE, SN, and PC, pre–post differences (week 0 to week 6) in these psychosocial measures were computed and modeled by the interaction of this difference with treatment condition on change in servings from baseline to post-booster (week 0 to week 26).

Results

Study Participants

Of the 204 eligible families, 107 (52.5%) enrolled in the study with 59 parent–child dyads at the intervention centers and 48 at the control centers. The majority of adult members of the dyads were married mothers (88%) who were college graduates (80%) with household incomes above \$80,000 (74%), White/European American (73%), parenting more than one child (70%), aged 30 to 39 years (58%), and employed full-time (55%) in occupations other than homemaker. Self-reported height and weight yielded BMI ranging from 17 to 58 with median 23 and arithmetic average 24. The majority (72%) of the parents was normal weight, but 9% were classified as obese. A total of 1,284 lunches were observed; 588 of these were

for children at control centers, and 696 for children at intervention centers. Measures of psychosocial variables were obtained once from each parent at each time point, for a total of 428 parent questionnaires ($4 \times 107 = 428$). After accounting for missing values, 1,260 usable observations of lunches packed and 368 usable parent questionnaires were available for regression analyses.

Changes in Servings of Fruits, Vegetables, and Whole Grain Foods in the Children's Sack Lunches

Table 2 presents estimates of fruits, vegetables, and whole grain packed by parents, as well as estimated levels of psychosocial variables at each of the four time points. *P* values for significance presented here refer to the strength of the time-by-treatment interaction (ie, the extent to which the magnitude of change across selected time points in the intervention group differed from the corresponding change in the comparison group). To maintain readability, Table 2 does not report on the significance of magnitude of change within the intervention and control groups separately (ie, the time effects), as such effects are relatively less meaningful in the context of a randomized controlled study. Moreover, our discussion is focused on vegetables and whole grains because the average amount of fruit servings packed in both control and treatment centers consistently exceeded one serving at all 4 time points.

Significant ($p < .001$) time by treatment effects were obtained for servings of vegetables and whole grains from week 0 to week 6. As depicted in Table 2, parents at the intervention centers *increased* the number of servings of vegetables from 0.35 pre-intervention to 0.50 post-intervention and whole grains from 0.25 pre-intervention to 0.85 post-intervention. In contrast, in the control centers, the number of vegetable servings decreased from 0.88 servings at baseline to 0.53 servings six weeks later, while the number of servings of whole grain remained virtually unchanged over this period (0.29 at baseline, and 0.25 six weeks later).

During the period of lunch packing between the end of the initial five weeks of intervention (week 6) and immediately pre-booster (week 20) significant ($p < .001$) decrease in servings of whole grains were obtained in time by treatment analyses. After increasing servings of whole grains from 0.25 pre-intervention to 0.85 post-intervention, parents at the intervention centers then decreased the amount of whole grains packed during the period of nonintervention to 0.32 at week 20. At the control centers, the number of whole grain servings decreased steadily from 0.29 at baseline to 0.25 at week 6 to 0.13 at week 20.

After the booster, servings of vegetables and whole grains packed by parents at the intervention centers appeared to move in the desired direction: for vegetables 0.35 pre-booster and 0.45 post-booster; for whole grains 0.32 pre-booster and 0.48 post-booster; but the changes from pre-booster (week 20) to post-booster (week 26) were not statistically significant in the time by treatment comparisons. However, analyses comparing week 0 with 26 week (ie, 5 weeks post-booster which was 6-months post-baseline) showed significant ($p < .001$) time by treatment effects for servings of vegetables and whole grains. The number of servings of vegetables and whole grains parents at the intervention centers packed at week 26 (ie, 5 weeks post-booster) were increased compared to baseline: 0.35 vegetable servings at baseline and 0.45 servings post-booster; 0.25 servings of whole grains at baseline and

0.48 post-booster. At the control centers, numbers of servings of these foods moved in the opposite direction: 0.88 servings of vegetables at baseline and 0.45 at week 26; 0.29 servings of whole grains at baseline and 0.14 at week 26. Numbers of servings of vegetables and whole grains parents at the intervention centers packed post-booster in their children's sack lunches rose toward, but did not exceed, the level of positive behavior change measured immediately after the initial five weeks of intervention.

Changes in Psychosocial Variables: Outcome Expectations (OE), Subjective Norms/Social Support (SN), and Perceived Behavioral Control/Self-Efficacy (PC).

Significant ($p < .05$) time by treatment effects from week 0 to week 6 were obtained for vegetable Outcome Expectations (OE) and for Perceived Behavioral Control/ Self-Efficacy (PC) for vegetables and for whole grains. As depicted in Table 2, parents at the intervention centers increased OE for vegetables from 3.97 to 4.15 on the 5-point scale, PC for vegetables increased from 4.19 to 4.31, and PC for whole grains increased from 4.38 to 4.54. At the control centers, parents' PC for packing vegetables and whole grains moved in the opposite direction: 4.57 at baseline for vegetables and 4.42 at week 6; 4.53 at baseline for whole grains and 4.47 at week 6. There was essentially no change at the control centers in OE for packing vegetables: 4.22 at week 0 and 4.25 at week 6.

During the non-prompted period of lunch packing between the end of the initial five weeks of *Lunch is in the Bag* and week 20 (ie, immediately pre-booster) there was significant ($p < .05$) time by treatment effect on parents' Outcome Expectations (OE) for packing whole grains. At the intervention centers OE for packing whole grains increased from 4.37 post-intervention to 4.48 at week 20 (ie, pre-booster). At the control centers, OE for packing whole grains remained unchanged during this same interval: 4.44 at week 6 and 4.43 at week 20.

After the booster, changes in parents' Outcome Expectations (OE), Subjective Norms/Social Support (SN), and Perceived Behavioral Control/Self-Efficacy (PC) for packing vegetables and whole grains in their preschool children's sack lunches appeared to have moved in the desired direction at the intervention centers, but the changes from pre-booster to 5 weeks post-booster were not statistically significant. However, analyses comparing week 0 with week 26 (ie, baseline and 5 weeks post-booster) showed significant ($p < .001$) positive time by treatment effects on all three of the psychosocial measures for vegetables and for whole grains. At intervention centers, parents' OE and SN and PC for packing vegetables and whole grains at week 26 (ie, 5 weeks post-booster) showed systematically larger increases over baseline than was observed at the control centers.

Change in Servings of the Targeted Foods as a Function of Change in the Psychosocial Variables

Increases from pre-intervention to post-intervention (week 0 to week 6) in Subjective Norms/Social Support (SN) and Perceived Behavioral Control/Self-Efficacy (PC) for packing whole grains were associated with increased amounts of whole grains parents packed in their children's lunches 6 months post-baseline. At the intervention centers, one standard deviation of increase in SN following the initial five weeks of intervention was

associated with increase of 0.28 servings of whole grains ($p < .01$) parents packed in their preschool children's sack lunches at post-booster compared to pre-intervention (week 26 compared with week 0). One standard deviation of increase in PC following the initial five weeks of intervention was associated with increase of 0.29 servings of whole grains ($p < .01$) parents packed post-booster compared to pre-intervention (week 26 compared with week 0).

Discussion

Results supported two of this study's three hypotheses: (1) the positive effects of *Lunch is in the Bag*'s initial five weeks of intervention were replicated, and (2) adding follow-up prompts in the form of a booster week of activities after three months of unprompted lunch packing contributed to maintenance of the positive changes in parents' packing of vegetables and whole grains in their preschool children's sack lunches.

There was no support for the hypothesis that adding a follow-up week of activities after three months of non-prompted lunch packing would “boost” the packing of vegetables and whole grains to levels greater than the amounts measured after the initial five weeks of intervention. Instead, results aligned with the more common outcome of behavior change studies in which positive effects degrade post-intervention^{23,47} but can be renewed by follow-up prompts.⁴⁸ In a study of fruit and vegetable intake of adults, for example, elicitation of a single implementation intention was effective for initiating increased fruit and vegetable intake; but the effect was not sustained over 6 months; however, administering a second implementation intention at 3 months was successful in increasing intake measured at 6 months.⁴⁹ In the current study, *Lunch is in the Bag* was effective in initiating parents' increased packing of vegetables and whole grains in their preschool children's sack lunches; but the effect degraded post-intervention; however, adding an additional week of activities 3 months post-intervention prompted increased packing of vegetables and whole grains at week 26 (ie, 6 months post-baseline).

The processes by which *Lunch is in the Bag* influenced initiation and maintenance of positive behavior change appeared to be different for vegetables than for whole grains. There were systematic improvements at intervention centers at 6 months post-baseline in outcome expectations, subjective norms/social support, and perceived behavioral control/self-efficacy for whole grains and for vegetables. But for vegetables, the initial changes in the psychosocial variables were not systematically useful as predictors of amount of increase in servings of vegetables packed in the lunches. For whole grains however, the initial increase in subjective norms/social support as well as initial increase in perceived behavioral control/self-efficacy for packing whole grains were reliable predictors of amount of change in servings of whole grains parents packed in the children's lunches measured 6 months post-baseline. And for whole grains, but not for vegetables, outcome expectations increased systematically from post-intervention to pre-booster perhaps signaling parents' satisfaction with outcomes received from packing whole grains in their children's lunches.

Despite differences in the psychosocial variables, the amount of change from baseline to six months post-baseline was approximately the same for servings of vegetables as for servings

of whole grains. The increase for vegetables was 0.10 servings compared with 0.23 for whole grains; and 6 months post-baseline the lunch sacks on average contained 0.45 servings of vegetables and 0.48 servings of whole grains. These results were far short of the intervention target of parents daily packing one serving each of vegetables and of whole grain foods in their preschool children's sack lunches.

The pattern of results for servings of vegetables and whole grains map most closely to the simple associative process mechanism for behavior change and maintenance. Without intervention materials prompting them, parents' packing of vegetables and whole grains degraded during the three months post-intervention but then rebounded when the booster week re-introduced the intervention materials and their cues and reinforcements. Similar to other studies of interventions to change dietary behaviors, this study confirmed parents' advice that they would need "reminders" to help them pack more vegetables and whole grains in their children's sack lunches.²² Adding a week of booster activities to the configuration of *Lunch is in the Bag* was, therefore, appropriate and necessary. But the week of booster activities was not sufficient to "boost" strength of the habit of packing of vegetables and whole grains to a level comparable to the already habitual practice of packing fruit in the children's lunches. The implication is that attention should be directed toward strategies for increasing the amounts of social and emotional gratification parents receive from providing their children with vegetables and whole grains to eat at lunch time.

Additional studies are needed of processes by which follow-up prompts influence health behavior change and maintenance. Limitations of the current study include its small sample size and skew in sample characteristics toward higher income and better educated families. The sample size was too small to test for possible effects of differences in qualities of implementation of the intervention or to identify factors that might explain the decreases at the control center in parents' packing of vegetables and whole grain foods. The skew in sample characteristics, which may be due to the higher rates of participation by lower income families in subsidized ECE centers that serve hot meals reimbursed through the Child and Adult Care Food Program, places further limits on capabilities for generalizing the obtained results. Strengths which somewhat offset these limitations are this study's extensive dietary and psychosocial measures across multiple time points to focus on processes and mechanisms by which a booster to a behavioral intervention targeting the parents may lead to better nutrition in early childhood.

Conclusions

Results of this study provide an empirical reminder that when the goal is to change a behavior whose performance is perceived by the performer as likely to need "reminders" or cues to action, designers of the intervention should give careful consideration to processes and mechanisms of stimulus-response associations and emotional memory. Effects of intervention design features based in instrumental incentive processes and cognitive decisional reasoning processes are enabled or at least reinforced by simple associative processes and emotional memory. Anchoring intervention design in these most basic principles of learning is fundamental to establishing and maintaining healthy habits.

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Figure 1.
Potential effects of adding a booster: Patterns projected by process of behavior change.

Table 1
Components of *Lunch is in the Bag*

<ul style="list-style-type: none">• Five weeks of intervention in fall of the school year at ECE centers that rely on parents to provide some or all of the children's meals and snacks• A training session for ECE teachers in the fall of the school year and materials to facilitate teacher-parent communication about the children's lunches• Five weekly parent handouts of nutrition information and homework activities to inspire parent-child interactions about packing healthy lunches and to challenge and assist parents in setting goals for packing their children's lunch sacks with a serving each from all five food groups• Lesson plan for a daily teacher-guided lunch sack unpacking activity to facilitate teacher-child communication about vegetables, whole grains and other food groups• Lesson plans for five weeks of nutrition learning activities in the children's classrooms with several of the activities requiring parents to send necessary materials (eg, empty boxes to build a great "grain train" around the classroom walls)• Five weekly activity stations displayed in a central area of the ECE facility to spark parent-child communication about vegetables and other food groups• A booster week of intervention in the spring approximately three months post-intervention
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Table 2
Parents' Lunch-packing Behaviors of Mean Servings of Fruits, Vegetables and Whole Grains with Associated Psychosocial Variables by Treatment (Intervention vs Control) and Time

	Intervention				Control			
	Baseline Week 0 Mean (SE)	Post-intervention Week 6 Mean (SE)	Pre-Booster Week 20 Mean (SE)	Post-Booster Week 26 Mean (SE)	Week 0 Mean (SE)	Week 6 Mean (SE)	Week 20 Mean (SE)	Week 26 Mean (SE)
Fruit servings	1.60 (0.24)	1.59 (0.24)	1.68 (0.24)	1.46 (0.24)	2.34 (0.27)	1.43 (0.27)	1.85 (0.27)	1.26 (0.27)
Vegetable servings	0.35 (0.43)	0.50 _a (0.43)	0.35 (0.43)	0.45 _d (0.43)	0.88 (0.34)	0.53 (0.34)	0.57 (0.34)	0.49 (0.34)
Whole grain servings	0.25 (0.13)	0.85 _a (0.13)	0.32 _b (0.13)	0.48 _d (0.13)	0.29 (0.09)	0.25 (0.09)	0.13 (0.09)	0.14 (0.09)
Vegetable outcome expectation	3.97 (0.07)	4.15 _a (0.07)	4.22 (0.07)	4.30 _d (0.08)	4.22 (0.08)	4.25 (0.08)	4.33 (0.08)	4.34 (0.08)
Vegetable perceived control	4.19 (0.07)	4.31 _a (0.07)	4.31 (0.08)	4.41 _d (0.08)	4.57 (0.08)	4.42 (0.08)	4.50 (0.08)	4.53 (0.09)
Vegetable subjective norm	3.51 (0.05)	3.74 (0.05)	3.85 (0.05)	4.10 _d (0.05)	3.90 (0.05)	3.89 (0.05)	4.02 (0.05)	4.03 (0.05)
Whole grain outcome expectation	4.24 (0.06)	4.37 _a (0.06)	4.48 _c (0.06)	4.52 _d (0.07)	4.37 (0.07)	4.44 (0.07)	4.43 (0.07)	4.48 (0.07)
Whole grain perceived control	4.38 (0.06)	4.54 _a (0.07)	4.57 (0.07)	4.56 _d (0.07)	4.53 (0.07)	4.47 (0.07)	4.52 (0.07)	4.52 (0.08)
Whole grain subjective norm	3.89 (0.05)	4.18 (0.05)	4.34 (0.05)	4.39 _d (0.05)	3.94 (0.05)	4.02 (0.05)	4.18 (0.05)	4.20 (0.05)

Notes. Means and standard errors are based on mixed-effects models of the treatment-by-time interaction adjusted for repeated measures within families and nesting of families within ECE centers. Models of fruit, vegetables, and whole grains are based on data from 1260 lunches packed, while models of psychosocial variables are based on data from 328 parent questionnaires across the four time points. Estimates were obtained at mean values of parental age, parental BMI, and number of people in household, and at the sample distribution of ethnicity. Significant time-by-intervention interaction effects are marked “*a*,” “*b*,” “*c*,” “*d*,” week 6 to week 20; “*a*,” “*b*,” “*c*,” “*d*,” week 20 to week 26; and “*a*,” “*b*,” “*c*,” “*d*,” week 0 to week 26.